# Jawaharlal Nehru Technological University Anantapur College of Engineering

Pulivendula –516 390 (A.P) India

# B.Tech. in Mechanical Engineering Course Structure and Syllabi under R19 Regulations

## MECHANICAL ENGINEERING

| S.No | Course Name | Category | L-T-P-C |
|---|---|---|---|
| 1 | Physical Activities -- Sports, Yoga and Meditation, Plantation | MC | 0-0-6-0 |
| 2 | Career Counseling | MC | 2-0-2-0 |
| 3 | Orientation to all branches -- career options, tools, etc. | MC | 3-0-0-0 |
| 4 | Orientation on admitted Branch -- corresponding labs, tools and platforms | EC | 2-0-3-0 |
| 5 | Proficiency Modules & Productivity Tools | ES | 2-1-2-0 |
| 6 | Assessment on basic aptitude and mathematical skills | MC | 2-0-3-0 |
| 7 | Remedial Training in Foundation Courses | MC | 2-1-2-0 |
| 8 | Human Values & Professional Ethics | MC | 3-0-0-0 |
| 9 | Communication Skills -- focus on Listening, Speaking, Reading, Writing skills | BS | 2-1-2-0 |
| 10 | Concepts of Programming | ES | 2-0-2-0 |

### B.Tech I Year I Semester

| Semester – 1 | | | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1 | 19ABS06 | Linear Algebra and Calculus | BS | 3-1-0 | 4 |
| 2 | 19ABS01 | Engineering Physics | BS | 3-0-0 | 3 |
| 3 | 19ACS01 | Problem Solving and Programming | ES | 3-1-0 | 4 |
| 4 | 19AME01 | Engineering Graphics | ES | 1-0-3 | 2.5 |
| 5 | 19AME02 | Engineering Workshop | LC | 0-0-3 | 1.5 |
| 6 | 19ABS02 | Engineering Physics Lab | BS | 0-0-3 | 1.5 |
| 7. | 19ACS02 | Problem Solving and Programming Lab | ES | 0-0-3 | 1.5 |
| | | | | **Total** | **18** |

### B.Tech I Year II Semester

| Semester - 2 | | | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1 | 19ABEE01 | Basic Electrical and Electronics Engineering | ES | 3-0-0 | 3 |
| 2 | 19ABS07 | Differential Equations and Vector Calculus | BS | 3-1-0 | 4 |
| 3 | 19ABS05 | Engineering Chemistry | BS | 3-0-0 | 3 |
| 4 | 19ACS05 | Data Structures | ES | 3-0-0 | 3 |
| 5 | 19AHS01 | Communicative English -I | HS | 2-0-0 | 2 |
| 6 | 19AHS02 | Communicative English Lab-I | HS | 0-0-2 | 1 |
| 7 | 19AME03 | Mechanical Engineering Workshop | LC | 0-0-2 | 1 |
| 8 | 19ABEE02 | Basic Electrical & Electronics Engineering Lab | ES | 0-0-3 | 1.5 |
| 9 | 19ABS08 | Engineering Chemistry Lab | BS | 0-0-3 | 1.5 |
| 10 | 19ACS06 | Data Structures Lab | ES | 0-0-3 | 1.5 |
| | | | | **Total** | **21.5** |

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**B.Tech II Year I Semester**

| Semester – 3 | | | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1 | 19ABS11 | Complex Variables, Transforms and Applications to PDE | BS | 3-0-0 | 3 |
| 2 | 19AME04 | Fluid Mechanics and Hydraulics Machinery | PC | 3-0-0 | 3 |
| 3 | 19AME06 | Thermodynamics | PC | 3-0-0 | 3 |
| 4 | 19AME07 | Engineering Mechanics | PC | 3-0-0 | 3 |
| 5 | 19AME08 | Material Science and Engineering | PC | 3-0-0 | 3 |
| 6 | 19AME10 | Manufacturing Processes - I | PC | 3-0-0 | 3 |
| 7 | 19AHS03 | Universal Human Values | HS | 2-0-0 | 2 |
| 8 | 19AME05 | Fluid Mechanics and Hydraulic Machinery Lab | PC | 0-0-2 | 1 |
| 9 | 19AME09 | Material Science and Engineering Lab | PC | 0-0-2 | 1 |
| 10 | 19AME11 | Manufacturing Processes - I Lab | PC | 0-0-3 | 1.5 |
| 11 | 19ABS14 | Environmental Science | MC | 3-0-0 | 0 |
| | | | | **Total** | **23.5** |

**B.Tech II Year II Semester**

| Semester - 4 | | | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1 | 19ABS15 | Numerical Methods, Probability and Statistics | BS | 3-0-0 | 3 |
| 2 | 19ACS18 | Internet of Things | ES | 2-0-0 | 2 |
| 3 | 19AME14 | Design Thinking and Product Innovation | ES | 2-0-0 | 2 |
| 4 | 19AME15 | Mechanics of Materials | PC | 3-0-0 | 3 |
| 5 | 19AME17 | Theory of Machines | PC | 3-0-0 | 3 |
| 6 | 19AME18 | Manufacturing Processes – II | PC | 3-0-0 | 3 |
| 7 | 19AME19 | Computer Aided Machine Drawing | LC | 0-0-3 | 1.5 |
| 8 | 19AME16 | Mechanics of Materials Lab | PC | 0-0-3 | 1.5 |
| 9 | 19ACS19 | Internet of Things (IOT)Lab | ES | 0-0-3 | 1.5 |
| 10 | 19AME20 | Design Thinking & Product Innovation Lab | ES | 0-0-2 | 1 |
| 11 | 19AHS04 | Constitution of India | MC | 3-0-0 | 0 |
| | | | | **Total** | **21.5** |

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**B.Tech III Year I Semester**

| Semester - 5 | | | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1 | 19AME51 | Thermal Engineering | PC | 3-0-0 | 3 |
| 2 | 19AME52 | Design of Machine Members | PC | 3-0-0 | 3 |
| 3 | 19AME53 | Automation and Robotics | PC | 3-0-0 | 3 |
| 4 | 19AME54 | Professional Elective 1 | PE | 3-0-0 | 3 |
| | 19AME54a | Alternative Fuels and Emission Control in Automotives | | | |
| | 19AME54b | Manufacturing Methods in Precision Engineering | | | |
| | 19AME54c | Design for Manufacturing (DFM) | | | |
| | 19AME54d | Power Plant Engineering | | | |
| | 19AME54e | Non Destructive Testing (NDT) | | | |
| | 19AME54f | Ergonomics and Human Factors in Engineering | | | |
| 5 | 19AME55 | Open Elective I (Inter Disciplinary) (ANNEXURE-I) | OE | 3-0-0 | 3 |
| 6 | 19AHS14 | Humanities Elective I | HS | 3-0-0 | 3 |
| | 19AHS14a | MEFA | | | |
| | 19AHS14b | Entrepreneurship & Innovation Management | | | |
| 7 | 19AME56 | Thermal Engineering Lab | PC | 0-0-3 | 1.5 |
| 8 | 19AME57 | Manufacturing Processes - II lab | PC | 0-0-2 | 1 |
| 9 | 19AME59 | Socially Relevant Projects (30 hours/sem) | PR | --------- | 1 |
| 10 | 19AHS16 | Organizational Behaviors | MC | 3-0-0 | 0 |
| | | | **Total :** | | **21.5** |

**B.Tech III Year II Semester**

| Semester - 6 | | | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1 | 19AHS12 | English Language Skills | HS | 2-0-0 | 2 |
| 2 | 19AME61 | Automobile Engineering | PC | 2-0-0 | 2 |
| 3 | 19AME62 | Heat Transfer | PC | 3-0-0 | 3 |
| 4 | 19AME63 | Operations Research | PC | 3-0-0 | 3 |
| 5 | 19AME64 | Professional Elective II | PE | 3-0-0 | 3 |
| | 19AME64a | Hybrid and Electric Vehicles | | | |
| | 19AME64b | Simulation and Modeling of Manufacturing Systems | | | |
| | 19AME64c | Design of Transmission Systems | | | |
| | 19AME64d | Solar and Wind Energy Systems | | | |
| | 19AME64e | Mechanical Behavior of Materials | | | |
| | 19AME64f | Total Quality Management (TQM) | | | |
| 6 | 19AME65 | Open Elective II (Inter Disciplinary)(ANNEXURE-II) | OE | 3-0-0 | 3 |
| 7 | 19AHS15 | Humanities Elective II | HS | 3-0-0 | 3 |
| | 19AHS15a | Management Science | | | |
| | 19AHS15b | Business Environment | | | |
| 8 | 19AHS13 | English Language Skills Lab | HS | 0-0-3 | 1.5 |
| 9 | 19AME66 | Heat Transfer Lab | PC | 0-0-2 | 1 |
| 10 | 19AHS17 | Research Methodology | MC | 3-0-0 | 0 |
| 11 | Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions | | PR | 4 Weeks Summer Internship | |
| | | | | **Total** | **21.5** |

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Vice-Principal

Principal

**B.Tech IV Year I Semester**

| Semester - 7 | | | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credits** |
| 1 | 19AME71 | Metrology & Measurements | PC | 2-0-0 | 2 |
| 2 | 19AME72 | Introduction to CAD/CAM | PC | 3-0-0 | 3 |
| 3 | 19AME73 | Finite Element Analysis | PC | 3-0-0 | 3 |
| 4 | 19AME74 | Professional Elective III | PE | 3-0-0 | 3 |
| | 19AME74a | Automotive Transmission | | | |
| | 19AME74b | Additive Manufacturing | | | |
| | 19AME74c | Mechanical Vibrations | | | |
| | 19AME74d | Refrigeration & Air Conditioning | | | |
| | 19AME74e | Material Characterization | | | |
| | 19AME74f | Production and Operations Management | | | |
| 5 | 19AME76 | Professional Elective IV | PE | 3-0-0 | 3 |
| | 19AME76a | Vehicle diagnosis and control | | | |
| | 19AME76b | Mechatronics & MEMS | | | |
| | 19AME76c | Design of Oil Hydraulics and Pneumatics | | | |
| | 19AME76d | Computational Fluid Dynamics (CFD) | | | |
| | 19AME76e | Geometric dimensioning and tolerances | | | |
| | 19AME76f | Product Marketing | | | |
| 6 | 19AME75 | Open Elective 3 | OE | 2-0-0 | 2 |
| | | **ANNEXURE-III** | | | |
| 7 | 19AME77 | CADD and CAM Lab | PC | 0-0-3 | 1.5 |
| 8 | 19AME70 | Metrology and Measurements Lab | PC | 0-0-2 | 1 |
| 9 | 19AME78 | Industrial Training/Internship/Research Projects in National Laboratories/Academic Institutions | PR | -------- | 2 |
| 10 | 19AME79 | Project Stage - I | PR | --------- | 2 |
| | | | | **Total** | **22.5** |

**B.Tech IV Year II Semester**

| Semester - 8 (Theory - 2, Lab - 1) | | | | | |
|---|---|---|---|---|---|
| **S.No** | **Course No** | **Course Name** | **Category** | **L-T-P** | **Credit** |
| 1 | 19AME81 | Professional Elective V (MOOC) | PE | 3-0-0 | 3 |
| 2 | 19AME82 | Open Elective IV (MOOC) | OE | 3-0-0 | 3 |
| 3 | 19AME89 | Project Stage - II | PR | -------- | 6 |
| | | | | | **12** |

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## ANNEXURE – I

## Open Elective I (Interdisciplinary)

| Branch | Subject Code | Subject |
|---|---|---|
| Humanities | 19AHS10 | Campus Recruitment Training & Soft Skills |
| Mathematics | 19ABS20 | Mathematical Modeling |
| | 19ABS21 | Fuzzy Set Theory, Arithmetic and Logic |
| | 19ABS22 | Number Theory |
| Physics | 19ABS31 | Sensors and Actuators for Engineering Applications |
| | 19ABS32 | Physics of Electronic Materials |
| Chemistry | 19ABS41 | Chemistry of Energy Materials |
| | 19ABS42 | Advanced Polymers and Their Applications |
| | 19ABS43 | Marine Chemistry |
| CIVIL | 19ACE55a | Air Pollution and Control |
| | 19ACE55b | Green Buildings |
| | 19ACE55c | Basics of Civil Engineering Materials and Construction Practice |
| EEE | 19AEE55a | Basics of Non-Conventional Energy Sources |
| | 19AEE55b | Electrical Measurements & Sensors |
| | 19AEE55c | Electric Vehicle Engineering |
| ECE | 19AEC55a | Fundamentals of Electronics and Communication Engineering |
| | 19AEC55b | Transducers and Sensors |
| | 19AEC55c | Principles of Communications |
| CSE | 19ACS55a | Object Oriented Programming Concepts Through Java |
| | 19ACS55b | Introduction to Internet Of Things |
| | 19ACS55c | Introduction to Operating Systems |

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## ANNEXURE – II
## Open Elective II (Interdisciplinary)

| Branch | Subject Code | Subject Name |
|---|---|---|
| Humanities | 19AHS11 | Competitive &Spoken English |
| Mathematics | 19ABS23 | Integral Transforms And ITS Applications |
| | 19ABS24 | Numerical Analysis |
| | 19ABS25 | Optimization Techniques |
| Physics | 19ABS33 | Functional Nanomaterials For Engineers |
| | 19ABS34 | Materials Characterization Techniques |
| Chemistry | 19ABS44 | Green Chemistry and Catalysis for Sustainable Environment |
| | 19ABS45 | Chemistry of Nanomaterials and Applications |
| | 19ABS46 | Environmental Management and Audit |
| CIVIL | 19ACE65a | Remote Sensing and GIS |
| | 19ACE65b | Environmental Impact Assessment |
| | 19ACE65c | Disaster Management and Mitigation |
| EEE | 19AEE65a | Energy Conservation and Management |
| | 19AEE65b | PLC & ITS Applications |
| | 19AEE65c | System Reliability Concepts |
| ECE | 19AEC65a | Introduction to Microcontrollers & Applications |
| | 19AEC65b | Principles of Digital Signal Processing |
| | 19AEC65c | Introduction to Image Processing |
| CSE | 19ACS65a | Introduction to Machine Learning |
| | 19ACS65b | Introduction to Computer Networks |
| | 19ACS65c | Web Design and Management |

## ANNEXURE – III - Open Elective III

| Branch | Subject Code | Subject Name |
|---|---|---|
| CIVIL | 19ACE75a | Architecture and town planning |
| | 19ACE75b | Experimental stress analysis |
| | 19ACE75c | Finite element methods |
| EEE | 19AEE75a | Electrical engineering materials |
| | 19AEE75b | Digital signal processors and applications |
| | 19AEE75c | IOT applications in electrical engineering |
| ME | 19AME75a | Special types of vehicles |
| | 19AME75b | Six sigma and lean manufacturing |
| | 19AME75c | Reverse engineering |
| | 19AME75d | Energy auditing |
| | 19AME75e | Introduction to composite materials |
| | 19AME75f | Customer relationship management |
| ECE | 19AEC75a | Embedded systems & IOT |
| | 19AEC75b | Electronic instrumentation |
| | 19AEC75c | Basics of VLSI design |
| CSE | 19ACS75a | Mobile application development |
| | 19ACS75b | Real time operating systems and applications |
| | 19ACS75c | Fundamentals of block chain and applications |

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA**
**DEPARTMENT OF MATHEMATICS**
**I B.TECH – I SEMESTER (Common to all Branches of Engineering)**
**(THEORY)**

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| | Linear Algebra and Calculus | 3 | 1 | - | 4 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | This course will illuminate the students in the concepts of calculus and linear algebra. |
| 2 | To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications |

| COURSE OUTCOMES | |
|---|---|
| CO1 | develop the use of matrix algebra techniques that is needed by engineers for practical applications |
| CO2 | Utilize mean value theorems to real life problems |
| CO3 | familiarize with functions of several variables which is useful in optimization |
| CO4 | Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems |
| CO5 | Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |

## SYLLABUS

**Unit I: Matrix Operations and Solving Systems of Linear Equations** **10 hrs**

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

**Unit II: Mean Value Theorems** **06 hrs**

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof);

**Unit III: Multivariable calculus** **08 hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers for three variables

**Unit IV: Double Integrals** **08 hrs**

Double integrals, change of order of integration, change of variables, areas enclosed by plane curves

**Unit V: Multiple Integrals and Special Functions** **08 hrs**

Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, Beta and Gamma functions and their properties, relation between beta and gamma functions.

**Textbooks:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

**References:**

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA**
**DEPARTMENT OF MATHEMATICS**
**I B.TECH – II SEMESTER (Common to all Branches of Engineering)**
**(THEORY)**

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| | Differential Equations and Vector Calculus | 3 | 1 | - | 4 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To enlighten the learners in the concept of differential equations and multivariable calculus |
| 2 | To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications. |

| COURSE OUTCOMES | |
|---|---|
| CO1 | solve the differential equations related to various engineering fields |
| CO2 | Identify solution methods for partial differential equations that model physical processes |
| CO3 | interpret the physical meaning of different operators such as gradient, curl and divergence |
| CO4 | estimate the work done against a field, circulation and flux using vector calculus |

**<u>Mapping between Course Outcomes and Programme Outcomes</u>**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |

## SYLLABUS

### UNIT I: Linear Differential Equations of Higher Order

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

### UNIT II: Equations Reducible to Linear Differential Equations and Applications

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

### UNIT III: Partial Differential Equations **08 hrs**

First order partial differential equations, solutions of first order linear and non-linear PDEs.
Solutions to homogenous and non-homogenous higher order linear partial differential equations.

**UNIT IV: Multivariable Calculus (Vector differentiation)**

Scalar and vector point functions, gradient, divergent, curl and their properties (Identities and applications)

**UNIT V: Multivariable Calculus (Vector integration)**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

**Textbooks:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

**References:**

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
3. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA**
**DEPARTMENT OF PHYSICS**
**I B.TECH – I SEMESTER (common to CIVIL & MECH)**
**(THEORY)**

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| | Engineering Physics | 3 | 0 | - | 3 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | Understand the basic concepts of mechanics and oscillations in correlation to engineering application. |
| 2 | To familiarize the concepts of theoretical acoustics to practical use in engineering field. To explain the significance of ultrasound and its application in NDT for diversified engineering application. |
| 3 | To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications. |
| 4 | To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications. |
| 5 | To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices<br>Considering the significance of micro miniaturization of electronic devices and significance of low dimensional materials, the basic concepts of nanomaterials, their properties and applications in modern emerging technologies are to be elicited. |

| COURSE OUTCOMES | |
|---|---|
| CO1 | **Identify** forces and moments in mechanical systems using scalar and vector techniques (L3). **Interpret** the equation of motion of a rigid rotating body (torque on a rigid body), Simple harmonic oscillators, Damped harmonic oscillator, Heavy, Forced oscillations , Resonance for consideration in designing technological applications. (L3) |
| CO2 | **Explain** sound waves and its is propagation /interaction with construction material in design of buildings (L2). **Analyze** acoustic parameters of typically used materials in buildings (L4). **Recognize** sound level disruptors and their application in architectural acoustics (L2). **Identify** the use of ultrasonics in diversified fields of engineering (L3) |
| CO3 | **Explain** the need of coherent sources and the conditions for sustained interference (L2). **Identify** engineering applications of interference including homodyne and heterodyne detection (L3). **Analyze** the differences between interference and diffraction with applications (L4). **Illustrate** the concept of polarization of light and its applications (L2). **Classify** ordinary polarized light and extraordinary polarized light (L2)The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics. |
| CO4 | **Explain** various types of emission of radiation (L2). **Identify** the role of laser in engineering applications (L3). **Describe** the construction and working principles of various types of lasers (L1). **Explain** the working principle of optical fibers (L2). **Classify** optical fibers based on refractive index profile and mode of propagation (L2). **Identify** the applications of optical fibers in medical, communication and other fields (L2). **Apply** the fiber optic concepts in various fields (L3). |
| CO5 | **Explain** the concept of dielectric constant and polarization in dielectric materials (L2). **Summarize** various types of polarization of dielectrics (L2). **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics (L2). **Classify** the magnetic |

| | |
|---|---|
| | materials based on susceptibility and their temperature dependence (L2). **Explain** the applications of dielectric and magnetic materials (L2). **Apply** the concept of magnetism to magnetic devices (L3)<br>**Identify** the nano size dependent properties of nanomaterials (L2). **Illustrate** the methods for the synthesis and characterization of nanomaterials (L2). **Apply** the basic properties of nanomaterials in various Engineering branches (L3). |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |

## SYLLABUS OF ENGINEERING PHYSICS

### Unit-I: Introduction to Mechanics and Oscillations

**Introduction to Mechanics and Oscillations**-Basic laws of vectors and scalars-Rotational frames-Conservative forces – F = - grad V, torque and angular momentum – Simple harmonic oscillators-Damped harmonic oscillator-Heavy, critical and under damping- Energy decay in damped harmonic oscillator- Forced oscillations – Resonance.

### Unit-II: Acoustics and Ultrasonics

**Acoustics**: Reverberation – Reverberation time– Sabine's formula (Qualitative) - Absorption coefficient and its determination –Factors affecting acoustics of buildings and their remedies.

**Ultrasonics:** Properties and Production by magnetostriction & piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications

### Unit-III: Wave Optics

**Interference**-Principle of superposition –Interference of light – Conditions for sustained interference-interference in thin films- Colors in thin films-Newton's Rings-Determination of wavelength and refractive index- Applications

**Diffraction**- Fresnel and Fraunhofer diffraction-Fraunhofer diffraction due to single slit and double slit – Diffraction grating- Grating spectra-Applications

**Polarization**-Polarization by double refraction-Nicol's Prism--Half wave and Quarter wave plates- Applications.

### Unit-IV: Lasers and Fiber optics

**Lasers:** Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein's coefficients – Population inversion – Pumping mechanisms – Nd:YAG laser – He-Ne laser – $CO_2$ Laser, Applications of lasers.

**Fiber optics**- Total Internal Reflection-Critical angle of propagation-Acceptance Angle-Numerical Aperture-Classification of fibers based on refractive index profile –Propagation of electromagnetic wave through optical fibers – Modes -Importance of V-number-Fiber optic sensors (Pressure/temperature/chemical change)

**UNIT V: Engineering Materials**

**Dielectric Materials:** Dielectric polarization- Dielectric constant- Types of polarizations: Electronic, Ionic and Orientation Polarizations (Qualitative) - Lorentz (Internal) field- Clausius-Mosotti equation-Applications of Dielectrics: Ferroelectricity and Piezoelectricity.

**Magnetic Materials:** Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials-Hysteresis - Soft and hard magnetic materials-Applications.

**Nanomaterials**: Surface area and quantum confinement –Physical properties: electrical and magnetic properties- Synthesis of nanomaterials: Top-down: Ball Milling, Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

**Prescribed Text books:**

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company

2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.

**Reference Books:**

1. Engineering Physics – K.Thyagarajan, MacGraw Hill Publishers, 2016
2. Introduction to modern optics – Grant R Fowles
3. A text book on Optics – Brijlal & Subramanyam
4. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
5. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley
6. Engineering Physics – M.R.Srinivasan, New Age Publications
7. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
8. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
9. Engineering Physics – M. Arumugam, Anuradha Publications

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3\. [illegible] 7. [illegible]

4\. [illegible]

# Problem Solving and Programming

**(Common to All Branches of Engineering)**

**B. Tech – I Semester** **L-T-P-C**
**3-1-0-4**

**Course Objectives:**

1. Introduce the internal parts of a computer, and peripherals.
2. Introduce the Concept of Algorithm and use it to solve computational problems
3. Identify the computational and non-computational problems
4. Teach the syntax and semantics of a C Programming language
5. Demonstrate the use of Control structures of C Programming language
6. Illustrate the methodology for solving Computational problems

**Outcomes:**

Student should be able to

1. Identify the different peripherals, ports and connecting cables in a PC (L2)
2. Illustrate the working of a Computer (L3)
3. Select the components of a Computer in the market and assemble a computer (L4)
4. Solve complex problems using language independent notations (L3)

**Unit 1:**

**Computer Fundamentals:** What is a Computer, Evolution of Computers, Generations of Computers, Classification of Computers, Anatomy of a Computer, Memory revisited, Introduction to Operating systems, Operational overview of a CPU.

**Introduction to Programming, Algorithms and Flowcharts**: Programs and Programming, Programming languages, Compiler, Interpreter, Loader, Linker, Program execution, Fourth generation languages, Fifth generation languages, Classification of Programming languages, Structured programming concept, Algorithms, Pseudo-code, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

**Unit 2:**

**Introduction to problem solving:** Introduction, the problem-solving aspect, Design and implementation of algorithms – Topdown design, Analysis of Algorithms, the efficiency of algorithms, the analysis of algorithms.

**Fundamental algorithms:** Exchanging the values of two variables, counting, summation of a set of numbers, factorial computation, sine function computation, generation of the Fibonacci sequence, reversing the digits of an integer.

**Learning Outcomes**: Student should be able to

1. Solve Computational problems (L3)
2. Apply Algorithmic approach to solving problems (L3)
3. Analyze the algorithms (L4)

**Unit 3:**

**Types, Operators, and Expressions:** Variable names, data types and sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

**Input and output:** standard input and output, formatted output-Printf, formatted input-Scanf

**Control Flow:** Statements and blocks, if-else, else-if, switch, Loops-while and for, Loops-Dowhile, break and continue, goto and labels.

**Functions and Program Structure:** Basics of functions, functions returning non-integers, external variables, scope variables, header variables, register variables, block structure, initialization, recursion, the C processor.

**Learning Outcomes**: Student should be able to

1. Recognize the programming elements of C Programming language (L1)
2. Select the control structure for solving the problem (L4)
3. Apply modular approach for solving the problem (L3)

**Unit 4:**

**Factoring methods:** Finding the square root of a number, the smallest divisor of a number, the greatest common divisor of two integers, generating prime numbers.

**Pointers and arrays:** Pointers and addresses, pointers and function arguments, pointers and arrays, address arithmetic, character pointers and functions, pointer array; pointers to pointers, Multi-dimensional arrays, initialization of arrays, pointer vs. multi-dimensional arrays, command line arguments, pointers to functions, complicated declarations.

**Array Techniques:** Array order reversal, finding the maximum number in a set, removal of duplicates from an order array, finding the $k^{th}$ smallest element.

**Learning Outcomes**: Student should be able to

1. Solve mathematical problems using C Programming language (L3)
2. Structure the individual data elements to simplify the solutions (L6)
3. Facilitate efficient memory utilization (L6)

**Unit 5:**

**Sorting and Searching:** Sorting by selection, sorting by exchange, sorting by insertion, sorting by partitioning, binary search.

**Structures:** Basics of structures, structures and functions, arrays of structures, pointers to structures, self-referential structures, table lookup, typedef, unions, bit-fields.

**Some other Features**: Variable-length argument lists, formatted input-Scanf, file access, Error handling-stderr and exit, Line Input and Output, Miscellaneous Functions.

**Learning Outcomes**: Student should be able to

1. Select sorting algorithm based on the type of the data (L4)
2. Organize heterogeneous data (L6)
3. Design a sorting algorithm (L6)

**Text Books**:

1. Brian W. Kernighan, and Dennis M. Ritchie, “The C Programming Language”, 2nd Edition, Pearson.
2. R.G. Dromey, “How to Solve it by Computer”. 2014, Pearson.
3. Pradip Dey, and Manas Ghosh, “Programming in C”, 2018, Oxford University Press.

**Reference Books:**

1. RS Bichkar “Programming with C”, 2012, Universities Press.
2. Pelin Aksoy, and Laura Denardis, “Information Technology in Theory”, 2017, Cengage
3. Byron Gottfried and Jitender Kumar Chhabra, “Programming with C”, 4th Edition, 2019, McGraw Hill Education.

**Course Outcomes:**

1. Construct his own computer using parts (L6).
2. Recognize the importance of programming language independent constructs (L2)
3. Solve computational problems (L3)
4. Select the features of C language appropriate for solving a problem (L4)
5. Design computer programs for real world problems (L6)
6. Organize the data which is more appropriated for solving a problem (L6)

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**(Common to all branches)**

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| 19A03102 | Engineering Graphics | 1 | 0 | 3 | 2.5 |

| | COURSE OBJECTIVES |
|---|---|
| 1 | To bring awareness that Engineering Drawing is the Language of Engineers. |
| 2 | To familiarize how industry communicates technical information. |
| 3 | To teach the practices for accuracy and clarity in presenting the technical information. |
| 4 | To develop the engineering imagination essential for successful design. |
| 5 | To instruct the utility of drafting & modeling packages in orthographic and isometric drawings. |
| 6 | To train the usage of 2D and 3D modeling. |
| 7 | To instruct graphical representation of machine components. |

| COURSE OUTCOMES | |
|---|---|
| CO1 | **Draw** various curves applied in engineering. |
| CO2 | **Show** projections of Lines, planes and solids.. |
| CO3 | **Draw** the sections of solids and development of surfaces of solids. |
| CO4 | **Use** computers as a drafting tool. |
| CO5 | **Draw** isometric and orthographic drawings. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 3 | 1 | | | | | | 1 | 1 |
| CO2 | 3 | 3 | 1 | 3 | 1 | | | | | | 1 | 1 |
| CO3 | 3 | 3 | 1 | 3 | 1 | | | | | | 1 | 1 |
| CO4 | 3 | 3 | 1 | 3 | 1 | | | | | | 1 | 1 |
| CO5 | 3 | 2 | 1 | 3 | 1 | | | | | | 1 | 1 |

**UNIT – I:**

**Introduction to Engineering Graphics:** Principles of Engineering Graphics and their significance – Conventions in drawing – Lettering – BIS conventions.

a) Conic sections including the rectangular hyperbola – general method only.
b) Cycloids, Epicycloids and Hypocycloids.
c) Involutes

**(2L + 6P hrs)**

1. V. Veera Prasad
3. [illegible]
4. [illegible]
5. K. Jaya Chandra Reddy

6 —
7 —
8 A. Dinesh Reddy
9 [illegible]

**UNIT – II:**

**Projection of Points, Lines and Planes:** Projection of points in any quadrant, Lines inclined to one and both planes, Finding true lengths, Angle made by line. Projections of regular plane surfaces.

**(2L + 6P hrs)**

**UNIT – III:**

**Projections of Solids:** Projections of regular solids inclined to one and both planes by rotational and auxiliary views method.

**Sections of Solids:** Section planes and sectional view of right regular solids – Prism, Cylinder, Pyramid and Cone. True shapes of the sections. **(2L + 6P hrs)**

**UNIT – V:**

**Development of Surfaces:** Development of surfaces of right regular solids – Prism, Cylinder, Pyramid, Cone and their sectional parts. **(1L + 6P hrs)**

**UNIT – V:**

**Orthographic Projections:** Systems of projections, Conventions and Application to Orthographic Projections.

**Isometric Projections:** Principles of Isometric Projection – Isometric scale, Isometric views – Lines, Planes, Figures, Simple and Compound Solids. **(5L + 15P hrs)**

**Text Books:**


1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.


**Reference Books:**


1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009.
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000.
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013.
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**I YEAR I SEMESTER**

**ENGINEERING WORKSHOP (19AME02)**

**(Common to CE, MECH & CSE)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**Course Objectives:**

- To bring awareness about workshop practices for Engineers.
- To familiarize how wood working operations can be performed.
- To teach the practices for sheet metal operations.
- To develop the technical skills related to fitting and electrical wiring.

**Section 1 : Wood Working**

Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint
b) Mortise and Tenon joint
c) Corner Dovetail joint or Bridle joint

**Section 2 : Sheet Metal Working**

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

**Section 3 : Fitting**

Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Dovetail fit c) Semi-circular fit
d) Bicycle tire puncture and change of two wheeler tyre

**Section 4 : Electrical Wiring**

Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two way switch c) Godown lighting d) Tube light
e) Three phase motor f) Soldering of wires

**Text Books:**

1. K.Venkata Reddy., Workshop Practice Manual, 6/e BS Publications.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2/e, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2/e, PHI 2010.

**Course Outcomes:**

At the end of this Course the student will be able to

- Apply wood working skills in real world applications. (L6)
- Apply fitting operations in various applications. (L6)
- Build different parts with metal sheets in real world applications. (L5)
- Demonstrate soldering and brazing. (L4)
- Apply basic electrical engineering knowledge for house wiring practice. (L6)

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

# Engineering Physics Laboratory

**(Common to I B.Tech I Semester CIVIL & MECH)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**Course Objectives:**

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

**EXP No.1:** Determination of the thickness of thin object using wedge shape method

**Learning Outcomes:**

At the end of this experiment, the student will be able to

| | |
|---|---|
| • **Operates** optical instrument like travelling microscope | **L2** |
| • **Estimate** the thickness of the wire using wedge shape method | **L2** |
| • **Identifies** the formation of interference fringes due to reflected light from non-uniform thin film. | **L2** |

**EXP No. 2 :** Determination of the radius of curvature of the lens by Newton's rings

**Learning Outcomes:**

At the end of this experiment, the student will be able to

| | |
|---|---|
| • **Operates** optical instrument like travelling microscope. | **L2** |
| • **Estimate** the radius of curvature of the lens | **L2** |
| • **Identifies** the formation of interference fringes due to reflected light from non-uniform thin film. | **L2** |
| • **Plots** the square of the diameter of a ring with no. of rings | **L3** |

**EXP No. 3:** Determination of wavelengths of various spectral lines of mercury source using diffraction grating in normal incidence method

**Learning Outcomes:**

At the end of this unit, the student will be able to

| | |
|---|---|
| • **Operates** optical instrument like spectrometer. | **L2** |
| • **Estimate** the wavelength of the given source | **L2** |
| • **Identifies** the formation of grating spectrum due diffraction. | **L2** |

**EXP No. 4:** Determination of dispersive power of grating.

**Learning Outcomes:**

At the end of this unit, the student will be able to

| | |
|---|---|
| • **Operates** optical instrument like spectrometer. | **L2** |
| • **Estimate** the refractive index and dispersive power of the given prism | **L2** |
| • **Identifies** the formation of spectrum due to dispersion. | **L2** |

| | |
|---|---|
| **EXP No. 5:** Determination of wavelength using diffraction grating by laser source. | |
| | |
| **Learning Outcomes:** | |
| At the end of this unit, the student will be able to | |
| • **Operates** various instrument | **L2** |
| • **Estimate** the wavelength of laser source | **L2** |
| • **Identifies** the formation of grating spectrum due diffraction. | **L2** |
| | |
| **EXP No. 6:** Determination of particle size by laser source | |
| | |
| **Learning Outcomes:** | |
| At the end of this unit, the student will be able to | |
| • **Operates** various instrument | **L2** |
| • **Estimate** the Particles size using laser | **L2** |
| • **Identifies** the application of laser | **L2** |
| | |
| **EXP No. 7:** Determination of numerical aperture and acceptance angle of an optical fiber | |
| | |
| **Learning Outcomes:** | |
| At the end of this unit, the student will be able to | |
| • **Operates** various instruments and connect them as per the circuit. | **L2** |
| • **Estimate** the numerical aperture and acceptance angle of a given optical fiber. | **L2** |
| • **Identifies** the significance of numerical aperture and acceptance angle of an optical fiber in various engineering applications | **L2** |
| | |
| **EXP No. 8:** Study of variation of Magnetic field along the axis of a current carrying coil – Stewart-Gee's Method. | |
| | |
| **Learning Outcomes:** | |
| At the end of this unit, the student will be able to | |
| • **Operates** various instruments and connect them as per the circuit. | **L2** |
| • **Estimate** the magnetic field along the axis of a circular coil carrying current. | **L2** |
| • **Plots** the intensity of the magnetic field of circular coil carrying current with distance | **L3** |
| | |
| **EXP No. 9:** Study of B-H curve of Ferromagnetic material. | |
| | |
| **Learning Outcomes:** | |
| At the end of this unit, the student will be able to | |
| • **Operates** various instruments and connect them as per the circuit. | **L2** |
| • **Estimate** the hysteresis loss, coercivity and retentivity of the ferromagnetic material | **L2** |
| • **Classifies** the soft and hard magnetic material based on B-H curve. | **L2** |
| • **Plots** the magnetic field H and flux density B | **L3** |
| | |
| **EXP No. 10:** Rigidity modulus of material of a wire-dynamic method (Torsional pendulum) | |
| | |
| **Learning Outcomes:** | |
| At the end of this unit, the student will be able to | |
| • **Operates** various instruments | **L2** |
| • **Estimate** the rigidity modulus of the given material | **L2** |

| | |
|---|---|
| • **Identifies** the applications of Torsional pendulum | **L2** |
| | |
| **Reference Books:** | |
| 1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017 | |
| 2. R. Padma Suvarna, K. Thyagarajan "Engineering Physics Practicals" – NU Age Publishing House. | |
| | |
| **Course Outcomes:** | |
| At the end of this Course the student will be able to | |
| ➢ **Operate** optical instruments like microscope and spectrometer | **L2** |
| ➢ **Determine** thickness of a hair/paper with the concept of interference | **L2** |
| ➢ **Estimate** the wavelength of different colors using diffraction grating and resolving power | **L2** |
| ➢ **Plot** the intensity of the magnetic field of circular coil carrying current with distance | **L3** |
| ➢ **Evaluate** the acceptance angle of an optical fiber and numerical aperture | **L3** |

# Problem Solving and Programming Laboratory

**(Common to All Branches of Engineering)**

**B.Tech – I Semester** **L-T-P-C**
**0-0-3-1.5**

**Laboratory Experiments #**

1. Assemble and disassemble parts of a Computer
2. Design a C program which reverses the number
3. Design a C program which finds the second maximum number among the given list of numbers.
4. Construct a program which finds the $k^{th}$ smallest number among the given list of numbers.
5. Design an algorithm and implement using C language the following exchanges
   $a \leftarrow b \leftarrow c \leftarrow d$
6. Develop a C Program which counts the number of positive and negative numbers separately and also compute the sum of them.
7. Implement the C program which computes the sum of the first n terms of the series
   Sum = 1 – 3 + 5 -7 + 9
8. Design a C program which determines the numbers whose factorial values are between 5000 and 32565.
9. Design an algorithm and implement using a C program which finds the sum of the Infinite series $1 - x^2/2! + x^4/4! - x^6/6! + ....$
10 Design a C program to print the sequence of numbers in which each number is the sum of the three most recent predecessors. Assume first three numbers as 0, 1, and 1.
11. Implement a C program which converts a hexadecimal, octal and binary number to decimal number and vice versa.
12. Develop an algorithm which computes the all the factors between 1 to 100 for a given number and implement it using C.
13. Construct an algorithm which computes the sum of the factorials of numbers between m and n.
14. Design a C program which reverses the elements of the array.
15. Given a list of n numbers, Design an algorithm which prints the number of stars equivalent to the value of the number. The starts for each number should be printed horizontally.
16. Implement the sorting algorithms
   a. Insertion sort b. Exchange sort c. Selection sort d. Partitioning sort.
17. Illustrate the use of auto, static, register and external variables.
18. Design algorithm and implement the operations creation, insertion, deletion, traversing on a singly linked list.
19. Develop a C program which takes two numbers as command line arguments and finds all the common factors of those two numbers.
20. Design a C program which sorts the strings using array of pointers.

# The above list is not exhaustive. Instructors may add some experiments to the above list. Moreover, 50% of the experiments are to be changed every academic year. Instructors can choose the experiments, provided those experiments are not repetitions.

Proposed

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

## COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA
## YSR (KADAPA) Dist 516 390, (A.P) INDIA

**B.Tech – II Sem** **L T P C**

**3 0 0 3**

# Basic Electrical & Electronics Engineering
## Part A: Basic Electrical Engineering
**(Civil, Mechanical, CSE)**, ECE

**Course Objectives:**

1. To introduce basics of electric circuits.
2. To teach DC and AC electrical circuit analysis.
3. To explain working principles of transformers and electrical machines.
4. To impart knowledge on low voltage electrical installations

**Unit 1 DC & AC Circuits:**
Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits.

**Unit Outcomes: Able to**
- Recall Kirchoff laws (L1)
- Analyze simple electric circuits with DC excitation (L4)
- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

**Unit 2 DC & AC Machines:**
Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC test on transformer - principle and operation of Induction Motor [ Elementary treatment only]

**Unit Outcomes: Able to**
- Explain principle and operation of DC Generator & Motor.
- Perform speed control of DC Motor (L2)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor - ~~DC motor~~

1. 
2. 
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8. C. Sireesh
9. 
10. 

**Unit 3 Electrical Installations:**

Components of LT. Switchgear: Switch fuse unit (SFU),MCB,ELCB,MCCB,Tpes of wires and cables,Earthing. Types of batteries,important Characteristics for Batteries. Elementary Calculations for energy consumption,power factor improvement and battery backup

**Unit Outcomes: Able to**

- Explain principle and operation of protecting equipments.
- Come to know different types of batteries and their usage.

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3. [illegible]
4. [illegible]
5. [illegible]
6. V. [illegible]
7. [illegible]
8. C. [illegible]
9. [illegible]
10. [illegible]

I B.Tech II Sem

# COURSE NO. - Basic Electrical & Electronics Engineering

**(Common to Civil, Mechanical, CSE)**

**L T P C**
**3 1 0 4**

## Part B: Basic Electronics Engineering

**Course Objectives:**

- To provide comprehensive idea about working principle, operation and applications of PN junction & zener diodes, BJT, FET, MOSFET and operational amplifier
- To introduce fundamentals of digital electronics
- To educate on principles of various communication systems
- To teach efficacy of electronic principles which are pervasive in engineering applications

### UNIT I ANALOG ELECTRONICS

Overview of Semiconductors, PN junction diode, Zener diode, Applications of diode as switch and rectifier, Zener diode as regulator, special purpose diodes: schottky diode, tunnel diode, varactor diode, photodiode, phototransistor and LED.
BJT construction, operation, configuration and characteristics, JFET and MOSFET construction, operation, characteristics (CS configuration), applications.
Operational Amplifiers: Introduction, block diagram, basic op-amp circuits: Inverting, Non Inverting, summer, subtractor, voltage follower.

**Unit Outcomes:**

- Describe operation and characteristics of diodes and transistors
- Make use of diodes and transistors in simple, typical circuit applications
- Understand operation of basic op-amp circuits

### UNIT II DIGITAL ELECTRONICS

Introduction, Switching and Logic Levels, Digital Waveform, characteristics of digital ICs, logic gates, number systems, combinational circuits - adders, multiplexers, decoders; introduction to sequential circuits, flip flops, shift register, binary counter.

**Unit Outcomes:**

- Explain different logic gates using truth table
- Distinguish combinational and sequential circuits
- Analyze various combinational circuits such as adders, multiplexers and decoders
- Understand functionality of flip-flops, shift registers and counters

## UNIT III COMMUNICATION SYSTEMS

Introduction, Elements of Communication Systems, EM spectrum, basics of electronic communication, Amplitude and Frequency modulation, Pulse modulation, Communication receivers, Examples of communication systems: Microwave & Satellite, Fibre optic, Television, mobile communication (block diagram approach).

**Unit Outcomes:**

- Describe basic elements of a communication system
- Explain need for modulation and different modulation techniques
- Understand functioning of various communication systems

## TEXT BOOKS:

1.D.P. Kothari, I.J.Nagrath, Basic Electronics, 2nd edition, McGraw Hill Education(India)Private Limited

2.S.K. Bhattacharya, Basic Electrical and Electronics Engineering, 2nd edition, Pearson India Private Limited.

## REFERENCES:

1.R. Muthusubramanian, S. Salivahanan, “Basic Electrical and Electronics Engineering”, Tata McGraw-Hill Education, Reprint 2012.

2.David Bell, Electronic Devices and Circuits: Oxford University Press, 5th EDn., 2008.

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA**
**DEPARTMENT OF MATHEMATICS**
**I B.TECH – II SEMESTER (Common to all Branches of Engineering)**
**(THEORY)**

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| | Differential Equations and Vector Calculus | 3 | 1 | - | 4 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To enlighten the learners in the concept of differential equations and multivariable calculus |
| 2 | To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications. |

| COURSE OUTCOMES | |
|---|---|
| CO1 | solve the differential equations related to various engineering fields |
| CO2 | Identify solution methods for partial differential equations that model physical processes |
| CO3 | interpret the physical meaning of different operators such as gradient, curl and divergence |
| CO4 | estimate the work done against a field, circulation and flux using vector calculus |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |

## SYLLABUS

**UNIT I: Linear Differential Equations of Higher Order**

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

**UNIT II: Equations Reducible to Linear Differential Equations and Applications**

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

**UNIT III: Partial Differential Equations** **08 hrs**

First order partial differential equations, solutions of first order linear and non-linear PDEs. Solutions to homogenous and non-homogenous higher order linear partial differential equations.

**UNIT IV: Multivariable Calculus (Vector differentiation)**

Scalar and vector point functions, gradient, divergent, curl and their properties (Identities and applications)

**UNIT V: Multivariable Calculus (Vector integration)**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

**Textbooks:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

**References:**

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
3. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
4. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA**
**DEPARTMENT OF CHEMISTRY**
**I B.TECH – I SEMESTER (common to CE , ME & CHEMICAL)**
**(THEORY)**

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| 19A53101 | Engineering Chemistry | 3 | 0 | - | 3 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To familiarize engineering chemistry and its applications |
| 2 | To impart the concept of soft and hard waters, softening methods of hard water |
| 3 | To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement |

| COURSE OUTCOMES | |
|---|---|
| CO1 | **list** the differences between temporary and permanent hardness of water, **explain** the principles of reverse osmosis and electrodialysis. **compare** quality of drinking water with BIS and WHO standards. **illustrate** problems associated with hard water - scale and sludge**. explain** the working principles of different Industrial water treatment processes |
| CO2 | **apply** Nernst equation for calculating electrode and cell potentials, **apply** Pilling Bedworth rule for corrosion and corrosion prevention, **demonstrate** the corrosion prevention methods and factors affecting corrosion, **compare** different batteries and their applications |
| CO3 | **explain** different types of polymers and their applications, **Solve the numerical problems based on Calorific value, select** suitable fuels for IC engines, **explain** calorific values, octane number, refining of petroleum and cracking of oils |
| CO4 | explain the constituents of Composites and its classification Identify the factors affecting the refractory material, Illustrate the functions and properties of lubricants, demonstrate the phases and reactivity of concrete formation, identify the constituents of Portland cement, enumerate the reactions at setting and hardening of the cement |
| CO5 | **summarize** the applications of SEM, TEM and X-ray diffraction in surface characterization, **explain** the synthesis of colloids with examples, **outline** the preparation of nanomaterials and metal oxides **identify** the application of colloids and nanomaterials in medicine, sensors and catalysis |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |

## SYLLABUS

### Unit 1: Water Technology (8 hrs)

Introduction –Causes and types of hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles , Industrial water treatment (Ion exchange process, Internal treatment of water) specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

**Unit 2: Electrochemistry and Applications(10 hrs)**

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zn-$MnO_2$ (Leclanche cell), Li Battery. Secondary cells – lead acid and lithium ion batteries- working of the batteries including cell reactions.

Fuel cells- Basic Principles and Working Principles of hydrogen-oxygen, methanol -oxygen fuel cells, Applications of Fuel cells.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry corrosion, Pilling Bedworth rule and uses, Factors affecting corrosion, Corrosion Control -cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

**Unit 3: Polymers and Fuel Chemistry:(12 hrs)**

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization,

Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of PVC and Bakelite, Biodegradable polymers

Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, Liquid Fuels refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane numbers, cracking of oils; alternative fuels- propane, methanol and ethanol, bio fuels.

**UNIT-4 Basic Engineering Materials(8Hrs)**

(i)Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications

(ii)Refractories- Classification, Properties, Factors affecting the refractory materials and Applications

(iii)Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils and Applications

(iv)Building materials- Portland Cement, constituents, phases and reactivity of clinker, Setting and Hardening of cement.

**Unit 5: Surface Chemistry and Applications (10 hrs)**

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, solid-gas interface, solid-liquid interface, adsorption isotherm, applications of colloids and nanomaterials – catalysis, medicine, sensors.

Text Books:

1. Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, Foruth Edition, New Delhi
2. A Text Book of Engineering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi

References:

1. 1. A Text book of Engineering Chemistry by K. Sesha Maheswaramma and Mridula Chugh, Pearson's Publications Pvt. Ltd., (PAN India Title)
2. A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi
3. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
4. A Text book of Engineering Chemistry by Prasanta Rath, B. Rama Devi, Ch.Venkata Ramana Reddy and Subhendu Chakroborty, Cengage learning India Pvt.Ltd.
5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

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# Data Structures

## (Common to All Branches of Engineering)

**B. Tech – II Semester** **L-T-P-C**
**3-0-0-3**

**Course Objectives:**

1. To teach the representation of solution to the problem using algorithm
2. To explain the approach to algorithm analysis
3. To introduce different data structures for solving the problems
4. To demonstrate modeling of the given problem as a graph
5. To elucidate the existing hashing techniques

**Unit – 1: Introduction**

Algorithm Specification, Performance analysis, Performance Measurement, Arrays: Arrays, Dynamically Allocated Arrays. Structures and Unions, Sorting: Motivation, Quick sort, how fast can we sort, Merge sort, Heap sort

**Learning Outcomes:**

Student should be able to

1. Analyze the given algorithm to find the time and space complexities (L4)
2. Select appropriate sorting algorithm (L4)
3. Design a sorting algorithm (L6)

**Unit – 2: Stack, Queue and Linked lists**

Stacks, Stacks using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues. Linked lists: Singly Linked Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Additional List Operations, Doubly Linked Lists.

**Learning outcomes:** Student should be able to

1. Evaluate expressions (L5)
2. Develop the applications using stacks and queues (L3)
3. Construct the linked lists for various applications (L6)

**Unit – 3: Trees**

Introduction, Binary Trees, Binary Tree Traversals, Additional Binary Tree Operations, Binary Search Trees, **Counting Binary Trees,** Optimal Binary search Trees, AVL Trees. B-Trees: BTrees, B + Trees.

**Learning outcomes**

1. Explain the concept of a tree (L2)
2. Compare different tree structures (L4)
3. Apply trees for indexing (L3)

**Unit – 4: Graphs and Hashing**

The Graph Abstract Data Type, Elementary Graph Operations, Minimum Cost Spanning Trees, Shortest Paths and Transitive Closure.

**Hashing**: Introduction to Hash Table, Static Hashing, Dynamic Hashing.

**Learning outcomes:**
Student should be able to
1. Recognize the importance of Graphs in solving real world problems (L2)
2. Apply various graph traversal methods to applications (L3)
3. Design a minimum cost solution for a problem using spanning trees (L6)
4. Select the appropriate hashing technique for a given application (L5)
5. Design a hashing technique (L6)

**Unit – 5: Files and Advanced Sorting & Searching**
**File Organization:** Sequential File Organization, Direct File Organization, Indexed Sequential File Organization.
**Advanced sorting and searching:** Sorting on Several keys, List and Table sorts, Summary of Internal sorting, External sorting.

**Learning outcomes:** Student should be able to
1. Organize data in the form of Files (L6)
2. Apply sorting on large amount of data (L3)

**Text Books:**
1. Ellis Horowitz, Sartaj Sahni and Susan Anderson Freed "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2007.
2. Alan L. Tharp, "File Organization and Processing", Wiley and Sons, 1988.

**Reference Books:**
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education.
2. D. Samanta, "Classic Data Structures", 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
3. Peter Bras, "Advanced Data Structures", Cambridge University Press, 2016
4. Richard F.Gilberg, Behrouz A.Forouzan, "Data Structures A Pseudo code Approach with C", Second Edition, Cengage Learning 2005.

**Course Outcomes:**
Students should be able to
1. Select Appropriate Data Structure for solving a real world problem (L4)
2. Select appropriate file organization technique depending on the processing to be done (L4)
3. Construct Indexes for Databases (L6)
4. Analyze the Algorithms (L4)
5. Develop Algorithm for sorting large files of data (L3)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA - 516390, A.P, INDIA.**
**HUMANITIES & SOCIAL SCIENCES DEPARTMENT**

# COMMUNICATIVE ENGLISH - 1

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| | Communicative English - 1 | 2 | 0 | 0 | 2 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | Facilitates effective listening skills for better comprehension of academic lectures and English spoken by native speakers. |
| 2 | Helps to improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations. |
| 3 | Imparts effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information. |
| 4 | Provides knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing. |

| COURSE OUTCOMES | |
|---|---|
| CO1 | Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English |
| CO2 | Apply grammatical structures to formulate sentences and correct word forms |
| CO3 | Analyze discourse markers to speak clearly on a specific topic in informal discussions |
| CO4 | Evaluate reading/listening texts and to write summaries based on global comprehension of these texts. |
| CO5 | Create a coherent paragraph interpreting a figure/graph/chart/table |

**Introduction**

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

**Unit 1**

**Lesson: On the Conduct of Life: William Hazlitt**

**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing :**Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

**Learning Outcomes**

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

**Unit 2**

**Lesson: The Brook: Alfred Tennyson**

**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

**Learning Outcomes**

At the end of the module, the learners will be able to

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- understand the use of cohesive devices for better reading comprehension
- write well structured paragraphs on specific topics
- identify basic errors of grammar/ usage and make necessary corrections in short texts

**Unit 3**

**Lesson: The Death Trap: Saki**

**Listening:** Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

**Learning Outcomes**

At the end of the module, the learners will be able to

- comprehend short talks and summarize the content with clarity and precision
- participate in informal discussions and report what is discussed
- infer meanings of unfamiliar words using contextual clues
- write summaries based on global comprehension of reading/listening texts
- use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

**Unit4**

**Lesson: Inspiration: Chindu Yellamma**

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

**Learning Outcomes**

At the end of the module, the learners will be able to

- infer and predict about content of spoken discourse
- understand verbal and non-verbal features of communication and hold formal/informal conversations
- interpret graphic elements used in academic texts
- produce a coherent paragraph interpreting a figure/graph/chart/table
- use language appropriate for description and interpretation of graphical elements

**Unit 5**

**Lesson: Politics and the English Language: George Orwell**

**Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences. **Grammar and Vocabulary:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

**Learning Outcomes**

At the end of the module, the learners will be able to

- take notes while listening to a talk/lecture and make use of them to answer questions
- make formal oral presentations using effective strategies
- comprehend, discuss and respond to academic texts orally and in writing
- produce a well-organized essay with adequate support and detail
- edit short texts by correcting common errors

**Prescribed Text:**

1. English All Round: Communication Skills for Undegurdation Learners Vol. I, Orient BlackSwan Publisers, First Edition 2019, Authored by Y.Prabhavathi, M.Lalitha Sridevi and Ruth Z Hauzel.

**Reference Books**


- Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
- Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
- Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
- Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
- Oxford Learners Dictionary, 12th Edition, 2011.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) :: PULIVENDULA

DEPARTMENT OF MECHANICAL ENGINEERING

I B.TECH – II SEMESTER

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| | Mechanical Engineering Workshop | 0 | 0 | 3 | 1.5 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To familiarize moulding and casting skills. |
| 2 | To train on different types welding joints. |
| 3 | To develop assemble or disassembly skills. |
| 4 | To make plastic components. |
| 5 | To familiarize with use of power tools. |

| COURSE OUTCOMES | |
|---|---|
| CO1 | Make moulds for sand casting. (L3) |
| CO2 | Develop different weld joints. (L3) |
| CO3 | Assemble or disassemble of machine components. (L3) |
| CO4 | Make plastic components. (L3) |
| CO5 | Use power tools for different applications. (L3) |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |

**1. Foundry Practice: (2 Sessions).**

i. a) Determination of average grain size for sand sample using sieve shaker.
   b) Preparation of a green sand mould using single piece pattern.

ii. Preparation of a green sand mould using split piece pattern with core and demonstration of casting.

**2. Welding Practice: (2 Sessions).**

i. Lap joint, butt joint and T joint using arc welding.

ii. a) Lap joint using resistance spot welding.
    b) Lap and butt joints using gas welding.

**3. Assembling/Disassembling Practice: (3 Sessions).**

2 — [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6 —
7 —
8 A [illegible] Reddy
9 [illegible]

i. Bicycle.
ii. Clutch and carburetor.
iii. Two wheeler engine.

**4. Manufacture of a Plastic Component (2 Sessions).**

i. Use of injection moulding machine.
ii. FRP composite using hand layup method.
iii. Joining of plastic components.

**5. Design and manufacture any two domestic utility products with any material (2 Sessions).**

**6. Use of Power Tools (2 Sessions).**

I B.Tech II Sem

COURSE NO. - **Basic Electrical & Electronics Engineering Lab**

**(Common to Civil, Mechanical, CSE)**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**PART A: ELECTRICAL ENGINEERING LAB**

**Course Objectives:**

- To Verify Kirchoff's laws
- To verify Superposition theorem.
- To learn performance characteristics of DC Machines.
- To perform open circuit & Short Circuit test on 1- Phase Transformer.
- To Study the I – V Characteristics of Solar PV Cell

**List of experiments: -**

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Open circuit characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Brake test on 3 - Phase Induction Motor.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

**Course Outcomes: Able to**

- Verify Kirchoff's Laws & Superposition theorem.
- Perform testing on AC and DC Machines.
- Study I – V Characteristics of PV Cell

**PART B: ELECTRONICS ENGINEERING LAB**

**Course outcomes:**

- Describe construction, working and characteristics of diodes, transistors and operational amplifiers
- Demonstrate how electronic devices are used for applications such as rectification, switching and amplification
- Build different building blocks in digital electronics using logic gates
- Explain functionality of flip-flops, shift registers and counters for data processing applications

- Explain functioning of various communication systems

**LIST OF EXPERIMENTS:**

1. Draw and study the characteristics of Semi-conductor diode and Zener Diode
2. Draw and study the input and output characteristics of Transistor in Common Emitter configuration
3. Draw and study the static and transfer characteristics of FET in Common Source Configuration
4. Construct half wave and full wave rectifier circuits. Find ripple factor and plot their output waveforms with and without filters
5. Study the application of Op-amp as an Inverting amplifier, Non-inverting amplifier, Voltage follower, Summer and Subtractor
6. Realization of logic gates, AND, OR, NOT, NAND, NOR, XOR
7. Realization of Adders, Multiplexers and Decoders using logic gates.
8. Realization of flip-flops using logic gates.
9. Conduct an experiment on AM & FM modulation & demodulation, Plot the corresponding modulated and demodulated signals

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA**
**DEPARTMENT OF CHEMISTRY**
**I B.TECH – I SEMESTER (common to CE, ME & CHEMICAL)**
**(ENGINEERING CHEMISTRY LAB)**

| Subject Code | Title of the Lab | L | T | P | C |
|---|---|---|---|---|---|
| 19A53103 | Engineering Chemistry lab | - | - | 4 | 2 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | Verify the fundamental concepts with experiments |

| COURSE OUTCOMES | |
|---|---|
| CO1 | **determine** the cell constant and conductance of solutions (L3) |
| CO2 | **prepare** advanced polymer materials (L2) |
| CO3 | **determine** the physical properties like surface tension, adsorption and viscosity (L3) |
| CO4 | **estimate** the Iron and Calcium in cement (L3) |
| CO5 | **calculate** the hardness of water (L4) |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |

## LIST OF EXPERIMENTS

1. Determination of Hardness of a groundwater sample.
2. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
3. Determination of cell constant and conductance of solutions
4. Potentiometry - determination of redox potentials and emfs
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of a polymer
7. Determination of percentage of Iron in Cement sample by colorimetry
8. Estimation of Calcium in port land Cement
9. Adsorption of acetic acid by charcoal
10. Determination of percentage Moisture content in a coal sample
11. Determination of Viscosity of lubricating oil by Red Wood Viscometer 1
12. Determination of Flash and Fire points of fuels
13. Determination of Calorific value of gases by Junker's gas Calorimeter

## TEXT BOOKS:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson Education.
2. Chemistry Practical – Lab Manual by Chandra Sekhar, GV Subba Reddy and Jayaveera

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# Data Structures Lab

**(Common to All Branches of Engineering)**

**B. Tech – II Semester** **L-T-P-C**
**0-0-3-1.5**

**Course Objectives:**

1. To introduce to the different data structures
2. To elucidate how the data structure selection influences the algorithm complexity
3. To explain the different operations that can be performed on different data structures
4. To introduce to the different search and sorting algorithms.

**Laboratory Experiments:**

1. String operations using array of pointers
2. Searching Algorithms (With the Number of Key Comparisons) Sequential, Binary and Fibonacci Search Algorithms.
3. Sorting Algorithms: Insertion Sort, Selection Sort, Shell Sort, Bubble Sort, Quick Sort, Heap Sort, Merge Sort, and Radix Sort. Using the system clock, compute the time taken for sorting of elements. The time for other operations like I/O etc should not be considered while computing time.
4. Implementation of Singly Linked List, Doubly Linked List, Circular Linked List
5. Stack implementation using arrays
6. Stack implementation using linked lists
7. Queue implementation using arrays. Implement different forms of queue.
   While implementing you should be able to store elements equal to the size of the queue. No positions should be left blank.
8. Queue implementation using linked lists
9. Creation of binary search tree, performing operations insertion, deletion, and traversal.
10. Breadth first search
11. Depth first search
12. Travelling sales man problem
13. File operations
14. Indexing of a file
15. Reversing the links (not just displaying) of a linked list.
16. Consider a linked list consisting of name of a person and gender as a node. Arrange the linked list using 'Ladies first' principle. You may create new linked lists if necessary.
17. An expression can be represented in three ways: infix, prefix and postfix. All the forms are necessary in different contexts. Write modules to convert from one form to another form.
18. A table can be defined as a collection of rows and columns. Each row and column may have a label. Different values are stored in the cells of the table.

The values can be of different data types. Numerical operations like summation, average etc can be performed on rows/columns which contain numerical data. Such operations are to be prevented on data which is not numeric. User may like to insert row/columns in the already existing table.
User may like to remove row/column. Create table data type and support different operations on it.

**Course Outcomes:**

At the end of the course students should be able to

1. Select the data structure appropriate for solving the problem (L5)
2. Implement searching and sorting algorithms (L3)
3. Design new data types (L6)
4. Illustrate the working of stack and queue (L4)
5. Organize the data in the form of files (L6)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA**

**B.Tech – II-I SEM (R19)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

## COMPLEX VARIABLES, TRANSFORMS & APPLICATIONS TO PARTIAL DIFFERENTIAL EQUATIONS

(Common to MECH & CIVIL)

**Course Objective:**
This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The aim is to analyze the solutions of partial differential equations.

**Unit-I: Complex Variables – Differentiation**:

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations in Cartesian and Polar coordinates (without proof), analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

Properties of elementary functions of exponential, trigonometric, hyperbolic, and logarithm. Conformal mappings-standard and special transformations ($z^2$, sin z, cos z, $e^z$, lnz) Mobius transformations (bilinear) and their properties.

**Unit Outcomes:**
Students will be able to
- Understand functions of Complex variable and its properties.
- Find derivatives of complex functions.
- Understand the analyticity of complex functions.
- Understand the conformal mappings of complex functions.

**Unit-II: Complex Variables – Integration**:

Line integral-Contour integration, Cauchy's integral theorem (with proof), Cauchy Integral formula, generalized Cauchy Integral formula (All theorems without Proof).

**Power series expansions:** Taylor's series and Laurent's series (without proof); zeros of analytic functions, singularities.

**Residues:** Evaluation of residue by formula and by Laurent's series, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi-circle with f(z) not having poles on real axis).

BOS Chairman.

**Unit Outcomes:**

Students will be able to

- Understand the integration of complex functions.
- Apply Cauchy's integral theorem and Cauchy's integral formula.
- Understand singularities of complex functions.
- Evaluate improper integrals of complex functions using Residue theorem.

**Unit-III: Laplace Transforms**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

**Unit Outcomes:**

Students will be able to

- Understand the concept of Laplace transforms and finds the Laplace transforms of elementary functions.
- Find the Laplace transforms of general functions using its properties.
- Understand Laplace transforms of special functions (Unit step function, Unit Impulse & Periodic).
- Apply Laplace transforms to solve Differential Equations.

**Unit-IV: Fourier series &Fourier transforms**

**Fourier Series :** Fourier coefficients (Euler's formulae) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions.

**Fourier Integrals & Fourier Transforms:** Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem – Finite Fourier Sine and Cosine transforms.

**Unit Outcomes:**

Students will be able to

- Understand finding Fourier series expression of the given function.
- Determine Fourier coefficients (Euler's) and identify existence of Fourier series of the given function.
- Expand the given function in Fourier series given in Half range interval.
- Find Fourier Sine and cosine integrals.
- Understand Fourier transforms.
- Apply properties of Fourier transforms.

**Unit-V: Partial Differential Equations & Applications**

Solution of PDEs by Method of separation of variables –Solutions of one dimensional wave equation, one dimensional heat equation and Laplace equation in two dimensions under initial and boundary conditions.

**Unit Outcomes:**

Students will be able to

- Understand the method of separation of variables.
- Solve applications of Partial Differential Equations.

**Course Outcomes:**

After the completion of course, students will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
- Understand the usage of Laplace Transforms.
- Evaluate the Fourier series expansion of periodic functions.
- Formulate/solve/classify the solutions of Partial differential equations and also find the solution of one dimensional wave equation and heat equation.

**Text Books:**

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna publishers.

2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

**Reference Books:**

1. B.V.Ramana, "Higher Engineering Mathematics", McGraw Hill publishers.

2. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier.

# Fluid Mechanics and Hydraulic Machinery

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 2 | 4 |

**Course Objectives**

- To impart the knowledge of fluid properties and their behavior in static and dynamic states.
- To acquaint mathematical techniques to fluid flow problems.
- To familiarize solution methods in one dimensional viscous flow of different cases.
- To introduce the concepts of boundary layer.
- To teach working principle of hydraulic machinery.

**UNIT I:** **8 hours**

**Definition of fluid**: Continuum, velocity field, stress field, Newton's law of viscosity, Properties - compressibility, surface tension, vapour pressure, manometry.

**Fluid Kinematics**: Methods of Analysis – Systemand control volume, differential and integral, Kinematics – streamtube, stream function, potential function, vortex motion, free and forced vortices, continuity equation, Classification of flows – steadyand unsteady, uniform and nonuniform, laminar and turbulent, rotational and irrotational, viscous and inviscid, internal and external flows.

**Learning outcomes:**

After completion of this unit, students will be able to

- Interpret the properties of fluid and their application. (L2)
- Select appropriate method for analyzing fluid flow problems. (L1)
- Understand principles of continuity in fluid motions. (L2)

**UNIT II:** **10 hours**

**Fluid Dynamics**: Momentum equation and Bernoulli's equation, Measurement of flow –Venturimeter, orifice meter and pitot tube, stagnation properties, Exact flow solution – Couetteand Poisuielle flow, concept of boundary layer, measures of controlling boundary layer thickness, Turbulence – Reynolds stresses.

Darcy Weisbach equation – frictionfactor, minor losses, Moody's diagram.

**Learning outcomes:**

After completion of this unit, students will be able to

- Convert conservation laws into flow governing equations. (L3)
- Apply Bernoulli's principle for determining flow in measuring devices. (L3)
- Solve governing equations for solutions of simple fluid flow problems. (L3)

- identify importance of boundary layer and advantages of control (L3)
- judge factors influencing laminar and turbulent flow (L4)

**UNIT III:** **8 hours**

**Dimensional analysis**: Fundamental and derived dimensions, Rayleigh method, Buckingham theorem, dimensionless groups, application of dimensional groups, model testing and similitude, types of similarity - geometric, kinematic and dynamic, model testing methods.

**Learning outcomes:**

After completion of this unit, students will be able to

- Compute major and minor losses in pipe flows. (L3)
- Solve for forces exerted by the fluid through impulse momentum equation. (L3)
- Employ suitable scaling laws for converting model to prototype. (L3)
- Use similitude principle to test prototypes of machines. (L3)

**UNIT IV:** **8 hours**

**Impact of Jets**: Impulse momentum equation, Hydrodynamic force of jet striking stationary and moving vanes, flat and curved vanes, centrally and tangentially, series of vanes, radial vanes, velocity triangles, work done and efficiency

**Hydraulic Turbines:** Classification of hydraulic turbines – Impulseand Reaction turbines, Pelton, Francis and Kaplan turbines, working principles, Unit and specific quantities, performance curves.

**Learning outcomes:**

After completion of this unit, students will be able to

- Estimate forces exerted by jet on blades. (L4)
- Classify turbines based on principle of operation. (L2)
- Calculate various efficiencies of turbines. (L2)
- Select suitable turbine for operating conditions. (L3)

**UNIT V:** **8 hours**

**Rotodynamic Pumps**: Classification – mixed, axial, construction, principle and application. Centrifugal Pumps: working principle, work done by impeller, performance curves – Cavitation.

**Positive displacement Pumps**: Working –gearpump, vane pump, rotary piston pump, and Reciprocating pump – Working, Slip, Indicator diagrams, Airvessels.

**Learning outcomes:**

After completion of this unit, students will be able to

- Explain construction and operation of different pumps. (L2)

- Classify pumps based on principle of operation. (L2)
- Calculate efficiencies of pumps. (L3)
- Identify pump suitable for an application. (L3)

**TextBooks:**


1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. S K Som, Gautam Biswas, S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill, 2017.


**References:**


1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
2. YunusCengel, John Cimbala, Fluid Mechanics, McGraw Hill Education, 2017.
3. Jagdish Lal, Hydraulic Machines Including Fluidics, Metropolitan Book Co. Pvt. Ltd., 2016.


**Course Outcomes**

At the end of the course, student will be able to

- Interpret the behavior under static and dynamic conditions. (L2)
- Analyze one dimensional viscous flows using conservation laws for compressible and incompressible flows. (L4)
- Apply boundary layer flows for laminar and turbulent regimes. (L3)
- Explain Reynolds stresses and its application. (L3)
- Compare working of different fluid machinery and their design parameters. (L2)
- Explain different types of pumps and their application. (L2)

# Thermodynamics

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives**

- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
- Explain relationships between properties of matter and basic laws of thermodynamics.
- Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- Introduce the concept of available energy for maximum work conversion.
- Familiarize steam properties to understand working of steam power plants.
- Provide fundamental concepts of thermodynamics cycles used in steam power plants, IC engines and gas turbines.

**UNIT I:** **10 hours**

**Introduction: Basic Concepts**: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.

**First law of Thermodynamics:** Joule's experiment – firstlaw of thermodynamics, corollaries – perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics.

**Learning outcomes**

At the end of this Unit, the student will be able to

- Identify thermodynamic systems, properties and their importance in solving engineering problems. (L3)
- Explain energy balance for closed systems and open systems. (L4)
- Solve simple thermodynamics problems. (L3)

**UNIT II:** **8 hours**

**Second Law of Thermodynamics**: Kelvin –Planckstatement and Clausius statement and their equivalence, corollaries –perpetualmotion machines of second kind – reversibilityand irreversibility, cause of irreversibility – Carnotcycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

**Learning outcomes**

At the end of this Unit, the student will be able to

- Apply second law of thermodynamics in design of heat engine, refrigerator and heat pump. (L3)

- Explainthe efficiencyof thermodynamic systems.(L2)
- Enumerate the causes for poor performance of thermodynamic systems. (L3)

**UNIT III:** **8 hours**

**Entropy:** Clausius inequality –Conceptof Entropy – entropyequation for different processes and systems

**Availability and Irreversibility**: Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

**Learning outcomes**

At the end of this Unit, the student will be able to

- Apply entropy affects to estimate the performance of systems. (L3)
- Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process. (L4)
- Explain thermo-economics.(L3)

**UNIT IV:** **8 hours**

**Properties of Steam and use of Steam Tables**: Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry.

**Learning outcomes**

At the end of this Unit, the student will be able to

- Apply properties of steam to design steam systems. (L3)
- Examine steam systems using conservation equations. (L4)
- Evaluate the performance of steam systems. (L4)

**UNIT V:** **8 hours**

**Thermodynamic Relations:** Maxwell relations, TdS equations, difference in heat capacities, ratio of heat capacities, Energy equation, Joule Thompson coefficient, Clausius-Clapeyron equation.

**Air Standard Cycles:** Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Comparison of Otto, Diesel and dual cycles.

**Vapour Power Cycles:**Vapour power cycle, simple Rankine cycle, mean temp of heat addition thermodynamic variables effecting efficiency and output ofRankine cycle.

**Learning outcomes**

At the end of this Unit, the student will be able to

- Explain the importance of T-ds equations. (L3)
- Relate specific heats, internal energy, enthalpy and Joule-Thomson coefficient in standard form.

(L3)

- Examine the importance of compression ratio. (L4)
- Explain the cycles on which internal combustion engines work. (L3)

**Text Book(s)**

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

**References**

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009
4. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010.

**Course Outcomes**

After completing the course, the student will be able to

- Explain the importance of thermodynamic propertiesrelated to conversion of heat energy into work. (L3)
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles. (L3)
- Utilize steam properties to design steam based components. (L4)
- Compare thermodynamic relations and air standard cycles. (L4)

# Engineering Mechanics

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Explain the effect of force and moment in the different engineering applications.
- Teach center of gravity and moment of inertia of solids and surfaces.
- Familiarize frictional forces in mechanical applications.
- Analysis of rigid bodies under dynamic conditions.

**UNIT I:** **08 hours**

**Introduction to Engineering Mechanics:** Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

**Friction:** Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Resolve the forces in mechanical systems. (L2)
- Identify the moments and forces. (L3)
- Draw free body diagram. (L3)

**UNIT II:** **10 hours**

**Analysis of Structures:**Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

**Virtual Work:** Equilibrium of ideal systems, work done by a force, work done by a couple, principle of virtual work.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify different types of trusses. (L2)
- Analyze the plane trusses by method of joints and the method of sections. (L4)
- Demonstrate equilibrium of ideal system. (L2)
- Estimate the work done by a force and work done by a couple. (L3)

**UNIT III:** **10 hours**

**Properties of Surfaces and Volumes:** Centroid and centre of gravity, derivation of centroids from first moment of area, centroids of composite sections, centre of gravity of common volumes – cylinder, cone, sphere, theorem of Pappus – guidinus.

**Moment of Inertia:** Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes – thinplates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the centre of gravity of composite sections. (L3)
- Determine the centre of gravity of common solids. (L3)
- Determine moment of inertia for composite volumes. (L3)

**UNIT IV:** **10 hours**

**Kinematics:** Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, and motion under gravity – projectilemotion, use of rectangular coordinates, tangential and normal coordinates, radius of curvature, rotation of a rigid body about a fixed axis, introduction to plane motion.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Write equations of motion for rigid bodies. (L3)
- Find velocity and acceleration in rectilinear and curvilinear motions. (L4)
- Trace the path of projectile. (L3)

**UNIT V:** **08 hours**

**Kinetics:**Principles of dynamics - Newton'sLaws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

**Ideal Systems:** Principle of conservation of energy and applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- ApplyD'Alembert's principle in rectilinear translation. (L3)
- Relate principle of work and energy in dynamic systems. (L3)
- Make use of principle of momentum and impulse to dynamic bodies. (L4)

**Text books:**

1. N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.
2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.
3. S SBhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

**Reference Books:**

1. Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2. Irving Shames, G.K.M Rao, Engineering Mechanics: Statics and Dynamics, 4/e, Pearson, 2009.
3. K.L. Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.

**Course Outcomes:**

Upon successful completion of the course, the students will be able to

- Resolve forces and couples in mechanical systems. (L3)
- Identify the frictional forces and its influence on equilibrium. (L3)
- Find the centre of gravity and moment of inertia for various geometric shapes. (L3)
- Develop equations for different motions. (L4)
- Determine the displacement, velocity and acceleration relations in dynamic systems. (L4)
- Relate the impulse and momentum. (L4)

# Material Science and Engineering

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 2 | 4 |

**Course Objectives**

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams and heat treatment of steels.
- Explain the methods to change the properties of materials through heat treatment processes.
- Expose commercially important metals and alloys (both ferrous and nonferrous) with engineering constraints.
- Familiarize properties and applications of ceramics, polymers and composite materials.
- Demonstrate the fundamental properties of nano-materials and their applications.

**UNIT I:** **10 Hours**

**Structure of Metals:** Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

**Constitution of Alloys:** Necessity of Alloying, substitutional and interstitial solid solutions – Phasediagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron – Iron – carbidediagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

**Learning Outcomes:**

At the end of this unit the student will be able to

- Explain the importance of material science in engineering.(L2)
- Recall the definitions and terminology of crystallography. (L1)
- Distinguish metals and alloys. (L4)
- Make use of the principles of construction of binary phase diagrams. (L3)
- Identify various invariant reactions in binary phase diagrams. (L3)
- Explain the concept of metallography in studying the microstructures of metals and alloys. (L2)

**UNIT II:** **8 Hours**

**Heat Treatment of Steels**: Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for $Fe$-$Fe_3C$alloys and microstructure development. Continious cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

**Learning Outcomes:**

At the end of this unit the student will be able to

- Understand the importance of steel and iron - iron carbide phase diagram. (L2)
- Explain the influence of heat treatment in modification of properties of steels. (L2)
- Develop a heat treatment cycle based on properties required. (L3)
- Explain the principles of surface hardening methods. (L2)

**UNIT III:** **8 Hours**

**Steels:** Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Micro structure, properties and applications of alloy steels-stainless steels and tool steels.

**Cast irons:** Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

**Learning Outcomes:**

At the end of this unit the student will be able to

- Classify various types of steels, their properties and applications. (L2)
- Identify various types of cast irons, their properties and applications. (L3)
- Compare steels and cast irons and their limitations in applications. (L3)

**UNIT IV:** **8 Hours**

**Non-ferrous Metals and Alloys:** Micro structure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al – Cuphase diagram, precipitation hardening. Micro structure, properties and applications of titanium and its alloys.

**Learning Outcomes:**

At the end of this unit the student will be able to

- Explain the importance of non-ferrous metals and alloys in engineering applications. (L2)
- Demonstrate various properties and applications of non-ferrous alloys. (L4)
- Differentiate between hardening of ferrous and non-ferrous alloys. (L4)

**UNIT V:** **8 Hours**

**Ceramics, Polymers and Composites:** Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterial's.

**Learning Outcomes:**

At the end of this unit the student will be able to

- Explain the properties of ceramics and their applications. (L2)
- Summarize the properties of polymers and composites and their use. (L2)
- Interpret the properties of Nano materials and their applications. (L2)
- Identify the difference between the micro and Nano scale materials and their uses. (L3)

**Course Outcomes:**

After completing the course, the student will be able to

- Explain the principles of binary phases. (L2)
- Apply heat treatment to different applications. (L3)
- Selectsteels and cast irons for a given application. (L3)
- Utilize nonferrous metals and alloys in engineering. (L3)
- Choose composites for various applications. (L3)
- Assess the properties of Nano-scale materials and their applications. (L2)

**TextBook:**

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. William D. Callister Jr.Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.

**References:**

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.VanVlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

# Manufacturing Processes– I

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 3 | 4.5 |

**Course Objectives:**

- Working principle of different metal casting processes and gating system.
- Classification of the welding processes, working of different types of welding processes and welding defects.
- Nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Principles of forging, tools and dies, working of forging processes.
- Classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy.

**UNIT I:** **8 Hours**

**Introduction:**Importance and selection of manufacturing processes.

**Casting Processes:** Introduction to casting process, process steps; pattern: types, materials and allowance; Cores: Types of cores, core prints, principles and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Selection of suitable manufacturing process for a given product. (L3)
- Understand the steps involved in metal casting, pattern making. (L2)
- Apply the knowledge of designing gating systems, risers. (L3)
- Compare the working of various metal casting processes. (L4)
- Identify the various casting defects. (L3)

**UNIT II:** **10 Hours**

**Metal Forming:** Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects.

**Rolling:** Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.



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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Compare cold working and hot working processes. (L4)
- Explain the working of rolling mills. (L2)
- Evaluate the forces and power in rolling and extrusion processes. (L5)
- Summarize the working of various extrusion processes. (L2)
- Identify the principles of forging, tools and dies. (L3)
- Summarize the various operations of Sheet metal forming. (L2)

**UNIT III:** **8 Hours**

**Metal Joining Processes:** Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding,Oxy Acetylene Gas Welding, Resistance Welding, Thermit Welding, applications, advantages, and disadvantages of the above processes, other fabrication processes. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies.

At the end of this unit, the student will be able to

- Classify the working of various welding processes. (L2)
- Compare V-I characteristics of different welding processes. (L4)
- Summarize the applications, advantages of various welding processes. (L2)
- Identify the defects in welding. (L3)

**UNIT IV:** **8 Hours**

**Plastics:** Types, properties and their applications, processing of plastics: extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding

**Ceramics**: Classification of ceramic materials, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the methods of manufacturing plastics parts. (L2)
- Explain the steps in making ceramics parts. (L2)
- Explain the steps in manufacturing of powder metallurgy parts. (L2)
- Demonstrate the application of plastic, ceramics and power metallurgy. (L2)

**UNIT V:** **10 Hours**

**Unconventional Machining Processes:** Principles and process parameters of Abrasive jet machining (AJM), Water jet machining (WJM), Ultrasonic machining (USM),and Electrical discharge machining (EDM).

Principle and processes parameters of Electro – chemical machining (ECM), Laser beam machining (LBM), Plasma arc machining (PAM) and Electron beam machining (EBM).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify different unconventional machining processes. (L3)
- Evaluate process parameters of EDM, ECM, LBM, PAM and AJM.(L5)
- Apply various unconventional machining processes. (L3)

**Text Books:**

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjain S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

**Reference Books:**

1. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
3. Hajra Choudhury S.K, Elements of Workshop Technology Vol 1: Manufacturing Processes, 15/e, Media Promoters and Publishers Pvt. Ltd., 2013.

**Course Outcomes:**

At the end of the course, the student will be able to

- Demonstrate different metal casting processes and gating systems. (L2)
- Classify working of various welding processes. (L2)
- Evaluate the forces and power requirements in rolling process. (L5)
- Apply the principles of various forging operations. (L3)
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy. (L1)
- Identify different unconventional processes and their applications. (L3)

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| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

## UNIVERSAL HUMAN VALUES

**OBJECTIVES**

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of Others

### Unit I: HUMAN VALUES

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Self interest - Spirituality, Moral dilemmas- Consensus and controversy.

### Unit II: PERSONALITY DEVELOPMENT

Concept of personality, types of personalities, Knowing of self(SWOT), improving personality – techniques, interpersonal skills, intrapersonal skills, building right attitude, developing the spirit of universal human goodness.

### Unit III: ENGINEERING AS SOCIAL EXPERIMENTATION AND

Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

### RESPONSIBILITY FOR SAFETY AND RISK

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk- Safety and the Engineer- Designing for the safety.

**UNIT IV:** UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY.

Understanding Harmony in the family – the basic unit of human interaction, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family.

**UINIT V: GLOBAL ISSUES**

Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics and Research – Analyzing Ethical Problems in research – Intellectual property Rights( IPR).

## Outcomes:

- Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field.
- Identify the multiple ethical interests at stake in a real-world situation or practice.
- Articulate what makes a particular course of action ethically defensible.
- Assess their own ethical values and the social context of problems.
- Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects.
- Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.
- Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

## Text Books

1. "**Engineering Ethics**" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
2. **Engineering Ethics includes Human Values**" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
3. **"Ethics in Engineering"** by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill– 2003.
4. **"Professional Ethics and Morals**" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
5. **"Professional Ethics and Human Values**" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
6. **"Indian Culture, Values and Professional Ethics"** by PSR Murthy-BS Publication.

7. **"Professional Ethics and Human Values"** by Prof.D.R.Kiran.

# Fluid Mechanics and Hydraulic Machinery Lab

**Course Objectives:**

- Explain the application of Bernoulli's equation in internal flows.
- Familiarize with the performance of turbines and pumps.
- Develop skill for measurement of pressure in external flows.

**LIST OF EXPERIMENTS**

1. Free and Forced vortex apparatus.
2. Calibration of Venturimeter / Orifice meter.
3. Resistance characteristics of pipes – friction factor.
4. Minor losses in pipes – sudden contraction/bends/valves.
5. Impact of a jet on flat and curved plates.
6. Performance characteristics of single and multi – stagecentrifugal pump.
7. Performance characteristics of reciprocating pump.
8. Performance characteristics of Pelton wheel turbine.
9. Performance characteristics of Francis turbine.
10. Performance characteristics of Kaplan turbine.

**Course Outcomes**

Upon the successful completion of course, students will be able to

- Explain the devices used for measuring flow.
- Compute major losses in pipes.
- Illustrate the operating parameters of turbines.
- Explain the working of different types of pumps.

# Material Science & Engineering Lab

**Course Objectives:**

1. To understand microstructure of engineering materials.
2. To explain grain boundary layers and grains size of different engineering materials.

**List of Experiments:**

1. Study of microstructure of pure metals – Iron, copper and aluminum.
2. Study of microstructure of low carbon steel, mild steel and high carbon steel.
3. Study of microstructure of cast irons.
4. Study of microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.
5. Study hardenability of steels by Jominy End Quench Test.
6. Study of microstructure of heat treated steels.
7. Find hardness of various untreated and treated steels.
8. Study of microstructure of ceramics, polymeric materials.
9. Study of microstructure of super alloy and Nanomaterial's.
10. Find the harness of ceramics, super alloys, Nanomaterial's and polymeric materials (one sample on each)

**Course Outcomes:**

The student is able to

- Identify various microstructures of steels and cast irons. (L3)
- Visualize grains and grain boundaries. (L3)
- Evaluate hardness of treated and untreated steels. (L4)
- Summarize the importance of hardening of steels. (L2)

# Manufacturing Processes - I Lab

**Course Objectives:**

- Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

1. **METAL CASTING**
   a) Gating Design and pouring time and solidification time calculations.
   b) Sand Properties Testing – Exercise for Strength and Permeability.
   c) Molding, Melting and Casting for ferrous/ non ferrous materials.

2. **WELDING**
   a) TIG Welding.
   b) MIG Welding.
   c) Friction stir welding
   d) Any other Special Welding Processes.

3. **MECHANICAL PRESS WORKING**
   a) Press Tool: Blanking and Piercing operation with Simple, Compound and Combination dies.
   b) Closed die forging, Deep Drawing and Extrusion operations.

4. **UN CONVENTIONAL MANUFACTUNRING PROCESSES**
   a) Electro Discharge Machining (EDM)/ Wire cut EDM.
   b) Plasma arc cutting / Abrasive jet machining (AJM).
   c) Additive manufacturing with reverse engineering.

**Course Outcomes:**

At the end of the lab, the student will be able to

- Fabricate different types of components using various manufacturing techniques. (L6)
- Adapt unconventional manufacturing methods. (L6)

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: PULIVENDULA**
**DEPARTMENT OF CHEMISTRY**
**II B.TECH – I/II SEMESTER Mandate Course (MC)**
**(THEORY)**

| Subject Code | Title of the Subject | L | T | P | C |
|---|---|---|---|---|---|
| | Environmental Science | 3 | 0 | - | 0 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To make the student understand multi disciplinary nature of environment and its components. |
| 2 | To investigate the relationship between human life and environment from scientific prospective. |
| 3 | To impart knowledge to the students about fundamental concepts of Ecosystem and Biodiversity |
| 4 | Necessasity of analyzing regional, national and global environmental problems |
| 5 | To understand and apply the fundamentals of Environmental science to important local, regional, national and global environmental problems and potential issues |

| COURSE OUTCOMES | |
|---|---|
| CO1 | Able to solve the environmental problems based fundamental concepts of Environmental Science. |
| CO2 | Enable the students to understand the structure and function of significant environmental systems |
| CO3 | Knowledge of concepts makes them differentiate Natural and Polluted environment.. |
| CO4 | Enable to apply the Pyramid of number, mass and Energy, understand about Renweable energy resources.<br>Illustrate the Forest ecosystem, Discuss about Grass and Net biomass productivity |
| CO5 | Differentiate between Forest and desert Ecosystems, Critically evaluate arguments regarding environmental issues. Illustrate the Food chain and food web, Identify the applications of rain water harvesting, Interpret advantages of In-situ and Ex-situ conservation of biodiversity |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |

## SYLLABUS

**UNIT-I:**

**i) Multidisciplinary** nature of environmental studies

The **Multidisciplinary** nature of environmental studies Definition; Scope and importance, Need for public awareness.

**ii) Natural Resources:**

Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and Over-exploitation, deforestation, case studies. Dams, benefits and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water

**c) Earth: Geomorphology, Weathering, Structure of Earth - inner core, outer core, mantle and the crust, magma.**

**d)** Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

e) Food resources: World food problems, changes caused by agriculture, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

**UNIT-II:**

**i) Ecosystems**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession. Food chains, food webs and ecological pyramids.

Types of some ecosystems: -

a. Forest ecosystem  b. Desert ecosystem

d. Aquatic ecosystems (ponds, rivers, oceans, estuaries).

**ii) Biodiversity and its Conservation**

Introduction-Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega-diversity nation.

Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT-III:**

Environmental Pollution and Disaster management**:**

**Definition** - Causes, effects and control measures of:

a. Air pollution  b. Water pollution  c. Soil pollution d. Marine pollution

e. Noise pollution  f. Thermal pollution  g. Nuclear hazards

Disaster management: floods, earthquake, cyclone and landslides.
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

**UNIT-IV:**

**Social Issues and the Environment**

From Unsustainable to Sustainable development. Water conservation, rain water harvesting, watershed management.
Resettlement and rehabilitation of people; its problems and concerns. Case studies.
Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.
Issues involved in enforcement of environmental legislation. Public awareness.

**UNIT-V:**

**i) Human Population and the Environment**

Population growth, variation among nations. Population explosion-Family welfare Programme.
Environment and human health, Women and Child Welfare, Role of information Technology in Environment and human health, Case Studies.

**ii) Field Work**

- Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of simple ecosystems-pond, river, hill slopes, etc.

**Text Books:**

1. Shashi Chawla, A Text Book of Environmental Studies, Mc Graw Hill Education, 4th edition, 2014
2. De A.K., Environmental Chemistry, Wiley Eastern Ltd , 2012

**Reference Books**

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
3. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**COLLEGE OF ENGINEERING (AUTONOMOUS), PULIVENDULA**
**B.Tech – II-II Sem (R19)**

**L T P C**
**3 0 0 3**

## Numerical Methods, Probability and Statistics
**(Common to CIVIL, ME, EEE& CSE)**

**Course Objectives:**

1) To familiarize the students with numerical methods of solving the non-linear equations, interpolation, differentiation, integration, and ordinary differential equations.
2) To impart knowledge in basic concepts and few techniques in probability and statistics in various applications in engineering.

### Unit I: Solution to algebraic and transcendental equations& Interpolation

Solution of algebraic and transcendental equations: bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

**Learning Outcomes:**

After completion of this unit student able to

- find approximate roots of the an equation by using different numerical methods
- explain various discrete operators and find the relation among operators
- apply Newton forward and backward formulas for equal and unequal intervals

### Unit II: Numerical differentiation, integration & Solution of Initial Value Problems to Ordinary Differential Equations of first order.

**Numerical Differentiation and Numerical integration**: Numerical differentiation using Newton's forward & backward interpolation formulae; Numerical Integration by trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

**Numerical Solutions of Ordinary differential equation:** Solution by Taylor's series, Picard's method of successive approximations, Euler's method, modified Euler's method and Runge-Kutta method of fourth order.

**Learning Outcomes:**

After completion of this unit student able to

- find integration of a function by different numerical methods
- solve ordinary differential equations using different numerical schemes

**Unit III: Probability & Random Variables**

Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem.

Random variables (discrete and continuous), probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties. (All concepts without proofs)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- explain the terms sample space, random variable, expected value
- apply probability theory via Baye's theorem
- identify the notations of discrete and continuous distribution functions
- evaluate Binomial and Poisson distributions
- explain the properties of normal distribution

**Unit IV: Testing of hypothesis**

Formulation of hypothesis, critical region, level of significance. Large sample tests: test for single proportion, difference of two proportions, test for single mean and difference of two means.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- explain the concept of testing of hypothesis
- apply the concept of hypothesis testing for large samples

**Unit V: Small Sample Tests**

Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), $\chi 2$ - test for independence of attributes and goodness of fit.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- apply the concept of testing hypothesis for small samples
- estimate the goodness of fit

**Text Books:**

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008
3. S.S.Sastry, "Introductory methods of Numerical Analysis", 5th edition, PHI, 2012.

**References:**

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons publications, 2012.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
3. P. Kandasamy, K. Thilagavathy, S. Gunavathy, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.

**Course Outcomes:**

Students will be able to

- apply different methods to find roots of the equations
- find approximate the solutions of ordinary differential equations
- apply the Laplace transform for solving differential equations
- explain the concepts of probability and their applications
- apply discrete and continuous probability distributions in practical problems
- use the statistical inferential methods based on small and large sampling tests

Hemy

# Internet of Things (IoT)

**(ME)**

**B. Tech – IV Semester (R19)** **L-T-P-C**

**2-0-0-2**

## Course objectives:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario..

## Course Outcomes:

Upon completion of this course, students will acquire knowledge about:

- Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
- Develop web services to access/control IoT devices.
- Deploy an IoT application by using all resources.
- Analyze applications of IoT in real time scenario.

### UNIT I: Fundamentals of IoT

Introduction – Characteristics-Physical Design - Protocols – Logical Design – Enabling technologies – IoT Levels – Six Levels of IoT - Domain Specific IoTs.

### UNIT II: IoT and M2M

M2M, IoTvs M2M, SDN and NFV for IoT, IOT system Management with NETCONF-YANG.

### UNIT III: IoT Design Methodology

IoT Systems Management – IoT Design Methodology – Specifications Integration and Application Development.

### UNIT IV: Sensors and Connectivity

Sensors- Types of sensor nodes, Internet communications, IP addresses, MAC Address, TCP and UDP Ports, Application layer protocols

### UNIT V: IoT Applications

IOT application for industry-Future factory concepts, Brownfield IoT, Smart objects, Smart applications, Study of existing IoT platforms/middleware, IoT- A, Hydra etc.

**TEXT BOOKS:**

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things – A Hands-on Approach", Universities Press, 2015.

**REFERENCES:**

1. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
2. Marco Schwartz, "Internet of Things with the Arduino Yun", Pack Publishing, 2014.
3. *Simon Monk, "Programming the Raspberry Pi: Getting Started with Python"*, McGraw-Hill, *2013.*
4. CharalamposDoukas,"Building Internet of Things With the Arduino", Second Edition, 2012.
5. Dr.John Bates, "Thingalytics: Smart Big Data Analytics for the Internet of Things", Software AG Publisher, 2015.

# Design Thinking and Product Innovation

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 2 | 3 |

Design is a realization of a concept or idea into a configuration, drawing or a product. Design thinking is cognitive and practical processes by which design concepts are developed by designers. Innovation is a new idea or a new concept. Product development is the creation of a new or different product that offers new benefits to the end user. This course introduces the design thinking in product innovation.

**Course Objectives:**

- To bring awareness on innovative design and new product development.
- To explain the basics of design thinking.
- To familiarize the role of reverse engineering in product development.
- To train how to identify the needs of society and convert into demand.
- To introduce product planning and product development process.

**UNIT I:**

Science to Engineering: Job of engineers, engineering units and measurement, elements of engineering analysis, forces and motion, energy, kinematics and motion, conversion of linear motion to rotary and vice versa, motion transmission.
Physics to Engineering: Application of Newton laws, Pascal's law, Bouncy, Bernoulli's theorem, Ohm's law, and electrical induction in engineering products.

**Learning Outcomes:**

After completion of this Unit, the student will be able to

- Relate the principles of science to engineering. (L2)
- Explain simple mechanics motion and force transmission. (L2)
- Identify the laws of physics applied to engineering products. (L3)

**UNIT II:**

Historical Development: Invention wheel, early mechanics in design, mechanical advantages, industrial revolution, steam and petrol for mobility. Innovations in Electrical and Electronics: Electrical energy generation, electrical bulb, electrical equipment, electronics and automation, computing for early days to present, innovations in communications.

**Learning Outcomes:**

After completion of this Unit, the student will be able to

- Identify innovation in early mechanical designs. (L2)
- Explain development of electrical equipment. (L2)
- List out the developments in computing machines. (L4)
- Summarize innovations in communication systems. (L2)

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**UNIT III:**

Systematic approach to product development: Design Thinking, Innovation, Empathize Design Thinking as a systematic approach to Innovation, brainstorming, visual thinking, design challenges, innovation, art of Innovation, strategies for idea generation, creativity, teams for innovation. Solution finding methods: Conventional, intuitive, discursive, methods for combining solution, decision making for new design.

**Learning Outcomes:**

After completion of this Unit, the student will be able to

- Explain the steps in the design process. (L2)
- Apply systematic approach in design. (L3)
- Develop strategies for new product development. (L3)

**UNIT IV:**

Reverse engineering in product development: Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, 3D printing, and study of introducing electrical and electronic controls to the old products, importance of ergonomics in product development, environmental considerations in design, and safety considerations in design.

**Learning Outcomes:**

After completion of this Unit, the student will be able to

- Understand reverse engineering methods in product development. (L2)
- Use new materials to improve the product. (L2)
- Apply electronic controls to improve the product acceptability. (L3)
- Summarize the safety and environmental factors in new product design. (L2)
- Understand 3D printing in manufacturing. (L2)

**UNIT V:**

Study of Product Development- Agriculture, development of machines for separation of corn seeds, peeling of groundnut shells, husk removing from paddy. Electrical: Design of burglar alarm, speedometer, water level indicator, smart gates, and smart lights. Design of electrical vehicles, unmanned vehicles, design principles in drones.

**Learning Outcomes:**

After completion of this Unit, the student will be able to

- Identify the needs for new product development in agriculture. (L3)
- Develop simple electrical gadgets. (L3)
- Explain the principles in design electrical vehicles and drones. (L2)

**Reference Books:**

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4/e, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2/e, Laurence King Publishing Ltd., 2010.

3. An AVA Book, "Design Thinking", AVA Publishing, 2010.
4. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3/e, Springer, 2007.
5. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

**Course Outcomes**

After completion of this course, the student will be able to

- Summarize the importance of basic sciences in product development. (L2)
- Explain the historical developments in mechanical, electrical, communications and computational engineering. (L3)
- Apply systematic approach to innovative designs. (L3)
- Identify new materials and manufacturing methods in design. (L3)

V. Venkatesh

# Mechanics of Materials

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 2 | 4 |

**Course Objectives:**

- Introduce the concepts of different stresses, strains and their relationships.
- Discuss the principal stresses and components of stress on different planes under different loads.
- Explain maximum shear force and bending moment of different beams under different loading conditions.
- Demonstrate bending stress and shear stress distribution of various cross section of beams and to predict the maximum slope deflection of beams.
- Impart strain energy due to axial, bending, and torsion loading, and to solve statically indeterminate problems using Castigliano's theorem.
- Focus on the stresses and deformations of the springs.
- Familiarize the Euler's concept of buckling in columns & struts.

**UNIT I:**

**10 Hours**

**Stresses and Strains:**Types of stresses and strains, stress-strain relations, stress-strain diagram for ductile and other materials, axial loaded bars of uniform and varying cross section, compound bars, relation between three elastic moduli, thermal stresses.

**Principal stresses and strains:** Biaxial state of stress with and without shear - Mohr's Circle and analytical methods.

**Learning outcomes:**

After completing this unit, the student will be able to

- Determine stresses and deformations due to axial loads in simple members. (L3)
- Analyze stresses compound bars due to temperature raise. (L4)
- Correlate the elastic constants of materials.(L3)
- Construct the Mohr's circle for calculating principal stresses.(L3)
- Analyze principal stresses in biaxial state of loading. (L4)

**UNIT II:**

**10 Hours**

**Analysis of Beams:** Types of beams and loads, shear force and bending moment diagram for cantilever, simply supported and overhanging beams for different types of loadings, point of contra flexure, relation between shearing force and bending moment.

**Deflection of Beams**: Differential equations of the deflection curve, Slope and deflection: using double integration method, Macaulay's method and Moment area method for simply supported, cantilever and overhanging beams.

**Learning outcomes:**

After completing this unit, the student will be able to

- Draw shear force and bending moment diagrams in beams subject to bending loading.(L3)
- Determine bending stresses in beams under different loading. (L4)
- Evaluate the maximum shear force and bending moment and their location in beams. (L4)
- Demonstrate the shear stress and bending moment distribution in different cross sections of beams.(L4)

**UNIT III:** **8 Hours**

**Bending Stresses**: Flexural equation, bending stress distribution and efficiency of various cross sections of beams. **Shear Stresses**: Shear stress distribution for different cross sections of beams.

**Energy Methods**: Strain energy, resilience. Deflection under single and several loads, Castigliano's theorem.

**Learning outcomes:**

After completing this unit, the student will be able to

- Compute the slope and deflection in beam under different loading.(L3)
- Distinguish various approaches for calculating slope and deflection. (L4)
- Explain the difference between strain energy, resilience, elastic strain energy and modulus of toughness. (L2)
- Apply the Castigliano's theorem for beams. (L3)

**UNIT IV:** **8 Hours**

**Torsion of Circular Shafts**: Theory of pure torsion, transmission of power in solid and hollow circular shafts, comparison of strengths of solid and hollow shafts, shafts in series and parallel, combined bending and torsion.

**Springs**: Deflection of closed and open coil helical springs under axial force and axial couple, Leaf springs.

**Learning outcomes:**

After completing this unit, the student will be able to

- Analyze circular shafts subjected to twisting couple. (L4)
- Determine stresses in shafts subjected to combined loads.(L4)
- Determine angle of twist in shafts. (L4)
- Determine stresses and deformations in helical and leaf springs. (L5)

**UNIT V:** **8 Hours**

**Buckling of Columns**: Analysis of columns to evaluate buckling loads with different boundary conditions, Euler's formula and its limitations, Rankine's formula, columns under eccentric load, columns under initial curvature.

**Thin Cylinders**: hoop and stresses, longitudinal, cylindrical and spherical shells subjected to internal pressure calculation of volumetric strain.

**Learning outcomes:**

After completing this unit, the student will be able to

- Determine buckling load in compressive members. (L4)
- Apply concepts of elastic stability of columns. (L3)
- Assess hoop and longitudinal stresses in thin cylinders. (L3)
- Calculate volumetric strain. (L3)

**Text Books:**

1. F.P. Beer, E.R. Johnston, Jr&John.T. DeWolf, Mechanics of Materials, 7/e, Tata McGraw-Hill, 2016.
2. SS Rattan, Strength of materials, 3/e, Tata McGraw-Hill, 2016.

**References:**

1. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
2. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

**Course Outcomes:**

After successful completion of this course student will be able to

- Apply the concepts of stress and strain to machine numbers. (L3)
- Determine, shear forces, and bending moments in beams. (L4)
- Find the slope and deflection in beams.(L4)
- Estimate the stress in machine members such as shafts and springs.(L4)
- ApplyCastigliano's theorem to determine displacements in beams. (L3)
- Analyze columns for buckling loads.(L4)
- Estimate the stresses in thin cylinders due to internal pressure.(L3)

# Theory of Machines

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Introduce various basic mechanisms and their applications.
- Explain importance of degree of freedom.
- Familiarize velocity and acceleration in mechanisms.
- Describe the cams and follower motions.
- Explain the importance of gyroscopic couples.
- Introduce the equation of motion for single degree of freedom system.

**UNIT I:** **10 Hours**

**Simple Mechanisms:**

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains- Limit positions – Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line mechanisms – UniversalJoint – Rocker mechanisms.

**Learning outcomes:**

After completion of this unit, students will be able to

- Contrast the difference between machine and structure. (L2)
- Identify different types of kinematic pairs, kinematic chains. (L3)
- Find degrees of freedom for different mechanisms. (L1)
- Identify the inversions of four bar mechanism. (L3)
- Explain the difference between Davis and Ackerman steering gear mechanisms. (L2)

**UNIT II:** **12 Hours**

**Plane and motion analysis:**

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations – kinematicanalysis of simple mechanisms – slidercrank mechanism dynamics – Coincidentpoints – Corioliscomponent of acceleration.

**Learning outcomes:**

After completion of this unit, students will be able to

- Calculate the velocities and acceleration of various links in a mechanism. (L4)
- Determine instantaneous centers for a given mechanism. (L4)

**UNIT III:** **10 Hours**

**Gyroscope:**

Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two wheeler, simple problems

**Gear Profile:**

Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

**Learning outcomes:**

After completion of this unit, students will be able to

- Explain the concept of gyroscopic couple. (L2)
- Analyze the effects of gyroscopic couple on an aeroplane, ship and road vehicles. (L4)
- Explain the different gear profiles and parameters. (L2)
- Identifydifferent types of gears and application. (L3)

**UNIT IV:** **12 Hours**

**Balancing of Rotating masses:**

Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

**Cams:**

Classification of cams and followers- Terminology and definitions – Displacementdiagrams – Uniformvelocity, parabolic, simple harmonic and cycloidal motions – derivativesof follower motions-specified contour cams- circular and tangent cams –pressureangle and undercutting.

**Learning outcomes:**

After completion of this unit, students will be able to

- Explain the importance of balancing. (L2)
- Analyze balancing problems in rotating engines. (L4)
- Explain the working of cams and followers. (L2)
- Analyze the different motions in cam and followers. (L4)

**UNIT V:** **12 Hours**

**Vibrations:**

Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.

**Turning Moment Diagrams and Flywheels:** Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.

**Learning outcomes:**

After completion of this unit, students will be able to

- Formulate equations of motion and solve for single degree of freedom system with damping. (L6)
- Estimate natural frequency of vibratory systems. (L5)
- Explain concept of vibration isolation and transmissibility. (L2)

**Text Book(s)**

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

**References**

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.: Prentice Hall, 1993.

**Course Outcomes:**

At the end of the course the students will be able to

- Understand different mechanisms and their inversions. (L2)
- Calculate velocity and acceleration of different links in a mechanism. (L4)
- Apply the effects of gyroscopic couple in ships, aero planes and road vehicles. (L3)
- Evaluate unbalance mass in rotating machines. (L5)
- Analyze free and forced vibrations of single degree freedom systems. (L4)

# Manufacturing Processes - II

| L | T | P | C |
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**Course Objectives:**

- Explain parameters in the metal cutting operation.
- Relate tool wear and tool life and the variables that control them.
- Calculate machining times for different machining processes.
- Teach various metal cutting processes. (Lathe, drilling, boring shaping, slotting, milling and grinding).
- Familiarize the principles of jigs and fixtures and types of clamping and work holding devices.

**UNIT I:** **8 Hours**

**Material Removal Processes:**

**Metal Cutting:** Single and multi-point cutting, orthogonal cutting, various force components, chip formation, tool wear and tool life, surface finish and integrity, machinability, cutting tool materials, cutting fluids, coatings.

**Learning Outcomes:**

At the end of the this unit, the student will be able to

- Describe cutting processes and variables. (L2)
- Classify various types of chips, cutting tool materials and cutting fluids. (L4)
- Calculate cutting force, speed and feed finding techniques during machining. (L5)

**UNIT II:** **10 Hours**

**Machining processes for round shapes:**

**Lathe and Lathe Operations:** Principles of working, specifications, types of lathes, operations performed, work holders and tool holders. Taper turning, thread turning attachments for lathes. Machining time calculations. Turret and capstan lathes – Principleof working, collect chucks, other work holders – toolholding devices.

**Boring and Boring Machines-** Principles of working, specifications, types, and operations performed – toolholding devices –nomenclature of boring tools

**Drilling and Drilling Machines:** Principles of working, specifications, types, and operations performed – toolholding devices – nomenclatureof twist drill.

**Reaming and Reamers:** Principles of working, specifications, types, and operations performed – toolholding devices – nomenclatureof reamers.

**Taping and Taps:** Principles of working, specifications, types, and operations performed – toolholding devices – nomenclatureof taps.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List the specifications for various types of lathes. (L1)
- Determine cutting speeds for different machining operations. (L5)
- Identify parts of drilling, boring, reaming machines. (L3)

**UNIT III:** **8 Hours**

**Machining processes for other shapes:**

**Milling operations and Milling machines:** Principles of working, specifications, classifications of milling machines, machining operations, types and geometry of milling cutters, methods of indexing, and accessories to milling machines, machining time calculations, gear hobing.

**Shaping, Slotting and planning machines:** Principles of working – principalparts, specification, classification, and operations performed, machining time calculations.

**Gear Manufacturing:**

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recognize the parts of milling, shaping, slotting and planning machine. (L3)
- Compare tool geometry for milling, shaping, slotting and planning operations. (L3)
- Calculate machining times. (L5)

**UNIT IV:** **8 Hours**

**Abrasive Machining:**

**Grinding and Grinding Machines:** Grinding process, types of grinding machines, grinding process parameters, honing, lapping, other finishing processes.

**Learning Outcomes:**

- At the end of this unit, the student will be able to
- Understand the basic principles of abrasive processes. (L2)
- Explain the designation of the grinding wheel and the significance of the various codes. (L2)
- Classify different types of grinding machines and their applications. (L4)
- Assess the grinding process and variables that effect the operation. (L5)
- Estimate the time and power required for the grinding operation. (L5)
- Explain various types of abrasive processes such as honing and lapping for final finishing operation. (L2)

UNIT V: **8Hours**

**Jigs and Fixtures** Principles of design of Jigs and fixtures and uses, 3-2-1 principle of location and clamping, classification of Jigs & Fixtures, types of clamping and work holding devices, typical examples of jigs and fixtures.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify various types of jigs and fixtures. (L4)
- Identify various types of work and tool holding devices. (L3)
- Explain the design principles of jigs and fixtures. (L2)
- Design a jig and fixture for a given application. (L6)

**Text books:**

1. P.N. Rao, Manufacturing Technology: Metal Cutting and Machine Tools, (Volume 2), 3/e,Tata McGraw-Hill Education, 2013
2. R.K. Jain and S.C. Gupta, Production Technology, 17/e, Khanna Publishers, 2012.

**Reference books:**

1. Kalpakzian S and Schmid SR, Manufacturing Engineering and Technology, 7/e, Pearson, 2018.
2. Milton C.Shaw, Metal Cutting Principles, 2/e, Oxford, 2012.
3. Hindustan Machine Tools, Production Technology, TMH, 2001.
4. V.K.Jain, Advanced Machining Process, 12/e, Allied Publications, 2010.
5. AB. Chattopadhyay, Machining and Machine Tools, 2/e, Wiley, 2017.
6. Halmi A Yousuf& Hassan, Machine Technology: Machine Tools and Operations, CRC Press Taylor and Francis Group, 2008.

**Course Outcomes:**

At the end of the course, the student will be able to

- Choose cutting processes and variables. (L3)
- Relate tool wear and tool life. (L1)
- Calculate the machining parameters for different machining processes. (L5)
- Identify methods to generate different types of surfaces. (L3)
- Explain work-holding requirements. (L2)
- Design jigs and fixtures. (L6)

# Computer Aided Machine Drawing

| L | T | P | C |
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**Course Objectives:**

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D assembly drawings from 3D assemblies.
- Familiarize with limits, fits and tolerances in mating components.

**The following contents are to be done by any 2D software package**

**Conventional representation of materials and components:**

**Detachable joints:** Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.

**Riveted joints:** Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

**Welded joints:** Lap joint and T joint with fillet, butt joint with conventions.

**Keys:** Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Shaft coupling, bushed pin-type flange coupling, universal joint, Oldhams' coupling.

**The following contents to be done by any 3D software package**

**Sectional views:** Creating solid models of complex machine parts and create sectional views.

**Assembly drawings: (Any four of the following using solid model software)**

Piston, Connecting rod, Eccentric, Screw jack, Plumber block, Axle bearing, Pipe vice, Clamping device, Geneva cam, Lathe Single tool post, Clapper Box, Tail stock, Machine vice, Air Cock, Carburetor.

**Manufacturing drawing:**

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

**Text Books:**

1. K.L.Narayana, P.Kannaiah, A text book on Machine Drawing, SciTech Publications, 2014.



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**Reference Books:**


1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
4. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014.


**Course Outcomes:**

After completion of this lab student will be able to

- Demonstrate the conventional representations of materials and machine components.
- Model riveted, welded and key joints using CAD system.
- Create solid models and sectional views of machine components.
- Generate solid models of machine parts and assemble them.
- Translate 3D assemblies into 2D drawings.
- Create manufacturing drawing with dimensional and geometric tolerances.

# Mechanics of Materials Laboratory

**Course Objectives:**

- To conduct uni-axial tension test on Steel, Aluminium, Copper and Brass.
- To perform compression test on spring and wood.
- To determine elastic constants of materials using flexural and torsion tests.
- To find hardness of given metals.

**List of Experiments:**

1. Study the stress – strain relations of (a) Mild Steel and (b) Tor Steel by conducting tension/compression test on U.T.M.
2. Study the stress – strain relation of (a) Copper and (b) Aluminium (c) other materials by conducting tension /compression test.
3. Find the compressive and shear strength of wood and shear strength of GI sheet by conducting relevant tests.
4. Find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper.
5. Determine the Modulus of rigidity (a) Solid shaft (b) Hollow shaft made of steel and aluminium.
6. Find the spring index and modulus of rigidity of the material of a spring by conducting compression and tensile tests.
7. Determine the Young's modulus of the material by conducting deflection test on a simply supported, propped cantilever and continuous beams.
8. Find impact strength of a given material by conducting a) Charpy test and b) Izod test.
9. Determine buckling load in a compressive member made with steel and aluminium.
10. Determine the deflection in leaf spring with a single leaf and multiple leafs.
11. Measure the increase in diameter in cylindrical and spherical shells subjected to internal hydraulic pressure.

**Course Outcomes:**

On completion of this lab student will be able to

- Understand the stress-strain behavior of different materials.
- Identify the difference between compression and tension testing.
- Evaluate the hardness of different materials.
- Correlate the elastic constants of the materials.
- Explain the relation between elastic constants and hardness of materials.

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**II YEAR II SEMESTER**

**DESIGN THINKING AND PRODUCT INNOVATION LAB (19AME20)**
**(MECH)**

| L | T | P | C |
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**Course Objectives:**

- Acquire practical knowledge on 3D Printing technology.
- Design the various measuring instruments like temperature, humidity, smart lighting system etc,.

**List of Experiments**

1. 3D Printing
    a. To develop a CAD model and simulate in CAE environment.
    b. To develop tooling and make a physical prototype.
2. To design a device for measurement of Temperature.
3. To design a device for measurement of Humidity.
4. To design a device for Water Level Indicator.
5. To design a Smart Lighting system.
6. To design Automatic Car Wiper.
7. Design of simple pneumatic and hydraulic circuits using basic components.
8. Design of pneumatic circuit for speed control of double acting cylinders.
9. Design a hydraulic circuit by using Flow Control Valves for simple application.
10. Design and Simulation of a Hydraulic Shaper.
11. Design and Simulation of a Hydro Electric Circuit for simple application.

**Course Outcomes:**

At the end of this Course the student will be able to

- Fabricate different types of components using 3D Printing technology. (L6)
- Design various measuring instruments like temperature, humidity, smart lighting system etc,. (L6).

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| L | T | P | C |
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# Constitution of India

## Course Objectives:

1. To enable the student to understand the importance of constitution.
2. To understand philosophy of fundamental rights and duties.
3. To understand the structure of executive, legislature and judiciary.
4. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
5. To understand the central and state relation financial and administrative.

## UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

**Learning Outcomes:**

At the end of this unit students will be able to:

1. Understand the concept of Indian constitution.
2. Apply the knowledge on directive principle of state policy.
3. Analyze the History, features of Indian constitution.
4. Evaluate Preamble Fundamental Rights and Duties.

## UNIT-II

Democratic forms of Constitution, Union Government and its Administration Structure of the Indian Union: Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

**Learning Outcomes:**

At the end of this unit students will be able to:

1. Understand the structure of Indian government.
2. Differentiate between the state and central government.
3. Explain the role of President and Prime Minister.
4. Know the Structure of supreme court and High court.

## UNIT-III

Federalism, Political relations, Financial relations of State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions.

**Learning Outcomes:**

At the end of this unit students will be able to:

1. Understand the structure of state government.
2. Analyze the role Governor and Chief Minister.
3. Explain the role of state Secretariat.
4. Differentiate between structure and functions of state secrateriate.

## UNIT-IV

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

**Learning Outcomes:**

At the end of this unit students will be able to:

1. Understand the local Administration.
2. Compare and contrast district administration role and importance.
3. Analyze the role of Myer and elected representatives of Municipalities.
4. Evaluate Zilla panchayat block level Organisation.

## UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate , State Election Commission, Supreme Court, High Court.

**Learning Outcomes:**

At the end of this unit students will be able to:

1. Know the role of Election Commission apply knowledge.
2. Contrast and compare the role of Chief Election commissioner and Commissiononerate.
3. Analyze role of state election commission.
4. Evaluate various commissions of viz SC/ST/OBC and women.

## REFERENCES:


1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi.
2. Subash Kashyap, Indian Constitution, National Book Trust.
3. J.A. Siwach, Dynamics of Indian Government & Politics.
4. D.C. Gupta, Indian Government and Politics.
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication.
6. J.C. Johari, Indian Government and Politics Hans.


## Course Outcomes:

1. Understand historical background of the constitution making and its importance for building a democratic India.
2. Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
3. Understand the value of the fundamental rights and duties for becoming good citizen of India.
4. Analyze the decentralization of power between central, state and local self-government.
5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

6. Know the sources, features and principles of Indian Constitution.
7. Learn about Union Government, State government and its administration.
8. Get acquainted with Local administration and Pachayati Raj.
9. Be aware of basic concepts and developments of Human Rights.
10. Gain knowledge on roles and functioning of Election Commission.

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME51 – THERMAL ENGINEERING**

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- To familiarize the developments in IC engines.
- To teach combustion process in SI and CI engines.
- To introduce different types of compressors.
- To familiarize concepts of thermodynamics cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.

**UNIT – 1: IC Engines** **10 Hrs**

**IC Engines:** Working and classification of IC engines, comparison of two stroke and four stroke engines, comparison of SI and CI Engines.

**Combustion in IC Engines:** SI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking, pre-ignition. CI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking. Fuel requirements and fuel rating.

**Testing and Performance of IC Engines:** Methods of testing IC Engines, performance analysis of IC Engines.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand working of IC engines on the basis of thermodynamic cycles. **L2**
- Estimate engine performance. **L5**
- Identify the effects of abnormal combustion in IC engines. **L3**

**UNIT – II: Classification of Air compressors** **8 Hrs**

**Reciprocating Compressor:** Single stage reciprocating compressors, work done, effect of clearance in compressors, volumetric efficiency, multi stage compressor, effect of inter cooling in multi stage compressors, compressor performance.

**Rotary Compressor:** Working principle of a rolling piston type compressor (fixed vane type), multi vane type compressors, characteristics of rotary vane type compressor.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify different types of air compressors. **L2**
- Compare the performance of different types of air compressors **L2**

**UNIT – III: Vapour Power Cycles & Gas power Cycle** **8 Hrs**

**Vapour Power Cycles:** Vapour power cycle, simple Rankine cycle, mean temp of heat addition thermodynamic variables effecting efficiency and output of Rankine cycle

**Gas power Cycle:** Simple gas turbine plant, Brayton cycle, closed cycle and open cycle for gas turbines, condition for maximum pressure ratio and optimum pressure ratio, actual cycle. Methods to improve performance: regeneration, intercooling and reheating. Introduction to jet propulsion: working principle of ramjet, turbojet, turbofan, turboprop and pulse jet engines,

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain concepts of vapour power cycle used in steam power plant. **L2**
- Evaluate the cycles used in gas turbine **L5**
- Outline the jet propulsion system. **L2**

**UNIT – IV: Nozzles & Steam Turbines** **10 Hrs**

**Nozzles:** Type of nozzles - air and steam nozzles. Compressible flow through nozzle- condition for maximum discharge - nozzle efficiency.

**Steam Turbines:** Classification of steam turbines -impulse turbine and reaction turbine - compounding in turbines - velocity diagrams in impulse and reaction turbines, efficiency, degree of reaction - governing of turbines.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Compare the performance of nozzles, used in turbines. **L2**
- Classify steam turbines and applications. **L4**
- Analyze the performance of steam turbines under different operating conditions. **L5**

**UNIT – V: Refrigeration** **8 Hrs**

**Refrigeration:** Bell-Coleman cycle - vapour compression cycle, effect of vapour condition on COP of VCR, - vapour absorption cycle, properties of common refrigerants

**Principles of Psychrometry and Air Conditioning:** Psychometric terms, psychometric processes and air conditioning systems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Outline the operation of refrigerators. **L2**
- Identify different refrigerants and applications. **L3**
- Use properties of moist air in calculations for air-conditioning system. **L3**

**Text Books:**

1. Ganesan V, Internal Combustion Engines, Tata McGraw Hill, 2017.
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014.
3. K.K.Ramalingam, Thermal Engineering, 2/e, Scitech Publications (India) Pvt Ltd,2011

**Reference Books:**

1. Cengal Y.A and Boles M.A, Thermodynamics: An Engineering Approach, 5/e, McGraw Hill, 2006.
2. Yahya, S. M., Turbines, Compressors and Fans, 4/e, Tata McGraw Hill, 2010.
3. Nag P.K, Engineering Thermodynamics, 4/e, Tata McGraw-Hill, 2008.
4. Onkar Singh, Thermal Turbomachines, 3/e, Wiley India, 2014.
5. P.L.Ballaney, Thermal Engineering, 2/e, Khanna, 2005.

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain working of IC engines with combustion process. **L2**
- Select compressors for different applications. **L1**
- Use T-s diagram in vapour power and gas power cycles. **L3**
- Explain the basic principles of steam turbines. **L2**
- Explain the basic principles of steam turbines. **L2**
- Select appropriate refrigerant for different applications **L1**



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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME52 – DESIGN OF MACHINE MEMBERS**

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students

- Provide an introduction to design of machine elements.
- Familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- Explain design procedures to different types of joints.
- Teach principles of clutches and brakes and design procedures.
- Instruct different types of bearings and design procedures.

**UNIT – I: Mechanical Engineering Design** **10 Hrs**

**Mechanical Engineering Design:** Design process, design considerations, codes and standards of designation of materials, selection of materials.

**Design for Static Loads:** Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

**Design for Dynamic Loads:** Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify materials suitable for machine elements. **L1**
- Apply codes and standards in design. **L3**
- Contrast the difference between static and dynamic loads. **L2**
- Apply failures theories in designing components subjected to static and dynamic loads **L3**

**UNIT – II: Design of Bolted and Bolted joints** **10 Hrs**

**Design of Bolted Joints:** Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints.

**Welded Joints:** Strength of lap and butt welds, Joints subjected to bending and torsion. Eccentrically loaded welded joints.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify different types of joints. **L1**
- Analyze stresses induced in joints subjected to different loads. **L4**
- Design different joints subjected to combined loading. **L6**

**UNIT – III: Power Transmission Shafts & Couplings** **8 Hrs**

**Power Transmission Shafts:** Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

**Couplings:** Design of flange and bushed pin couplings, universal coupling.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the functions of different keys. **L2**
- Design shafts subjected to fluctuating loads. **L6**
- Select coupling for a given application and outline the design procedure. **L3**
- Explain construction and design procedure for helical and leaf springs. **L2**



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**UNIT – IV: Friction Clutches, Brakes & Springs** **8 Hrs**

**Friction Clutches:** Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

**Brakes:** Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

**Springs:** Design of helical compression, tension, torsion and leaf springs.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the difference between brake and clutch. L2
- Calculate the torque transmitting capacity in clutches.
- Compare different types of brakes and their applications.
- Explain the concepts of self-energizing and self-locking brakes.
- Discuss procedures to design different types of brakes. L2

**UNIT – V: Design of Sliding Contact Bearings** **10 Hrs**

**Design of Sliding Contact Bearings:** Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

**Design of Rolling Contact Bearings:** Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

**Design of Gears:** Spur gears, beam strength, Lewis equation, design for dynamic and wear loads.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Contrast the difference between sliding and rolling contact bearings. L2
- Explain the mechanics of lubrication in sliding contact bearings L2
- Identify failures in bearings. L3
- Evaluate static and dynamic load capacity of rolling contact bearings. L5
- Explain the procedure to select bearings from manufacturer's catalogue L3

**Text Books:**

1. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004.
2. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
3. Dr. N. C. Pandya & Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.

**Reference Books:**

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.

**Course Outcomes:**

At the end of this Course the student will be able to

- Estimate safety factors of machine members subjected to static and dynamic loads. L5
- Design fasteners subjected to variety of loads. L6
- Select of standard machine elements such as keys, shafts, couplings. L1
- Design clutches brakes and spur gears. L6

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME53 – AUTOMATION AND ROBOTICS**

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about
- Describe the basic concepts of automation in manufacturing systems.
- Acquire the fundamental concepts of automated flow lines and their analysis.
- Classify automated material handling, automated storage and retrieval systems.
- Illustrate adaptive control systems and automated inspection methods.

**UNIT – 1: Introduction** **10 Hrs**

**Introduction:** Automation in production system, need, types, Principles and Strategies of automation, levels of automation, basic elements of an automated system, hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

**Automated flow lines** & transfer mechanisms, fundamentals of transfer Lines, flow lines with or without buffer storage.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Define the automation in production system. **L1**
- Describing the concept of automated flow lines. **L2**
- Classify the types of hardware components of automation and control system. **L3**
- Compare various types of part transfer mechanisms. **L4**

**UNIT – II: Assembly Line Balancing** **10 Hrs**

**Assembly Line Balancing:** Assembly process and systems assembly line, line balancing algorithms, ways of improving line balance, flexible assembly lines.

**Material handling and Identification Technologies:** Overview of automatic material handling systems, principles and design consideration, material transport systems, storage systems, overview of automatic identification methods.

**Automated Manufacturing Systems:** Components, classification and overview of manufacturing systems, manufacturing cells, GT and cellular manufacturing, FMS and its planning and implementation.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Describing the concept of assembly line balancing. **L2**
- Identify the components of automated manufacturing system **L1**
- Understand the concept of GT, FMS, cellular manufacturing and material handling system **L1**
- Classify the types of automated manufacturing system. **L2**
- Design a simple material handling system for low cost manufacturing **L6**

**UNIT – III: Introduction Robotics** **8 Hrs**

**Introduction:** Brief history of robots, classification of robot, functional line diagram, degrees of freedom. Elements of robot - types and its functions, factors to be considered in the design of grippers.

**Robot Actuators And Feedback Components:** Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Design a simple gripper for robot. **L6**
- Compare the types of actuators used in robot manipulator. **L4**

- List out the various types of robots and feedback components. **L1**
- Define the degree of freedom for robot. **L1**

**UNIT – IV: Manipulator Kinematics & Dynamics** **12 Hrs**

**Manipulator Kinematics:** Homogenous transformations as applicable to translation, rotations- D-H notation, Forward and inverse kinematics.

**Manipulator Dynamics:** Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Evaluate D-H notations for simple robot manipulator **L4**
- Identify the path and position of robot gripper within work volume **L1**
- Use the Jacobian, Lagrange-Euler and Newton- Euler formations to solve manipulator dynamic problems **L6**
- Explain the concepts of manipulator kinematics and dynamics **L3**

**UNIT – V: Robot Programming & Applications** **8 Hrs**

**Robot Programming:** Methods of programming - requirements and features of programming languages, software packages, problems with programming languages. Motion path control- slew motion, joint integrated motion, straight line motion; avoidance of obstacles.

**Robot Application in Manufacturing:** Material Transfer - Material handling, loading and unloading; Process - spot and continuous arc welding & spray painting; Assembly and Inspection.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the requirements and features of robot programming **L1**
- Demonstrate the various applications of robots in manufacturing. **L6**
- List the various methods of robot programming. **L1**
- Use various software packages to write the robot programming **L4**

**Text Books:**

1. Mikell P.Groover, Automation, Production Systems and Computer Integrated Manufacturing-Pearson Education.5/e, 2009.
2. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas G.Odrey , Industrial Robotics – – Mc Graw Hill, 1986.

**Reference Books:**

1. S. R. Deb & Sankha Deb, Robotics Technology and Flexible Automation, Tata McGraw-Hill Education.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.
3. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
4. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain the principles and Strategies of automation. **L2**
- Select type of automatic material handling system **L1**
- Use D-H parameters for determining the position of the end effecter. **L3**
- Explain the manipulator kinematics and dynamics **L2**
- Write the program for robot **L5**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME54a - ALTERNATIVE FUELS AND EMISSION CONTROL IN AUTOMOTIVES**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Explain various alcohol and gaseous fuels and their use in SI and CI engines.
- Explain various vegetable oils and their use in CI engines.
- Determine the formation of various emissions from SI engine and control techniques.
- Identify various emission measuring instruments and test procedures.

**UNIT – I** **12 Hours**

**Alcohol fuels and gaseous fuels:** Properties of alcohols, alcohol – gasoline blends, fuel flexible vehicle, methanol reformed gas engine, dual fuel system, Spark assisted diesel engine, surface ignition engine, ignition accelerators, performance, combustion and emission characteristics in SI and CI engines, Properties of hydrogen, production and storage methods, safety precautions, biogas production and its properties, properties of LPG and CNG, Performance, combustion and emission characteristics of hydrogen, biogas, LPG and CNG in SI and CI engines

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Assets the properties of alcohols and alcohol gasoline blends **L5**
- Explain the principles of spark assisted diesel engine and surface ignition engine. **L3**
- Identify the performance, combustion and emission characteristics in SI and CI engines. **L3**
- Explain production, storage methods and emission characteristics of hydrogen. **L3**

**UNIT – II** **10 Hours**

**Vegetable oils:** Various vegetable oils for diesel engines, structure and properties, problems in using vegetable oils in diesel engines, Methods to improve the engine performance using vegetable oils – preheating, Esterification , blending with good secondary fuels, Semi-adiabatic engine, surface ignition engine, ignition accelerators dual fuelling with gaseous and liquid fuels coils, Performance, combustion and emission characteristics of biodiesel fuelled diesel engines.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List various vegetable oils and its properties used for diesel engines. **L1**
- Identify the problems in using vegetable oils in diesel engines. **L3**
- Explain the methods to improve the engine performance using vegetable oils. **L3**
- Explain the method of blending with good secondary fuels. **L3**
- Determine the performance, combustion and emission characteristics of biodiesel fuelled diesel engine. **L3**

**UNIT – III** **10 Hrs**

**Emissions from SI engines and their control:** Emission formation in SI engines (CO, HC and NOx), Effect of design and operating variables on emission formation, Control techniques – Thermal reactor, exhaust gas recirculation, Three way catalytic convertor and Charcoal canister control for evaporative emission, Positive crank case ventilation for blow by gas control.

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain emission formation in SI engines. **L3**
- Practice the effect of design and operating variables on emission formation in SI engine. **L5**
- Classify various control techniques on SI engine emission formation. **L2**
- Choose a control technique for a given application **L1**
- Explain on positive crank case ventilation for blow by gas control. **L3**

**UNIT – IV** **08 Hrs**

**Emissions from CI engines and their control:** Emission formation in CI engines (HC, CO, NOx, Aldehydes, smoke and particulates), Effect of design and operating variables on emission formation, Control techniques – Exhaust gas recirculation, NOx selective catalytic reduction, Diesel oxidation catalytic convertor, Diesel particulate filter, NOx versus particulates – Trade off

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain emission formation in CI engines **L3**
- Appraise the effect of design and operating variables on emission formation in CI engine. **L5**
- Explain various control techniques on CI engine emission formation. **L3**
- Choose a control technique for a given application **L1**

**UNIT – V** **08 Hrs**

**Emission measuring instruments and test procedures:** Principle of operation of emission measuring instruments used in SI and CI engines, Measurement of $CO_2$ and CO by NDIR, Hydrocarbon emission by FID, Chemiluminescent analyser for NOx, Liquid and Gas chromatograph Spot sampling and continuous indication type smoke meters (Bosch, AVL and Hartridge smoke meters) emission test procedures – FTP, Euro and Bharat norms

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify various emission measuring instruments for SI and CI engines **L2**
- Apply the principle of operation of emission measuring instruments used in SI and CI engines **L3**
- Explain the method of measurement of $CO_2$ and CO by NHIR **L3**
- Identify the emission of hydrocarbons using FID **L3**

**Text Books:**

1. Ganesan V, Internal combustion engines, 4th Edition, Tata McGraw Hill Education, 2012
2. Thipse.S.S, Alternative Fuels: Concepts, Technologies and Developments, Jaico Publishing House, 2010.

**Reference Books:**

1. Michael F. Hordeski, Alternative Fuels: The Future of Hydrogen, The Fairmont Press, 2008
2. R.K.Rajput, A textbook of Internal Combustion Engines, 2nd Edition, Laxmi Publications, 2007
3. "Society of Automotive Engineers", Alternative Fuels: Fuel Cells and Natural Gas, Society of Automotive Engineers, Incorporated, 2000

**Course Outcomes:**

At the end of this Course the student will be able to

- Identify various emissions from SI and CI engines. **L3**
- Explain the properties of alcohol fuels and gaseous fuels. **L3**
- Predict the problems by using vegetable oils in diesel engines. **L6**
- Choose the use of various emission measuring instruments. **L3**

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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME54b – MANUFACTURING METHODS IN PRECISION ENGINEERING**

*(Professional Elective – I)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize with surface treatments and their industrial applications.
- Explain powder metal production sintering techniques for metal powders, glass, ceramics and plastics.
- Explain wafer preparation, optical lithography including current best practice and perceived limits and equipment required for micro-device packaging processes.
- Demonstrate plastics processing.
- Train different liquefied, solidified and particulate methods for different MMC, CMC, Polymer matrix composites.

**UNIT – I** **10 Hrs**

**Surface treatment:** Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the phenomenon related to different surface modification by physical and chemical treatments: **L2**
- Develop the basics of CVD (Chemical Vapour Deposition) and PVD (Physical Vapour Deposition) technologies for surface coating deposition, description of thermal spraying technology for surface coating applications. **L2**
- Explain properties and characteristics of different surface coatings and their applications. **L3**

**UNIT – II** **10 Hrs**

**Processing of Powder metals, Glass and Superconductors**: Introduction, production of metal powders, compaction of metal powders, sintering, secondary and finishing operations, design considerations for powder metallurgy, Process capabilities, economics of powder metallurgy, forming and shaping of Glass, techniques for strengthening and treating Glass, design considerations for Glass, processing of superconductors.

**Processing of ceramics:** Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain powder metallurgy and ceramics applications. **L2**
- Demonstrate processing of powders and sintering techniques. **L2**
- Outline mechanism of sintering properties and characteristics of powder metals, glass and superconductors. **L3**

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**UNIT – III** **10 Hrs**

**Fabrication of Microelectronic devices:** Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology, and micro machining, High speed Machining.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate wafer preparation, optical lithography. **L1**
- Explain the basic packaging and its levels, different IC chip mounting and interconnect methods. **L2**
- Summarize mechanisms like E-Manufacturing, nanotechnology, and micromachining, high speed machining. **L3**

**UNIT – IV** **10 Hrs**

**Processing Of Plastics**, injection and blow moulding, calendaring, thermo forming, compression moulding, transfer moulding, High energy rate forming methods Rapid manufacturing: - Introduction - concepts of rapid manufacturing, information flow for rapid prototyping, classification of rapid prototyping process, stereo holography fused deposition modeling, selective laser sintering, Applications of rapid prototyping process.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Build basic knowledge of manufacturing of plastics. **L1**
- Explain the rapid prototyping methods in plastic processing. **L2**

**UNIT – V** **08 Hrs**

**Processing of Composites:** Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Use of fibre-reinforced composites in engineering applications. **L1**
- Summarize the use of composite materials, micromechanics of layered composites. **L2**
- Explain different liquefied, solidified and particulate methods for MMC, CMC, Polymer matrix composites. **L3**

**Text Books:**

1. Schmid and Kalpakjin, Manufacturing Engineering and Technology, 7/e, Pearson Education India, 2001
2. P.N. Rao, Manufacturing Technology, Foundry forming and welding, Vol I, 2/e, Tata McGraw-Hill, 2001
3. Rafiq Noorani, Rapid Prototyping Principles and Applications, Illustrated edition, Wiley, 2006

**Reference Books:**

1. R.K. Jain, Production Technology, 17/e, Khanna Publishers, 2012
2. Roy A. Lindberg, Process and materials of manufacturing, 2/e, Allyn and Bacon, 1978.

**Course Outcomes:**

At the end of this Course the student will be able to

- Classify different surface treatment methods. **L2**
- Explain processing of powder metals, glass and super conductors. **L2**
- Develop fabrication of microelectronic devices. **L2**
- Process plastics and composites. **L2**

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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME54c – DESIGN FOR MANUFACTURING**

*(Professional Elective – I)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Explain the product development cycle and manufacturing issues to be considered in design.
- Familiarize manufacturing consideration in cast, forged, and weld components.
- Describe the manufacture of sheet metal components.
- Impart knowledge plastics as substitution to metallic parts

**UNIT – I** **12 Hrs**

**Introduction:** Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

**Materials:** Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Implement various steps in design process. **L6**
- Apply economical considerations at design stage. **L2**
- Develop creativity attitude in designing. **L5**
- Use Ashby charts for material selection. **L3**
- Apply process selection charts. **L2**

**UNIT II** **10 Hours**

**Machining processes:** Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recall various machining processes. **L1**
- Assign dimensional tolerances and surface roughness values. **L4**
- Identify the necessity of redesigning of the components. **L3**
- Summarize the design rules for machining. **L2**
- Assign recommendations for machining of components. **L4**

**UNIT III** **10 Hours**

**Metal casting:** Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List various casting processes. **L1**
- Assign tolerances for various casting processes. **L5**
- Simulate sand casting design. **L4**
- Prescribe pre and post treatment of welds. **L5**
- Discuss the effects of thermal stresses in weld joints and brazed joints. **L2**



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**UNIT IV** **8 hours**

**Forging:** Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

**Extrusion & Sheet metal work:** Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the difference between open and closed die forging. **L2**
- Identify the problems in parting lines of dies. **L3**
- Apply the design guidelines the extruded sections. **L2**
- Apply the design principles for various sheet metal operations. **L2**
- Utilize sheet metal effectively for blanking operations. **L3**

**UNIT V** **8 Hours**

**Plastics:** Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain visco elastic and creep behavior in plastics. **L2**
- Discuss various plastic molding processes. **L6**
- Apply the design considerations for injection molding. **L2**
- Use the design guidelines in machining of plastics. **L3**

**Text Books:**

1. George E Dieter and Linda Schmidt, Engineering Design, 4th Edition, McGraw Hill (2015)
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 5th Edition, PHI Learning (2011)
3. David M Anderson, Design for Manufacturability, CRC Press (2013)

**Reference Books:**

1. James G Bralla, Design For Manufacturability Handbook, 2nd Edition, McGraw Hill (2004).
2. Dr.P.C.Sharma, Production Technology, S.Chand & Company (2009).

**Course Outcomes:**

At the end of this Course the student will be able to

- Design mechanical components with economical consideration. **L6**
- Select materials and machining processes. **L6**
- Identify the necessity for redesigning components out of manufacturing considerations. **L3**
- Consider the manufacturing considerations while designing cast, forged weld and sheet metal components. **L3**
- Design plastic parts with manufacturing considerations. **L6**

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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME54d – POWER PLANT ENGINEERING**

*(Professional Elective – I)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.
- Impart types of nuclear power plants, and outline working principle and advantages and hazards.

**UNIT I** **12 Hours**

**Introduction to the Sources Of Energy** - Resources and Development of Power in India. Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection.

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection And Safety Regulations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Outline sources of energy, compare and selection of types of power plants. L2
- Explain cost factors, load and power distribution factors. L2
- Select tariff based on load and demand factors. L3
- Summarize the impact of power plant on the environment, pollution mitigation and regulations. **L2**

**UNIT II** **10 Hours**

**Steam Power Plant :** Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

**Steam Power Plant** : Combustion Process : Properties of Coal - Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Demonstrate latest high pressure boilers, power plant cycles and their improvements. **L2**
- Explain various types of coals, coal handling operations and associated systems. **L2**
- Outline and compare types of feeders, stokers, combustion systems. **L2**
- Illustrate draught, dust collector, furnace, cooling tower and heat rejection systems. **L2**
- Evaluate pollution levels from power plants, pollution control methods, and application of pollution recorders. **L4**

**UNIT III** **8 Hours**

**Diesel Power Plant:** Diesel Power Plant: Introduction - IC Engines, Types, Construction- Plant Layout with Auxiliaries - Fuel Storage

**GAS TURBINE PLANT:** Introduction - Classification - Construction - Layout with Auxiliaries - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain working principle, and compare types of diesel power plant. **L2**
- Outline the diesel power plant layout with its supporting equipment. **L2**
- Illustrate the working principle of open cycle and closed cycle gas turbine. **L2**
- Demonstrate combined cycle power plants with benefits and shortcomings. **L2**

**UNIT IV** **8 hours**

**Hydro Electric Power Plant:** Water Power - Hydrological Cycle / Flow Measurement - Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways.

**Hydro Projects And Plant:** Classification - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain hydrological cycle, infer flow measurements from hydrographs. **L2**
- Summarize working principle of hydro electric power plant. **L2**
- Illustrate typical layout of hydro electric power plant, and its auxiliary equipments. **L2**

**UNIT V** **8 Hours**

**Power From Non-Conventional Sources:** Utilization of Solar Collectors- Principle of its Working, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation.

**Nuclear Power Station:** Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

**Types Of Reactors:** Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Demonstrate working principle of power generation from non-conventional energy sources. **L2**
- Explain working principle of Nuclear power plants, nuclear fuels, and reactor operations. **L2**
- Outline the various types of nuclear reactors, their applications and limitations. **L2**
- Summarize the hazards of nuclear reactors and significance of nuclear waste disposal. **L2**

**Text Books:**

1. P.K. Nag, Power Plant Engineering, 3/e, TMH, 2013.
2. Arora and S. Domkundwar, A course in Power Plant Engineering, Dhanpat Rai & Co (P) Ltd, 2014

**Reference Books:**

1. Rajput, A Text Book of Power Plant Engineering, 4/e, Laxmi Publications, 2012.
2. Ramalingam, Power plant Engineering, Scietech Publishers, 2013
3. P.C. Sharma, Power Plant Engineering, S.K. Kataria Publications, 2012.

**Course Outcomes:**

At the end of this Course the student will be able to

- Outline sources of energy, power plant economics, and environmental aspects. **L2**
- Explain power plant economics and environmental considerations. **L2**
- Describe working components of a steam power plant. **L2**
- Illustrate the working mechanism of Diesel and Gas turbine power plants. **L2**
- Summarize types of renewable energy sources and their working principle. **L4**

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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME54e – NON-DESTRUCTIVE TESTING**

*(Professional Elective - I)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students

- Introduce basic concepts of non destructive testing.
- Familiarize with characteristics of ultrasonic test, transducers, rejection and effectiveness.
- Describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- Explain the principles of infrared and thermal testing, applications and honey comb and sandwich structures case studies.
- Impart NDE and its applications in pressure vessels, casting and welded constructions.

**UNIT I** **10 Hours**

**Introduction to non-destructive testing**: Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain non destructive testing techniques **L2**
- Summarize the basic concepts of Radiographic test **L2**
- Outline the concepts of sources of X and Gamma Rays **L2**
- Explain the radiographic techniques **L2**
- Discuss the safety aspects of industrial radiography. **L4**

**UNIT II** **10 Hours**

**Ultrasonic test:** Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the principle of ultrasonic test. **L2**
- Analyze the performance of wave propagation, reflection, refraction, diffraction and sound field in ultrasonic test. **L4**
- Discuss the characteristics of ultrasonic transducers. **L4**
- Outline the limitations of ultrasonic testing. **L2**

**UNIT III** **10 Hours**

**Liquid Penetrant Test:** Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.

**Eddy Current Test:** Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing.

**Magnetic Particle Test:** Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate the procedure of Liquid Penetrant, eddy current and magnetic particle test. **L2**
- Outline the limitations of Penetrant, eddy current and magnetic particle tests. **L2**
- Explain the effectiveness of Penetrant, eddy current and magnetic particle tests **L2**
- Apply the applications of Magnetic particle test. **L3**

**UNIT IV** **8 hours**

**Infrared And Thermal Testing:** Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers —thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings – Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials– IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures– Case studies.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Discuss the fundamentals of thermal testing. **L6**
- Explain the techniques of liquid crystals, active and passive. **L2**
- Illustrate thermal inspection methods. **L2**
- Outline the limitations of thermal testing. **L2**
- Explain the applications of honey comb and sandwich structures. **L2**

**UNIT V** **8 Hours**

**Industrial Applications of NDE:** Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate applications of NDE. **L2**
- Explain the applications of Railways, Nuclear and chemical industries. **L2**
- Outline the limitations and disadvantages of NDE. **L2**
- Explain the applications of NDA of pressure vessels, casting and welding constructions **L2**

**Text Books:**

1. J Prasad, GCK Nair , Non destructive test and evaluation of Materials, Tata mcgraw-Hill Education Publishers, 2008.
2. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag, 1983.
3. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

**Reference Books:**

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007.
2. ASTM Standards, Vol 3.01, Metals and alloys

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain various methods of non-destructive testing. **L3**
- Apply relevant non-destructive testing method different applications. **L3**
- Explain the applications of Railways, Nuclear and chemical industries. **L2**
- Outline the limitations and disadvantages of NDE. **L2**
- Explain the applications of NDA of pressure vessels, casting and welding constructions **L2**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME54f – ERGONOMICS AND HUMAN FACTORS IN ENGINEERING**

*(Professional Elective – I)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize the fundamentals of human factors in engineering.
- Explain principles Hours Anthropometry, Ergonomics and product design.
- Describe the Improvement of human work place through controls.
- Evaluate the sources of vibration and performance effect of vibration in machine tools.
- Know the Special purpose lighting for illumination and quality control.

**UNIT I** **12 Hours**

**Fundamentals of Human Factors Engineering:** Human Biological, Ergonomic and psychological capabilities and limitations, Concepts of human factors engineering and ergonomics, Man-Machine system and Design philosophy.

**Physical work and energy expenditure:** Manual lifting, Work posture, Repetitive motion, Provision of energy for muscular work, Heat stress, Role of oxygen physical exertion, Measurement of energy expenditure, Respiration, Pulse rate and blood pressure during physical work, Physical work capacity and its evaluation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Define the fundamentals concepts of human factors in engineering. L1
- Discuss the Human biological, Ergonomic and psychological capabilities in engineering. L6
- Evaluate physical work capacity and energy expenditure. L4
- Measure the energy expenditure, respiration, pulse rate and blood pressure during physical exertion. **L4**

**UNIT II** **10 Hours**

**Anthropometry:** Physical dimensions of the human body as a working machine, Motion size relationships, Static and dynamic anthropometry, Anthropometric design principles, Using anthropometric measures for industrial design.

**Ergonomics and product design:** Ergonomics in automated systems, Expert systems for ergonomic design, Anthropometric data and its application in ergonomic design, Limitations of anthropometric data, Use of computerized database.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concept of hours anthropometry. **L2**
- Illustrate the physical dimensions of the human body as a working machine. **L2**
- Discuss anthropometric data and its application in ergonomic design. **L6**
- State the limitations of anthropometric data in ergonomic design. **L4**

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**UNIT III** **10 Hours**

**Machine controls:** Improvement of human work place through controls, Displays and Controls, Shapes and sizes of various controls and displays, Multiple display and control situations, Design of major controls in automobiles and machine tools, Principles of hand tool design.

**Work place and seating design:** Design of office furniture, Redesign of instruments, Work process: Duration of rest periods, Design of visual displays, Design for shift work.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe the concept of improvement of human work place through controls. **L2**
- Explain the principles of hand tool design. **L2**
- Illustrate the design of major controls in automobiles and machine tools. **L2**
- Design the work place and seating plane in machine controls. **L6**

**UNIT IV** **8 hours**

**Color and light:** Color and the eye, Color consistency, Color terms, Reactions to color and color continuation, Color on engineering equipments.

**Temperature-Humidity-Illumination and Contrast:** Use of Photometers, Recommended illumination levels, The ageing eye, Use of indirect (Reflected) lighting, Cost efficiency of illumination, Special purpose lighting for illumination and quality control.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the terms color consistency, reactions to color and color continuation. **L2**
- Describe effects of color on engineering equipments. **L2**
- Indentify recommended illumination levels. **L3**
- Explain about special purpose lighting for illumination and quality control. **L2**

**UNIT V** **8 Hours**

**Measurement of sound**: Noise exposure and hearing loss, Hearing protectors, Analysis and reduction of noise, Effects of noise, Performance annoyance of noise and interface with communication, Sources of vibration and performance effect of vibration, Vibrations in machine tools.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe the sources of vibration and performance effect of vibrations in machine tools. **L6**
- Illustrate the effects of noise on machine tool operation. **L2**
- Explain the terms noise exposure, hearing loss and hearing protectors. **L2**
- Explain the terms analysis and reduction of noise in machine tools. **L2**

**Text Books:**

- M. S. Sanders and E. J. McCormick, Human Factors in Engineering Design, 7/e, McGraw-Hill International, 1993.



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JNTUA College of Engineering,
PULIVENDULA - 516 390.

**Reference Books:**


1. P. V. Karpovich and W. E. Sinning, Physiology of Muscular Activity, 7/e, Saunders (W.B.) Co Ltd., 1971.
2. Applied Ergonomics Handbook, I.P.C. Science and Technology Press Limited, 1974.
3. M. Helander, A Guide to the Ergonomics of Manufacturing, 2/e, CRC Press, 1997.
4. K. H. E. Kroemer, H. B. Kroemer and K. E. Kroemer Elbert, Ergonomics: How to design for ease and efficiency, 2/e, Pearson Publications, 2001.


**Course Outcomes:**

At the end of this Course the student will be able to

| | |
|---|---|
| • Describe the sources of vibration and performance effect of vibrations in machine tools. | **L6** |
| • Indentify recommended illumination levels. | **L3** |
| • Illustrate the design of major controls in automobiles and machine tools. | **L2** |
| • State the limitations of anthropometric data in ergonomic design. | **L4** |
| • Measure the energy expenditure, respiration, pulse rate and blood pressure during physical exertion. | **L4** |

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**B.Tech III Year I semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS10-CAMPUS RECRUITMENT TRAINING & SOFT SKILLS**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To prepare to face global competition for employment and excellence in profession.
- To help the students understand and build interpersonal and interpersonal skills that will enable them to lead meaningful professional life.

**UNIT – 1: SOFT SKILLS: INTRODUCTIUON**

Soft Skills: Definition-Meaning--Importance- Why skill gap -Analysis—Personality Developments. Soft Skills- Learning Methods.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Developing self-motivation, raised aspirations and belief in one's own abilities, defining and committing to achieving one's goals. **L1**
- Learning to keep going when things don't go according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict **L2**

**UNIT – II: PERSONAL SKILLS**

**Intra-Personal:** Definition-Meaning-Importance-SWOT analysis- Goal Setting- Emotional Intelligence- Right thinking- Problem Solving-Time management.

**Inter-Personal:** Definition-Meaning-Importance-Communications skills- Team Work-Negotiation Skills-Leadership skills.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- A commitment to ethics and integrity in academic and professional relationships, within the community and the environment. **L1**
- Describe how good communication with other can influence our working relationships **L2**

**UNIT – III:VERBAL AND NON VERBAL SKILLS**

**Verbal Skills**: Definition and Meaning-Importance-Improving Tips for Listening, Speaking, Reading-Writing Skills.

**Non Verbal Skills**: Definition and Meaning-Importance- Dress Code- Facial Expressions- Eye Contact- Proxemics - Haptics-Posture-Kinetics- Para Language.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Compares verbal and nonverbal communication **L1**
- Understand the functions of nonverbal communication **L2**

**UNIT – IV: FINISHING SCHOOL**

**Before Interview**: Bridging between Campus and Corporate-Preparation of Resume-Cover Letter-Statement of Purpose-E-mail writing-Corporate Etiquettes.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learner will be able to prepare his/ her own Resume and Cover letter. **L1**
- Learner will understand the importance of etiquettes and learn the nuances of expected behaviour within a group, a social class and society at general **L2**



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**UNIT – V: DURING INTERVIEW**

**Interview Skills**: Importance-Purpose- Types of interviews –Preparation for interviews - Top Questions- Body Language in Interview Room-Do's and Don't s of interview.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learner will be able to face interview questions and effectively present his /her. skills **L1**
- Learner will manage how to plan and organize personal and professional life. **L2**

**Reference Books:**

1. Sherfield, M. Robert at al **CornerstoneDeveloping Soft Skills**, 4th ed. Pearson Publication,New Delhi, 2014.
2. Alka Wadkar, **Life Skills for Success,** Sage Publications India Private Limited; First edition (1 May 2016)
3. Sambaiah.M. **Technical English**, Wiley publishers India. New Delhi. 2014.
4. GANGADHAR JOSHI, **From Campus to Corporate**, SAGE TEXT.
5. Alex.K, **Soft Skills,** 3rd ed. S. Chand Publication, New Delhi, 2014.
6. Meenakshi Raman and Sangita Sharma, **Technical Communication: Principle and Practice**, Oxford University Press. 2009.
7. Shalini Varma, **Body Language for Your Success Mantra**, 4th ed, S. Chand Publication, New Delhi, 2014.
8. Stephen Covey, **Seven Habits of Highly Effective People**, JMD Book, 2013.

**Course Outcomes:**

At the end of this Course the student will be able to

- The students will be able to assimilate and understood the meaning and importance of soft skills and learn how to develop them. **L1**
- The students will understand the significance of soft skills in the working environment for professional excellence. **L2**
- The students will be prepared to undergo the placement process with confidence and clarity. **L3**
- The students will be ready to face any situation in life and equip themselves to handle them effectively. **L4**
- The students will understand and learn the importance of etiquettes in both professional and personal life **L5**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS20-MATHEMATICAL MODELING**

**(Open Elective -I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To provide the basic knowledge to understand a Mathematical model.
- To formulate a Mathematical model related to a real world problems of engineering, biological science etc.

**UNIT – 1: Mathematical Modeling & Mathematical modeling Through Ordinary differential equations of First Order :** **9 Hrs**

**Mathematical Modeling :** Need, Techniques, Classifications and Simple illustrations,

**Mathematical modeling Through Ordinary differential equations of First Order :**
Mathematical modeling Through differential equations; Linear growth and decay models; Non-Linear Growth and Decay models; Mathematical modeling in dynamics through ordinary differential equations of first order.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Learn various mathematical techniques in modeling a problem. **L2**
- Learn modeling in dynamics through ordinary differential equations of first order. **L3**

**UNIT – II: Mathematical modeling Through System of Ordinary differential equations of First Order:**
Mathematical modeling in population dynamics; Mathematical modeling of Epidemics through system of ordinary differential equations of first order; Compartment models through Systems of ordinary differential equations; Mathematical modeling in dynamics through systems of ordinary differential equations of first order.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Develop a modeling of Epidemics through system of ordinary differential equations of first order. **L4**
- Analyze a modeling in dynamics through systems of ordinary differential equations of first order. **L3**

**UNIT – III: Mathematical modeling Through Ordinary differential equations of Second Order:**
Mathematical modeling of Planetary motion; Mathematical modeling of Circular motion and motion of satellites; Mathematical modeling through linear differential equations of second order.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Evaluate a mathematical modeling of planetary motion. **L5**
- Analyze a mathematical modeling of Circular motion and motion of satellites **L3**

**UNIT – IV: Mathematical modeling Through Difference equations :**
Need for Mathematical modeling Through Difference equations and simple models; Basic theory of Linear difference equations with constant coefficients; Mathematical modeling Through Difference equations in population dynamics and genetics; Mathematical modeling Through Difference equations in Probability theory.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Analyze mathematical modeling through difference equations in population dynamics and genetics. **L4**
- Analyze mathematical modeling through difference equations in probability theory. **L4**

**UNIT – V: Mathematical modeling Through Functional, Integral, Delay- Differential and Differential-Difference Equations :**
Mathematical modeling Through Functional equations; Mathematical modeling Through Integral equations; Mathematical modeling Through Delay- Differential and Differential-Difference Equations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze a mathematical modeling through functional equations and integral equations. **L4**
- Analyze a mathematical modeling Through Delay- Differential and Differential-Difference Equations **L4**

**Text Books:**

1. J. N. Kapoor. Mathematical Modeling , New Age International Publishers.

**Reference Books:**

1. A. C. Fowler. Mathematical Models in Applied Sciences, Cambridge University Press.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the basic concepts in mathematical modeling. **L1**
- Have better insight of the real word problems through mathematical modeling. **L2**
- Apply various concepts of mathematics in modeling. **L3**
- Analyze the real word problems through the techniques of modeling. **L4**
- Evaluate the real word problems through mathematical modeling. **L5**

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**B.Tech III year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS21-FUZZY SET THEORY, ARITHMETIC AND LOGIC**

**(Open Elective -I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** This course aims at providing

- the basic knowledge to understand Fuzzy set theory and Arithmetic. and
- Logic, related to a real word problems of engineering, Science etc.

**UNIT – 1: Classical (Crisp) Sets To Fuzzy Sets & Fuzzy Sets Versus Crisp Sets** **9 Hrs**

**Classical (Crisp) Sets To Fuzzy Sets:**

Introduction: Crisp Sets: An Overview, Fuzzy Sets: Basic Types, Fuzzy Sets: Basic Concepts, Characteristics and Significance of the Paradigm Shift.

**Fuzzy Sets Versus Crisp Sets:**

Alpha -Cuts :Additional Properties of alpha -Cuts, Representations of Fuzzy Sets, Extension Principle for Fuzzy Sets

**Learning Outcomes:**

At the end of this unit, the student will be able to

- The basic concepts of Sets and Fuzzy sets **L2**
- Analyze the Fuzzy Sets Versus Crisp Sets **L3**

**UNIT – II: Operations On Fuzzy Sets:**

Types of Operations, Fuzzy Complements, Fuzzy Intersections: t-Norms Fuzzy Unions: t- Conorms, Combinations of Operations, Aggregation Operations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Do some operations on Fuzzy sets **L2**
- Assess t-Norms Fuzzy Unions **L3**

**UNIT – III: Fuzzy Arithmetic & Fuzzy Relations:**

**Fuzzy Arithmetic :**

Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals, Arithmetic Operations on Fuzzy Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.

**Fuzzy Relations:**

Crisp versus Fuzzy Relations, Projections and Cylindric Extensions, Binary Fuzzy Relations, Binary Relations on a Single Set, Fuzzy Equivalence Relations, Fuzzy Compatibility Relations, Fuzzy Ordering Relations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Perform arithmetic operations on Fuzzy numbers and equations. **L2**
- Analyze Fuzzy Relations, Projections and Cylindric Extensions etc. **L3**

**UNIT – IV: Fuzzy Relation Equations & Possibility Theory**

**Fuzzy Relation Equations:**

General Discussion ,Problem Partitioning , Solution Method , Fuzzy Relation Equations Based on Sup-i Compositions , Fuzzy Relation Equations Based on Inf- $\omega_i$ Compositions

**Possibility Theory:**

Fuzzy Measures, Evidence Theory, Possibility Theory, Fuzzy Sets and Possibility Theory, Possibility Theory versus Probability Theory.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve Fuzzy relation equations. **L3**
- Analyze Possibility Theory **L4**

**UNIT – V: Fuzzy logic**

Classical Logic: An Overview, Multivalued Logics, Fuzzy Propositions, Fuzzy Quantifiers, Linguistic Hedges, Inference from Conditional Fuzzy Propositions, Inference from Conditional and Qualified Propositions, Inference from Quantified Propositions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the Fuzzy logic. **L1**
- Analyze the Inferences from Conditional, Qualified, and Quantified Propositions. **L4**

**Text Books:**

1. Fuzzy Sets and Fuzzy Logic, Geoge J. Klir and Bo Yuan

**Reference Books:**

1. Fuzzy Mathematical Models in Engineering and Management Science, A. Kaufmann and M.M. Gupta
2. Fuzzy Logic, Timothy J. Ross
3. Fuzzy Set Theory, H.J. Zimmermann
4. Introduction to Fuzzy Logic and Fuzzy Sets, J.J. Buckley and E. Eslami

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the basic concepts of Fuzzy sets and logic. **L1**
- Do some operations of Fuzzy sets. **L2**
- Solve Fuzzy relation equations. **L3**
- Analyze the Inferences from Conditional, Qualified, and Quantified Propositions. **L4**
- Analyze the real word problem through the technique of Fuzzy set theory and logic to have better insight of the real word problems. **L5**

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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS22-NUMBER THEORY**

**(Open Elective -I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** This course aims at providing the basic knowledge

- To understand basic concepts of Number theory and
- To analyze the applications of Riemann Zeta Function and Dirichlet L Function of Number theory related to real word problems of engineering, biological science etc.

**UNIT – 1: Divisibility and Primes & Congruences** **9 Hrs**

**Divisibility and Primes:**

Division algorithm, Euclid's algorithm for the greatest common divisor- Linear Diophantine equations - Prime numbers, fundamental theorem of arithmetic, infinitude of primes- Distribution of primes, twin primes, Goldbach conjecture - Fermat and Mersenne primes - Primality testing and factorization.

**Congruences:**

Modular arithmetic- Linear congruences- Simultaneous linear congruences, Chinese Remainder Theorem- An extension of Chinese Remainder Theorem (with non-coprime moduli).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn Division algorithm, Euclid's algorithm etc. **L2**
- Analyze linear congruences- Simultaneous linear congruences, and Chinese Remainder Theorem. **L3**

**UNIT – II: Congruences with a Prime-Power Modulus, Euler's Function and RSA Cryptosystem, and Units Modulo an Integer**

**Congruences with a Prime-Power Modulus:**

Arithmetic modulo p, Fermat's little theorem, Wilson's theorem - Pseudo-primes and Carmichael numbers- Solving congruences modulo prime powers.

**Euler's Function and RSA Cryptosystem:**

Definition of Euler function, examples and properties - Multiplicative property of Euler's function - RSA cryptography.

**Units Modulo an Integer:**

The group of units modulo an integer, primitive roots- Existence of primitive roots.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze the Congruences with a Prime-Power Modulus **L3**
- Analyze the Euler's Function, RSA Cryptosystem and Units Modulo an Integer **L4**

**UNIT – III: Quadratic Residues and Quadratic Forms**

Quadratic residues, Legendre symbol, Euler's criterion- Gauss lemma, law of quadratic reciprocity- Quadratic residues for prime-power moduli and arbitrary moduli- Binary quadratic forms, equivalent forms- Discriminant, principal forms, positive definite forms, indefinite forms- Representation of a number by a form, examples- Reduction of positive definite forms, reduced forms- Number of proper representations, automorph, class number.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze the Quadratic residues **L3**
- Analyze the Quadratic Forms **L4**

**UNIT – IV: Sum of Powers, Continued Fractions and Pell's Equation**

**Sum of Powers:**

Sum of two squares, sum of three squares, Waring's problem- Sum of four squares-Fermat's Last Theorem.

**Continued Fractions and Pell's Equation**:

Finite continued fractions, recurrence relation, Euler's rule- Convergents, infinite continued fractions, representation of irrational numbers- Periodic continued fractions and quadratic irrationals- Solution of Pell's equation by continued fractions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Compute sum of powers and learn Fermat's last theorem. **L3**
- Solve Pell's equation by continued fractions **L4**

**UNIT – V: Arithmetic Functions, The Riemann Zeta Function and Dirichlet L Function**

**Arithmetic Functions:**

Definition and examples, multiplicative functions and their properties- Perfect numbers, Mobius function and its properties- Mobius inversion formula- Convolution of arithmetic functions.

**The Riemann Zeta Function and Dirichlet L Function:**

Historical background for the Riemann Zeta function, Euler product formula, convergence. -Applications to prime numbers- Dirichlet L-functions, Products of two Dirichlet L functions, Euler product formula.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze the arithmetic functions **L3**
- Analyze the Riemann Zeta function and its Applications to prime numbers **L4**

**Text Books:**

1. G. A. Jones & J.M. Jones, Elementary Number Theory, Springer UTM, 2007.
2. Niven, H. S. Zuckerman & H.L. Montgomery, Introduction to the Theory of Numbers, Wiley, 2000.
3. D. Burton; Elementary Number Theory, McGraw-Hill, 2005

**Reference Books:**

1. Tom M. Apostol, Introduction to Analytical Number theory, Narosa Publishing house, 1998.
2. Elementary number theory and its applications, BEL laboratories.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the basic concepts such as Learn Division algorithm, Euclid's algorithm etc. **L1**
- Analyze the Congruences with a Prime-Power Modulus and RSA Cryptosystem. **L2**
- Analyze the Quadratic residues and Quadratic forms. **L3**
- Solve Pell's equation by continued fractions **L4**
- Analyze the real word problem through the technique of Number theory. **L5**

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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS31-SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To provide exposure to various kinds of sensors, actuators and their Engineering applications.
- Capable of understanding the principles and physics of various kinds of sensors from macro to micro/nano level.

**UNIT – 1: Introduction to sensors** **9 Hrs**

**Content of the Unit – I**

Sensors, Sensor systems, Nanosensors, -Types of sensors(based on Functions, temperature, pressure, strain, ranging and motion, time- active and passive sensors). Materials used and their fabrication process (Deposition, Pattern and Etching), General characteristics of sensors. Actuators, Functional diagram of actuators, Design of Actuators, Types of actuators (Hydraulic, Pneumatic, Mechanical, Electromagnetic, EAP and EM actuators). Applications of Actuators.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify different types of Sensors, Actuators and their characteristics
- Identifies the applications of Actuators in different fields
- Explain about different fabrication process of Sensors
- Illustrate functional diagram of Actuators

**UNIT – II: Mechanical sensors** **9 Hrs**

**Content of the Unit – II**

Principles of mechanical sensors (piezoresistivity, piezoelectricity, capacitive, inductive and resonant techniques), Displacement sensors, velocity sensors, Torque sensors, flow sensors, Micro and nanosensors, Multimodal nanosensors.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Summarize various types of Mechanical sensors
- Explain the working principle of different types mechanical sensors
- Identifies the applications of Mechanical sensors in different environmental conditions
- Understand the basic concepts of micro and nano sensors

**UNIT – III: Thermal sensors and Magnetic sensors** **9 Hrs**

**Content of the Unit – III**

Introduction – Principles of Thermal sensors, Thermocouples, Types of thermocouples, Bi-metallic thermometer, Resistance Temperature Detectors (RTD), Advantages and Applications of these temperature sensors.

Introduction, Difference between conventional and magnetic sensors, Types of magnetic sensors (Low field, Earth field and BIAS magnetic field sensors), Working of variable reluctance sensors, Inductive sensors (LVDT), Eddy current sensors, Hall effect sensors, Applications of magnetic sensors.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyse the difference between conventional sensors and magnetic sensors
- Explain the working principle of different magnetic sensors
- Identifies the applications of Thermal and Magnetic sensors
- Summarize various types of thermal and magnetic sensors

**UNIT – IV: Electronic and Optical Sensors-I** **9 Hrs**

**Content of the Unit – IV**

Introduction, Block diagram of electronic sensor system, Microelectronic sensors, semiconductor strain gauge, Gas sensors – Basic principle and working, Applications of electronic sensors – Electronic nose. Optical system components, Solid state optical systems, Optical radiation sources.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the working and principle of various electronic and optical sensors
- Explain the block diagram of electronic sensor system
- Identifies the applications Electronic sensors in various fields
- Identify the various optical, solid state system components

**UNIT – V: Electronic and Optical Sensors –II** **9 Hrs**

**Content of the Unit – V**

Optical system components, Solid state optical systems, Optical transmitter and filters type (Geometrical optics, Fiber optics, optical Filters), Solid state photoelectric sensors, Photoconductive cells, Photo junction sensors, photon couplers, Example: MEMS transducers, Sensors calibration and compensation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the optical system components and solid state optical systems
- Classify different types of Optical filters
- Explain the solid state photoelectric sensors, photo junction sensors and photoconductive cells
- Understand basics of MEMS transducers, sensors calibration and compensation

**Text Books:**

1. Sensors and Signal Conditioning Wiley-Blackwell, 2008 Jacob Fraden,
2. Piezoelectric Sensors and Actuators: Fundamentals and Applications, Springer,2018Senturia S. D.

**Reference Books:**

1. Doebelin, "Measurement Systems: Application and Design", McGraw Hill Kogakusha Ltd.
2. Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim "Microsensors, MEMS and Smart Devices", New York: Wiley, 2001.
3. Henry Bolte, "Sensors – A Comprehensive Sensors", John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
5. Microsystem Design, Kluwer Academic Publisher, 2001 J.D. Plummer, M.D. Deal, P.G. Griffin

**Course Outcomes:**

At the end of this Course the student will be able to

- recognize the need of sensors
- types of sensors which they will able to utilize for the concerned engineering application

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS32-PHYSICS OF ELECTRONIC MATERIALS**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Be able to explain the fundamentals of materials.
- Be able to explain the kinds of semiconductor materials, their physical properties, and their applications.
- Be able to explain the kinds of magnetic materials, their physical properties, advances and their applications.
- Be able to explain the kinds of dielectric materials, their physical properties, advances and their applications.

**UNIT – 1: Fundamentals of Materials** **9 Hrs**

**Content of the Unit – I**

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Elementary idea of point, line and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RT and glow discharge).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic concepts of Phase and Phase diagram
- Understand the straight forward information of Nucleation and Growth
- Explain the preparation and deposition of Thin film using various methods
- Illustrate the methods of Crystal growth
- Summarize the different defects in crystal growth

**UNIT – II: Semiconductors** **9 Hrs**

**Content of the Unit – II**

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, diffusion length, diffusion and recombination. The Fermi level & Fermi dirac distribution, Temperature dependence of carrier concentration, Invariance of the Fermi level at equilibrium. Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Transistors, MOSFETs.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basics concepts regarding drift, diffusion, diffusion length and recombination.
- Classifies the energy bands of a Semiconductors
- Analyse how the position of the fermi level changes with carrier concentration and temperature.
- Explain the concepts regarding PN junctions, Transistors and MOSFETs.

**UNIT – III: Optoelectronics** **9 Hrs**

**Content of the Unit – III**

Introduction, Optoelectronic concepts, Hetrostructure p-n junction, Schottky junction and Ohmic contacts, Light emission and absorption, amplification and modulation in semiconductors, Semiconductor Light sources [Light emitting diodes (LEDs) , LASER, vertical cavity surface emitting laser (VCSEL), Quantum well laser {device structure – characteristics – Materials and applications}] and semiconductor Photo detectors [General Characteristics, Responsivity and Impulse response, photoconductors, semiconductor photodiodes].

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic concepts of PN junction and Schottky junction

- Explain about absorption, emission, amplification and modulation
- Illustrate various semiconductor light sources and their structure
- Identifies the characteristics and applications of optoelectronic devices
- Elucidate semiconductor photodetectors

**UNIT – IV: Dielectric Materials and their applications** **9 Hrs**

**Content of the Unit – IV**

Introduction, Dielectric properties, Electronic polarisability and susceptibility, dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of dielectric constant, polarisability, susceptibility
- Describe how the polarisation of the dielectric constant depends on the frequecy
- Explain about dielectric strength and dielectric loss
- Comprehend dielectric and piezoelectric properties

**UNIT – V: Magnetic Materials and their applications** **9 Hrs**

**Content of the Unit – V**

Introduction, Magnetism & various contributions to para and dia magnetism, Fero and Ferri magnetism and ferrites, concepts of Spin waves and Magnons, antiferromagnetism, domains and domain walls, coercive force, hysteresis, Nanomagnetism, Superparamagnetism – Properties and applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Differentiate different types of magnetic materials depending upon their properties
- Understand the concepts of Spin waves and Magnons
- Interpret the concepts of domains and domain walls
- Explain about the properties of Nanomagnetism, Super paramagnetism
- Identify the applications of magnetic materials

**Text Books:**

1. S.O. Kasap Principles of Electronic Materials and Devices, 3rd edition, McGraw-Hill Education (India) Pvt. Ltd., 2007.
2. Electrical Engineering Materials",by A.J. Dekker, PHI Pub.
3. "Electronic Components and Materials" Grover and Jamwal, DhanpatRai and Co.

**Reference Books:**

1. B.G. Streetman and S. Banerjee, Solid State Electronic Devices, 6th edition, PHI Learning,
2. Eugene A. Irene, Electronic Materials Science, Wiley, 2005
3. Wei Gao, Zhengwei Li, Nigel Sammes, An Introduction to Electronic Materials for Engineers, 2nd Edition, World Scientific Publishing Co. Pvt. Ltd., 2011
4. W D Callister, Materials Science and Engineering – An Introduction, Jr., John Willey and Sons, Inc, New York, 7th edition, 2007.
5. "A First Course In Material Science" by Raghvan, McGraw Hill Pub.
6. "Solid State Physics" by S.O.Pillai,New Age Publication.
7. 'The Science and Engineering of materials' by Donald R.Askeland,Chapman& Hall Pub.

**Course Outcomes:**

At the end of this Course the student will be able to

- Recognize the need of semiconductors
- Dielectric and magnetic materials which they will able to utilize for the concerned engineering application

*Department of Chemistry* *R19*

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS41-CHEMISTRY OF ENERGY MATERIALS**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To make the student understand basic electrochemical principles such as standard electrode potentials, EMF and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquefaction method
- Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
- To understand and apply the basics of calculations related to material and energy flow in the processes.

**UNIT – 1: Electrochemical Systems** **9 Hrs**

Galvanic cell, standard electrode potential, application of EMF, Electrode mechanism, polarization, Batteries-Lead-acid and Lithium ion batteries.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve the problems based on electrode potential L3
- Describe the Galvanic Cell L2
- Differentiate between Lead acid and Lithium ion batteries L2
- Illustrate the electrical double layer L2

**UNIT – II: : Fuel Cells**

Basic design of fuel cell, Fuel cell working principle, Fuel cell efficiency Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), and their applications

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe the working Principle of Fuel cell L2
- Explain the efficiency of the fuel cell L2
- Discuss about the Basic design of fuel cells L3
- Classify the fuel cell L2

**UNIT – III: Hydrogen Storage**

Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures (Carbon nano tubes, fullerenes), metal oxide porous structures, hydrogen storage by high pressure methods. Liquefaction method

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Differentiate Chemical and Physical methods of hydrogen storage L2
- Discuss the metal organic frame work L3
- Illustrate the carbon and metal oxide porous structures L2
- Describe the liquification methods L2

**UNIT – IV: Solar Energy**

Solar energy introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar Fuels – Hydrogen: Ammonia& Hydrazine, Solar cells (Si-Te& Cd-Te), advantages and disadvantages.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply the photo voltaic technology L3
- Demonstrate about solar energy and prospects L2
- Illustrate the Solar cells L2
- Discuss about concentrated solar power L3

**UNIT – V: Photo and Photoelectrochemical Conversions**

Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Differentiate between Photo and Photo electrochemical Conversions L2
- Illustrate the photochemical cells L2
- Identify the applications of photochemical reactions L3
- Interpret advantages of photoelectron catalytic conversion L2

**Text Books:**

1. Bahl and Bahl and Tuli, Essentials of Physical Chemistry, S. Chand Publications, New Delhi, 28$^{th}$ Edition, 2020.
2. US Department of Energy (EG&G technical services and corporation), Fuel Cell Hand Book 7$^{th}$ Edition, 2004.

**Reference Books:**

1. Ira N. Levine, Physical chemistry 6$^{th}$ Edition, McGraw Hills Education, New Delhi, 2009.
2. Silver and Atkins, Inorganic Chemistry, , 7$^{th}$ Edition, Oxford University Press, 2018.
3. Michael Hirscher, Hand book of Hydrogen Storage: New materials for future energy, storage, Wiley-VCH Verlag GmbH & Co. KGaA, 2010
4. Klaus Jagar et.al., Solar energy fundamental, technology and systems, UIT-Cambridge publishers, 2016

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand to perform simultaneous material and energy balances **L1**
- Lists about various electrochemical and energy systems **L1**
- Classify solid, liquid and gaseous fuels **L3**
- Analyze the energy demand of world, nation and available resources to fulfill the demand **L3**
- Evaluate the conventional energy resources and their effective utilization **L3**
- To be able to understand and perform the various characterization techniques of fuels **L1**
- Explain knowledge of modern energy conversion technologies **L2**
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively **L1**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS42-ADVANCED POLYMERS AND THEIR APPLICATIONS**

**(Open Elective-I)**

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**Course Objectives:**

- To understand the basic principles of polymers
- To synthesize the different polymeric materials and their characterization by various instrumental methods.
- To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
- To enumerate the applications of polymers in engineering

**UNIT – 1: Polymers-Basics and Characterization** **9 Hrs**

Basic concepts: monomers, repeat units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization mechanisms: condensation, addition, radical chain, ionic and coordination copolymerization, Zeigler-Natta and Ring opening metathesis polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers, Characterization of polymers by XRD, DSC.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify the polymers L3
- Explain polymerization mechanism L2
- Differentiate addition, condensation polymerizations L2
- Describe measurement of molecular weight of polymer L2

**UNIT – II: : Synthetic Polymers**

Polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications.

Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol - formaldehyde and melamine Epoxy and Ion exchange resins

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Differentiate Bulk, solution, Suspension and emulsion polymerization L2
- Describe fibers and elastomers L2
- Identify the thermosetting and thermo polymers L3

**UNIT – III: Natural Polymers & Modified cellulosics**

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins. Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe the properties and applications of polymers L2



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- Interpret the properties of cellulose, lignin, starch, rosin, latex etc., **L2**
- Discuss the special plastics of PES, PAES, PEEK etc., **L3**
- Explain modified cellulosics **L2**

**UNIT – IV: Hydrogels of Polymer networks and Drug delivery**

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, **Applications** of hydrogels in drug delivery. Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify types of polymer networks **L3**
- Describe methods involve in hydrogel preparation **L2**
- Explain applications of hydrogels in drug delivery **L2**
- Demonstrate the advanced drug delivery systems and controlled release **L2**

**UNIT – V: Surface phenomena**

Surface tension, adsorption on solids, electrical phenomena at interfaces including electro-kinetics, micelles, reverse micelles, solubilization. XPS principle-application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Demonstrate electrical phenomena at interfaces including electrokinetics, miselles, reverse micelles etc., **L3**
- Explain photoelectron spectroscopy **L2**
- Discuss ESCA and Auger spectroscopy to the study of surfaces **L3**
- Differentiate micelles and reverse micelles **L2**

**Text Books:**

1. Fred W.Billmayer, A Text book of Polymer science, 3rd Edition, Wiley India, 2007.
2. K.J.Saunders, Organic polymer Chemistry, Chapman and Hall, 1973.

**Reference Books:**

1. B.Miller, Advanced Organic Chemistry, Prentice Hall, 2nd Edn, 2003.
2. Ambikanandan Misra, Aliasgar Shahiwala, Applications of polymers in Drug delivery system, Elsevier Pub., 2020.
3. Gowarikar, Polymer Chemistry –New Age International Publications, 2019.
4. Physical Chemistry , Samel Galsstone, Lan Caster Press, 1970.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the state of art synthesis of Polymeric materials **L1**
- Understand the hydro gels preparation, properties and applications in drug delivery system. **L2**
- Characterize polymers materials using XPS. **L2**
- Analyze surface phenomenon of micelles and characterize using photoelectron spectroscopy, ESCA and Auger spectroscopy. **L3**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS43-Marine Chemistry**

**(Open Elective-I)**

| L | T | P | C |
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**Course Objectives:**

- To classify the different dissolved gases in sea water.
- To predict the role of biological processes in affecting oceanic carbonate system.
- To describe chemical and pharmacological properties of bioactive substances in marine organisms.
- To determine micro-nutrient elements (N, P, Si) in seawater.
- To identify dissolved elements in the estuary.

**UNIT – 1: Dissolved gases in seawater** **9 Hrs**

Dissolution of gases in seawater and their solubility; classification of dissolved gases and factors affecting their concentration in seawater; distribution of dissolved oxygen in seawater and affecting factors, Apparent Oxygen Utilization (AOU) and oxygen minimum zone formation in the ocean, origin and consequences of ocean hypoxia, Methane hydrate, clathrates

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the factors affecting on the dissolution of gases **L1**
- Understand apparent oxygen utilization and ozygen minimum zone formation in ocean. **L1**
- Compare the distribution of dissolved gaseous in sea water **L4**
- Analyze origin and consequences of ocean hypoxia, methane hydrate and clathrates **L3**

**UNIT – II: : Carbonate systems in the ocean**

Acid base equilibria in seawater, carbon dioxide system – absorption of carbon dioxide, carbon cycle; parameters of carbonate systems and their distribution in the ocean; role of biological processes in affecting oceanic carbonate system; precipitation and dissolution of calcium carbonate in seawater, lysocline and carbonate compensation depth; Ocean acidification

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic principle of acid-base equibria in sea water **L1**
- Explain the concept of carbon cycle **L1**
- Lists the various biological process in affecting oceanic carbonate, pptn and dissolution **L1**
- Analyze the parameters of carbonate system in oceanic water **L3**

**UNIT – III: Chemistry of marine natural products**

Biomedical aspects; chemical and pharmacological properties of bioactive substances in marine organisms, carbohydrates and their derivatives in red and brown algae, aliphatic acids and their derivatives in marine organisms, steroids and their use as biomarkers, nitrogenous compounds in invertebrates, nucleosides from sponges, biopolymer

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the chemical and pharmacological properties of bioactive substances in marine organism **L1**
- Explain the steroids and their use as biomarkers **L2**
- List the chemical properties in nitrogenous compounds in invertebrates **L1**

**UNIT – IV: Micronutrients in seawater**

Micro-nutrient elements (N, P, Si) in seawater, their forms, distribution and seasonal variation in the ocean. Stoichiometry of uptake and regeneration of nutrients elements and Apparent Oxygen Utilization (AOU)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List the micro-nutrients in sea water **L1**
- Understand the stoichiometry of uptake and regeneration of nutrients **L1**
- Differentiate the distribution of micronutrients with seasonal variation in the ocean **L2**

**UNIT – V: Estuarine chemistry**

Behavior of dissolved and particulate material during estuarine mixing, interaction among them and speciation of dissolved elements in the estuary; physico-chemical characteristics of estuarine sediment, anoxic sediments and pore water; heavy metals in estuaries and the processes affecting their distribution

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the behavior of dissolved and particulate matter in estuarine system **L1**
- Analyze the physicochemical characteristics of estuarine system **L3**
- Differentiate the effect of heavy metals in estuaries and affecting in distribution **L2**

**Text Books:**

1. Riley, J.P. and Chester, R., Introduction to Marine Chemistry, Academic Press, 1971.
2. Chester, R., Marine Geochemistry, Blackwell Science, 1990, 2000

**Reference Books:**

1. Riley, J.P., Skirrow, G, Chemical Oceanography (Vol.1,2, 3 ), Academic Press, 1975.
2. Horne, R.A, Marine Chemistry - The Structure of Water and the Chemistry of the Hydrosphere, 1969 Wiley- Interscience.
3. Seawater: Its composition, properties & behaviour, 2nd Edn, The Open University Team, 1989
4. Martin, D.F., Marcel Dekker, Marine Chemistry (Vol.2), 2nd Edition, Academic Press, NY, 1970.
5. Broecker and Peng, Tracers in the Sea, Lamont-Doherty Geological Observatory, 1982, NY.
6. Chemical Oceanography, 1992 – Millero, F. J. and Sohn, M.L., CRC Press
7. Burton et al., Dynamic processes in the chemistry of the upper ocean, Plenum Press, 1986.
8. Heinrich D Holland, The Chemistry of the Atmosphere and Oceans, John Wiley & sons Inc, 1978.

**Course Outcomes:**

At the end of this Course the student will be able to

- List the various dissolved gases in sea water and factors affecting their. **L1**
- Demonstrate knowledge of concepts and principles of ocean acidification. Analyse and evaluate biomedical aspects of marine natural products. **L2**
- Integrate and apply the knowledge of stoichiometry of uptake and regeneration of nutrients elements. **L3**
- Reflect on the influence heavy metals in estuaries. **L4**
- Evaluate total findings in marine chemistry to solve engineering problems **L3**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE55a-AIR POLLUTION AND CONTROL**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To teach the basics of air pollution
- To impart the behavior of air due to metrological influence
- To throw light on air quality management
- To teach the design of air pollution control methods

**UNIT – I:**

**INTRODUCTION :** Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, point and Non- Point, Line and Areal Sources of air pollution- stationary and mobile sources.

**EFFECTS OF AIR POLLUTION :** Effects of Air pollutants on man, material and vegetation: Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holesetc.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the basics of air pollutants.
- Estimate the impact of air pollution

**UNIT – II:**

**THERMODYNAMIC OF AIR POLLUTION:** Thermodynamics and Kinetics of Air-pollution – Applications in the removal of gases like Sox, Nox, CO, HC etc., air-fuel ratio. Computation and Control of products of combustion.

**PLUME BEHAVIOUR :** Meteorology and plume Dispersion; properties of atmosphere; Heat, Pressure, Wind forces, Moisture and relative Humidity, Influence of Meteorological phenomena on Air Quality-wind rosediagrams.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Study properties of atmosphere
- Learn plume behavior in different environmental conditions
- Analyse and compute the parameters of air pollutants
- Evaluate procedures for control of pollution

**UNIT – III:**

**POLLUTANT DISPERSION MODELS :** Lapse Rates, Pressure Systems, Winds and moisture plume behaviour and plume Rise Models; Gaussian Model for Plume Dispersion.

**CONTROL OF PARTICULATES :** Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control, Equipment"s – Settling Chambers, Centrifugal separators, filters Dry and Wet scrubbers, Electrostatic precipitators.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the design principles of particulate control.
- Learn and design pollutant dispersion models

**UNIT – IV:**

**CONTROL OF GASEOUS POLLUTANTS :**General Methods of Control of Nox and Sox emissions – In-plant Control Measures, process changes, dry and wet methods of removal and recycling.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the design principles of gaseous control.
- Develop environmental friendly fuels and study their properties.

**UNIT – V:**

**AIR QUALITY MANAGEMENT :** Air Quality Management – Monitoring of SPM, SO; NO and CO Emission Standards.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Study the air quality management.
- Visualize emissions and their permissible standards

**Text Books:**

1. Air Quality by Thodgodish, Levis Publishers, Special India Edition, NewDelhi
2. Air pollution By M.N.Rao and H.V.N.Rao – Tata Mc.Graw HillCompany.
3. Air pollution by Wark and Warner.- Harper & Row, NewYork.

**Reference Books:**

1. An introduction to Air pollution by R.K. Trivedy and P.K. Goel, B.S.Publications
2. Air Pollution and Control by K.V.S.G.Murali Krishna, Kousal& Co. Publications, New Delhi.
3. Enivronmental meteorology by S.Padmanabhammurthy ,I.K.InternationalsPvtLtd,New Delhi

**Course Outcomes:**

At the end of this Course the student will be able to

- Evaluating the ambient air quality based on the analysis of air pollutants
- Design particulate and gaseous control measures for an industry
- Judge the plume behavior in a prevailing environmental condition
- Estimate carbon credits for various day to day activities

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE55b-GREEN BUILDINGS**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about
- Learn the principles of planning and orientation ofgreen buildings.
- Acquire knowledge on various aspects of green buildings

**UNIT – I:**

**Introduction**:ConceptofGreenBuilding,NeedforGreenBuilding,Benefitsof' Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Understand need for green building
- Obtain knowledge on features of green building

**UNIT – II:**

**Green Building Concepts and Practices:** Indian Green Building Council,Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation;

Green **Building** Opportunities And **Benefits:** Opportunities of Green Building, Green BuildingFeatures,MaterialandResources,WaterEfficiency,OptimumEnergyEfficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Knowledge on benefits and energy efficiency of green buildings
- Knowledge on practices and concepts of green buildings

**UNIT – III:**

**Green Building Design** Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Ecofriendly captive power generation for factory, Building requirement,

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Learn steps in design of green buildings
- Learn how renewable energy resources are used in green buildings

**UNIT – IV:**

**Air Conditioning** Introduction, CII Godrej Green business centre, Design philosophy, Design interventions, Energy modeling, HVAC System design, Chiller se1ection,pump selection, Selection of cooling towers, Selection of air handing units, Precooling of fresh air, Interior lighting system, Key feature of the building. Eco- friendly captive power generation for factory, Building requirement.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Learn designing of air conditioning in green building

**UNIT – V:**

**Material Conservation** Handling of non process waste, waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, Rapidly renewable building materials and furniture; Indoor Environment Quality And Occupational Health: Air conditioning, Indoor air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Suggest materials and technologies to improve energy efficiency of building.

**Text Books:**

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers,2009.
2. Green Building Hand Book by Tomwoolley and Samkimings,2009.

**Reference Books:**

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain the principles of green buildings , its byelaws
- Understand the concepts of design of green buildings and material conversation in green buildings
- knowledge on rating systems of green buildings
- Suggest materials and technologies to improve energy efficiency of building.

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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE55c-BASICS OF CIVIL ENGINEERING MATERIALS AND CONSTRUCTION PRACTICE**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering
- to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs.

**UNIT – I:**

**Introduction to Civil Engineering Building planning:** Introduction to types of buildings as per NBC; Selection of site for buildings. Components of a residential building and their functions. Introduction to industrial buildings- office / factory / software development office / power house / electronic equipment service centre

**Learning Outcomes:**

At the end of this unit, the student will be able to

- learn different types of buildings as per NBC and their components and function
- learn how to select different type of buildings sites

**UNIT – II:**

Site plan, Orientation of a building, Open space requirements, Position of doors and windows, Size of rooms; Preparation of a scaled sketch of the plan of a single storeyed residential building in a given site plan. Introduction to the various building area terms - Computation of plinth area/ built up area, Floor area / carpet area - for a simple single storeyed building; Setting out of a building.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- .learn site plans and orientation of buildings.
- learn setting out a building and preparation of scaled sketch of building plans

**UNIT – III:**

**Surveying** - Principles and objectives of surveying; Horizontal measurements – instruments used – tape, types of tapes; Ranging(direct ranging only) Theodolite and Total station-Principles

**Learning Outcomes:**

At the end of this unit, the student will be able to

- learn principles and objectives of surveying.
- learn instruments used in surveying and application in field

**UNIT – IV:**

**Building materials:** Bricks, cement blocks - Properties and specifications.Cement – OPC, properties, grades; other types of cement and its uses (in brief). Cement mortar – constituents, preparation. Concrete – PCC and RCC – grades. Steel - Use of steel in building construction, types and market forms.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- learn basic civil engineering materials (bricks, cement, cement mortar, cement concrete)
- learn about steel and use of steel in building construction

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**UNIT – V:**

Building construction – Foundations; Bearing capacity of soil (definitiononly); Functions of foundations, Types - shallow and deep (sketches only).

Brick masonry – header and stretcher bond, English bonds – Elevation and plan (one brick thick walls only).

Roofs – functions, types, roofing materials (brief discussion only).

Floors – functions, types; flooring materials (brief discussion only).

Decorative finishes – Plastering – Purpose, procedure.

Paints and Painting – Purpose, types, preparation of surfaces for painting (brief discussion only).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- learn foundations, SBC and theirs functions.
- learn about brick masonry(header, stretcher bond and english bond).
- learn roofs, floors and their materials

**Text Books:**

1. Rangwala, S. C., Essentials of Civil Engineering, Charotar Publishing House
2. Rangwala, S. C. and Dalal, K. B., Engineering Materials, Charotar Publishing house
3. Rangwala, S. C. and Dalal, K. B., Building Construction, Charotar Publishing house
4. Dr. K. R. Arora, "Surveying Volume-1", Standard book house, New Delhi, 13th Edition, 2012. 2. S. K. Duggal, "SurveyingVolume-2", Tata McGraw-Hill Education Private Limited, India,New Delhi, 3rd Edition, 2009.

**Reference Books:**

**Course Outcomes:**

At the end of this Course the student will be able to

- Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
- Explain different types of buildings, building components, building materials and building construction
- Describe the importance, objectives and principles of surveying.

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE55a- BASICS OF NON-CONVENTIONAL ENERGY SOURCES**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Identify various sources of Energy and the need of Renewable Energy Systems
- Understand the concepts of Solar Radiation, Wind energy and its applications
- Distinguish between solar thermal and solar PV systems
- Interpret the concept of geo thermal energy and its applications
- Understand the use of biomass energy and the concept of Ocean energy and fuel cells.

**UNIT – I: Solar Energy** **10 Hrs**

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy thermal storage.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To understand about solar thermal parameters
- To distinguish between flat plate and concentrated solar collectors
- To know about thermal storage requirements
- To know about measurement of solar radiation

**UNIT – II: PV Energy Systems** **10 Hrs**

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems..

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of PV effect in crystalline silicon and their characteristics
- Understand other PV technologies
- To know about electrical characteristics of PV cells & modules
- To know about grid connected PV systems

**UNIT – III: Wind Energy** **10 Hrs**

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To understand basics of wind energy conversion and system
- To distinguish between VAWT and HAWT systems
- To understand about design considerations
- To know about site selection considerations of WECS

**UNIT – IV: Geothermal Energy** **10 Hrs**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India..

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the Geothermal energy and its mechanism of production and its Applications
- Analyze the concept of producing Geothermal energies
- To learn about disadvantages and advantages of Geo Thermal Energy Systems
- To know about various applications of GTES

**UNIT – V: Miscellaneous Energy Technologies** **10 Hrs**

**Ocean Energy**: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.

**Bio mass Energy**: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

**Fuel cell**: Principle of working of various types of fuel cells and their working, performance and limitations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze the operation of tidal energy
- Analyze the operation of wave energy
- Analyze the operation of bio mass energy
- Understand the principle, working and performance of fuel cell technology
- Apply these technologies to generate power for usage at remote centres

**Text Books:**

1. Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.
2. G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

**Reference Books:**

1. S. P. Sukhatme, "Solar Energy",3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd,2008.
2. B H Khan , " Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma,"Non-Conventional Energy Resources",3rd Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles and Applications", Narosa Publishing House, 2004.

**Course Outcomes:**

At the end of this Course the student will be able to

- To distinguish between various alternate sources of energy for different suitable application requirements
- To differentiate between solar thermal and PV system energy generation strategies
- To understand about wind energy system
- To get exposed to the basics of Geo Thermal Energy Systems
- To know about various diversified energy scenarios of ocean, biomass and fuel cells

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE55b- ELECTRICAL MEASUREMENTS & SENSORS**

**(Open Elective-I)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- The basic principles of different types of electrical instruments for the measurement of voltage, current, power factor, power and energy.
- The measurements of RLC parameters using bridge principles.
- The principles of magnetic measurements.
- The principle of working of CRO and its applications.
- Extending the range of an Instrument.

**UNIT – I: Measuring Instruments** **10 Hrs**

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range–Numerical examples

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the operation of different in struments.
- Know the different types of errors and their compensation

**UNIT – II: Measurement of Power, Power Factor and Energy** **10 Hrs**

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type–1-phand3-ph Power factor Meters. Single Phase Induction Type Energy Meter-Driving and Braking Torques–Errors and their Compensation, Three Phase Energy Meter-Numerical examples

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the working principles and construction of different types of Energy meters
- Distinguish between low and high power factor ranges in wattmeters

**UNIT – III: Instrument transformers, Potentiometers, and magnetic measurements** **10 Hrs**

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – MethodsforReductionofErrors-DesignConsiderations.DCPotentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types-Standardization – Applications. Determination of B-H Loop Methods of Reversals – Six Point magnetic measurement Method–A.C.Testing–Iron Loss of Bar Samples –Numerical Examples

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Distinguish between CTs and PTs
- Understand the principles and working of various measuring instruments used to detect electrical circuit parameters R,L,C

**UNIT – IV:** D.C & A.C Bridges **10 Hrs**

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheat stone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance –Loss of Charge Method. Measurement of Inductance-Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge –Schering Bridge–Numerical Examples

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the bridge configurations and their applications for various ranges of resistance measurement
- Compute the unknown parameters of Inductance and Capacitance using the bridges

**UNIT – V: CRO and Digital Meters** **10 Hrs**

Cathode Ray Oscilloscope-Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers–Applications of CRO–Measurement of Phase, Frequency, Current and Voltage-Lissajous Patterns. Digital Voltmeters – Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter- Digital Tachometer.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the operation of CRO and its parts
- Know about Digital voltmeters and Distinguish between an along and digital meters

**Text Books:**

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments–by E.W.Golding and F.C.Widdis, 5$^{th}$Edition, Reem Publications,2011.

**Reference Books:**

1. Electronic Instrumentation by H.S. Kalsi, Tata McGraw-Hill, 3$^{rd}$ Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications –by Reissland, M.U, New Age International (P) Limited,2010.
3. Electrical & Electronic Measurement & Instrumentation by R.K.Rajput,2$^{nd}$ Edition, S.Chand & Co., 2$^{nd}$Edition,2013.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the working of various instruments and equipments used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc in industry as well as in power generation, transmission and distribution sectors **L1**
- Analyze and solve the varieties of problems and issues coming up in the vast field of electrical measurements. **L2**
- Analyze the different operation of extension range ammeters and voltmeters, **L3**
- Design and development of various voltage and current measuring meters. **L4**
- Analyze DC and AC bridges for measurement of parameters and different characteristics of periodic and a periodic signals using CRO. **L5**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE55c- ELECTRIC VEHICLE ENGINEERING**

**(Open Elective-I)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- To get exposed to EV system configuration and parameters
- To know about electro mobility and environmental issues of EVs
- To understand about basic EV propulsion and dynamics
- To understand about fuel cell technologies for EV and HVEs
- To know about basic battery charging and control strategies used in electric vehicles

**UNIT – I: Introduction to EV Systems and Parameters** **10 Hrs**

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about past, present and latest technologies of EV **L1**
- To understand about configurations of EV systems **L1**
- To distinguish between EV parameters and performance parameters of EV systems **L2**
- To distinguish between single and multiple motor drive EVs **L4**
- To understand about in-wheel EV **L5**

**UNIT – II: EV and Energy Sources** **10 Hrs**

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about various types of EV sources **L1**
- To understand about e-mobility **L2**
- To know about environmental aspects of EV **L3**
- To distinguish between conventional and recent technology developments in EV systems **L4**

**UNIT – III: EV Propulsion and Dynamics** **10 Hrs**

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about what is meant by propulsion system **L1**
- To understand about single and multi motor EV configurations **L2**
- To get exposed to current and recent applications of EV **L3**
- To understand about load factors in vehicle dynamics **L4**
- To know what is meant acceleration in EV **L5**

**UNIT – IV: Fuel Cells** **10 Hrs**

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle. Introduction to HEV, brake specific fuel consumption, comparison of series, series parallel hybrid systems, examples

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about fuel cell technology of EV **L1**
- To know about basic operation of FCEV **L2**
- To know about characteristics and sizing of EV with suitable example **L3**
- To get exposed to concept of Hybrid Electric Vehicle using fuel cells **L4**
- To know about the comparison of various hybrid EV systems **L5**

**UNIT – V: Battery Charging and Control** **10 Hrs**

Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction. Control: Introduction, modeling of electro mechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To understand about basic requirements of battery charging and its architecture **L1**
- To know about charger functions **L2**
- To get exposed to wireless charging principle **L3**
- To understand about block diagram, modeling of electro mechanical systems of EV **L4**
- To be able to design various compensation requirements **L5**

**Text Books:**

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University PressInc., New York 2001.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

**Reference Books:**

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.

**Course Outcomes:**

At the end of this Course the student will be able to

- To understand and differentiate between conventional and latest trends in Electric Vehicles **L1**
- To know about various configurations in parameters of EV system **L2**
- To know about propulsion and dynamic aspects of EV **L3**
- To understand about fuel cell technologies in EV and HEV systems **L4**
- To understand about battery charging and controls required of EVs **L5**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEC55a- FUNDAMENTALS OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To study the basic principle, construction and operation of semiconductor devices.
- To learn the real time applications of semiconductor devices.
- To introduce binary number systems, logic gates and digital logic circuits.
- To get an idea about the basic principles of communication systems and their applications.
- To learn the measurement of physical parameters using Sensors and Transducers.

**UNIT – I:**

**Introduction to Electronics Engineering:** Overview, scope and objective of studying Electronics Engineering. Introduction to semiconductor devices: Bond structure of semiconductors, intrinsic and extrinsic semiconductors; Basic principle and operation of semiconductor devices – diode, bipolar junction transistor, field effect transistors; Introduction to VLSI.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic principle, construction and operation of semiconductor devices. **L2**
- Learn about the diode, bipolar junction transistor and field effect transistors. **L1**

**UNIT – II:**

**Applications of semiconductor devices:** Basic concepts of rectifiers, voltage regulators, amplifiers and oscillators; Basic concepts of operational amplifier and their applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To learn the real time applications of semiconductor devices.(L1) **L1**
- To understand the basic concepts of operational amplifier and their applications.(L2) **L2**

**UNIT – III:**

**Introduction to digital systems:** Binary number system, Boolean algebra, Logic gates, adders, one-bit memory, flip-flops (SR, JK), shift registers, Asynchronous counter.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the binary number systems, Boolean algebra and working of logic gates. **L2**
- Know the working and applications of digital logic circuits. **L1**

**UNIT – IV:**

**Introduction to Communication Systems:** Elements of a communication system – transmitter and receiver; Signal types in communication; FDM and TDM; Processing of signals for transmission – basic concepts of amplitude and frequency modulation; Examples of telecommunication systems – telephone, radio, television, mobile communication and satellite communication.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the basic elements of a communication system. **L2**
- Understand various examples of telecommunication systems. **L2**

**UNIT – V:**

**Sensors and Transducers** - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Understand the basic working principle and applications of different sensors and transducers. **L2**
- Measure physical parameters using different types of sensors and transducers. **L3**

**Text Books:**

1. Millman J, Halkias C.C andJit S, "Electronic Devices and Circuits", Tata McGraw-Hill, 2nd 2007 Edition.
2. Mano M.M., "Digital Design", Prentice-Hall, 3rd Edition. 2002
3. A.K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai& Co. 3rd edition Delhi, 2010.
4. Kennedy G. and Davis B., "Electronic Communication Systems", Tata McGraw-Hill, 4th 2008 Edition.

**Reference Books:**

1. Tomasi W., "Advanced Electronic Communication Systems", Pearson/Prentice-Hall, 6th 2004 Edition.
2. Boylstead R.L. andNashelsky L., "Electronic Devices and Circuit Theory", Pearson, 10th 2009 Edition.

**Course Outcomes:**
At the end of this Course the student will be able to

- Understand the basic principle, construction and operation of semiconductor devices. **L2**
- Learn the real time applications of semiconductor devices. **L1**
- Comprehend the binary number systems, logic gates and digital logic circuits. **L1**
- Understand the basic principles of communication systems and their applications. **L2**
- Measure the physical parameters using Sensors and Transducers. **L3**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEC55b- TRANSDUCERS AND SENSORS**

**(Open Elective-I)**

| L | T | P | C |
|---|---|---|---|
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**Course Objectives:** The objectives of the course are to make the students learn about

- To study about the characteristics of instrumentation system and transducers.
- To know the operation of different types of Temperature Transducers.
- To learn the operation of different types of Flow Transducers.
- To understand the working and operation of different types of Pressure Transducers.
- To gain the knowledge on working of Force and Sound Transducers.

**UNIT – I:**

**Introduction:** General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

**Motion Transducers:** Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the characteristics of instrumentation system and transducers. **L1**
- Measure motion using different motion transducers. **L3**

**UNIT – II:**

**Temperature Transducers:** Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the working principle of temperature transducers. **L2**
- Study about different types of bio sensors and smart sensors. **L1**

**UNIT – III:**

**Flow Transducers:** Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the Bernoulli's principle and continuity. **L2**
- Learn how to measure flow using different types of flow meters. **L1**

**UNIT – IV:**

**Pressure Transducers:** Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Work with different types of manometers. **L3**
- Use different types of pressure transducersto measure pressure. **L3**

**UNIT – V:**

**Force and Sound Transducers:** Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn how to measure force using force transducers. **L1**
- Understand the working and operation of sound transducers. **L2**

**Text Books:**

1. A.K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai& Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V,"Instrumentation Devices and Systems", TATA McGraw Hill publications, 2007.

**Reference Books:**

1. Doebelin. E.O, "Measurement Systems Application and Design",McGraw Hill International, New York, 2004.
2. Nakra B.CandChaudharyK.K , "Instrumentation Measurement and Analysis", Second Edition, Tata McGraw-Hill Publication Ltd.2006.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the characteristics of instrumentation system and transducers **L2**
- Know the operation of different types of Temperature Transducers. **L1**
- Compare the operation of different types of Flow Transducers. **L2**
- Correlate the working and operation of different types of Pressure Transducers. **L4**
- Gain the knowledge on working of Force and Sound Transducers. **L1**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEC55c- PRINCIPLES OF COMMUNICATIONS**

**(Open Elective-I)**

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- To understand the importance of modulation and Amplitude modulation.
- To know about the frequency modulation and phase modulation.
- To study different types of pulse analog modulation techniquesand multiple access techniques.
- To gain knowledge on pulse code modulation and different waveform coding techniques.
- To comprehend the wireless communication systems, their evolution and standards.

**UNIT – I:**

**Analog communication-I:** Elements of communication systems need for Modulation, Modulation Methods, Baseband and carrier communication Amplitude Modulation(AM),Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double side band suppressed carrier(DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband(SSB) transmission, VSB Modulation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic elements of communication systems. **L2**
- Compare the performance of analog modulation schemes. **L2**

**UNIT – II:**

**Analog communication-II : Angle Modulation & Demodulation:** Concept of instantaneous frequency Generalized concept of angle modulation, Bandwidth of angle modulated waves- Narrow band frequency modulation (NBFM); and Wide band FM (WBFM),Phase modulation, Pre-emphasis & De-emphasis, Illustrative Problems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Compare the performance of different frequency modulated schemes. **L2**
- Learn about the Pre-emphasis & De-emphasis circuits in frequency modulation. **L1**

**UNIT – III:**

**Digital communications-I (Qualitative Approach only) :Pulse Analog Modulation Techniques :** Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation

**Multiple Access Techniques:** Introduction to multiple access techniques, FDMA,TDMA, CDMA, SDMA: Advantages and applications

**Learning Outcomes:** At the end of this unit, the student will be able to

- Analyze the performance of different pulse modulation techniques. **L4**
- Understand the basic principles of Multiple Access Techniques. **L2**

**UNIT – IV:**

**Digital communications-II (Qualitative Approach only)** :Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M-PSK techniques.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the performance of different types of digital modulation schemes. **L2**
- Explain different types of waveform coding techniques and their applications. **L1**

**UNIT – V:**

**Wireless communications (Qualitative Approach only) :** Introduction to wireless communication systems, Examples of wireless communication systems, comparison of 2G and 3G cellular networks, Introduction to wireless networks, Differences between wireless and fixed telephone networks, Introduction to Global system for mobile(GSM),GSM services and features.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand various types of wireless communication systems. **L1**
- Explain GSM services and features. **L2**

**Text Books:**

1. H Taub, D. Schilling and Gautam Sahe, "Principles of Communication Systems", TMH, 2007, 3rd Edition
2. George Kennedy and Bernard Davis, "Electronics & Communication System", 4th Edition, TMH 2009
3. Wayne Tomasi, "Electronic Communication System: Fundamentals Through Advanced",$2^{nd}$ editions,PHI,2001.

**Reference Books:**

1. Simon Haykin, "Principles of Communication Systems", John Wiley, 2nd Edition.
2. Sham Shanmugam," Digital and Analog communication Systems",Wiley-India edition,2006.
3. Theodore. S.Rapport, "Wireless Communications",Pearson Education,$2^{nd}$ Edition,2002.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the importance of modulation and Amplitude modulation. **L2**
- Summarize the frequency modulation and phase modulation methods. **L2**
- Explain about different types of pulse analog modulation techniquesand multiple access techniques. **L3**
- Acquire knowledge on pulse code modulation and different waveform coding techniques. **L1**
- Comprehend the wireless communication systems, their evolution and standards. **L1**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACS55a- OOPS CONCEPTS THROUGH JAVA**

**Open Elective-1**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Study the syntax, semantics and features of Java Programming Language
- Study the Object Oriented Programming Concepts of Java Programming language
- Learn the method of creating Multi-threaded programs and handle exceptions
- Learn Java features to create GUI applications & perform event handling

**UNIT – I: INTRODUCTION** **8hrs**

**Introduction to Java**: The key attributes of object oriented programming, simple program, The Java keywords, Identifiers, Data types and operators, Program control statements, Arrays, Strings, String Handling

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basics of computer graphics, different graphics systems and applications of computer graphics. L2
- Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis. L2

**UNIT – II: CLASSES** **8hrs**

**Classes**: Classes, Objects, Methods, Parameters, Constructors, Garbage Collection, Access modifiers, Pass Objects and arguments, Method and Constructor Overloading, Understanding static, Nested and inner classes.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Use of geometric transformations on graphics objects and their application in composite form. L3
- Extract scene with different clipping methods and its transformation to graphics display device. L3

**UNIT – III: INHERITANCE** **8hrs**

**Inheritance** – Basics, Member Access, Usage of Super, Multi level hierarchy, Method overriding, Abstract class, Final keyword.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explore projections and visible surface detection techniques for display of 3D scene on 2D screen. L4
- Render projected objects to naturalize the scene in 2D view and use of illumination models . L4

**UNIT – IV: INTERFACES** **7 Hrs**

**Interfaces** – Creating, Implementing, Using, Extending, and Nesting of interfaces.

**Packages** – Defining, Finding, Member Access, Importing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basics of Multimedia basics, different graphics systems and applications of computer graphics. **L3**
- Discuss various multimedia data structures. **L3**

**UNIT – V: EXCEPTION HANDLING**

**Exception handling**: Hierarchy, Fundamentals, Multiple catch clauses, subclass exceptions, Nesting try blocks, Throwing an exception, Using Finally and Throws, Built-in exceptions, User-defined exceptions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basics of Multimedia Authoring systems. **L5**
- Understand the how videos are placed. **L5**

**Text Books:**

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
2. "Java The Complete Reference" Herbert Schildt, 8$^{th}$ Edition, 2011, Oracle press, TataMcGraw-Hill.
3. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.

**Reference Books:**

1. "Programming with Java" T.V.Suresh Kumar, B.Eswara Reddy, P.Raghavan Pearson Edition.
2. "Core Java", Nageswar Rao, Wiley Publishers.
3. "Thinking in Java", Bruce Eckel, Pearson Education.
4. "A Programmers Guide to Java SCJP", Third Edition, Mughal, Rasmussen, Pearson.
5. "Head First Java", Kathy Sierra, Bert Bates, O'Reilly
6. "SCJP – Sun Certified Programmer for Java Study guide" – Kathy Sierra, Bert Bates, McGrawHill.
7. "Java in Nutshell", David Flanagan, O'Reilly
8. "Core Java : Volume I – Fundamentals, Cay S. Horstmann, Gary Cornell, The Sun Micro Systems Press.

**Course Outcomes:**

At the end of this Course the student will be able to

- Gain knowledge of client-side scripting, validation of forms and AJAX programming. **L3**
- Understand server-side scripting with PHP language. **L4**
- Understand what XML is and how to parse and use XML Data with Java. **L5**
- To introduce Server-side programming with Java Servlets and JSP.

III B.Tech I SEMESTER

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

**19ACS55b- INTRODUCTION TO INTERNET OF THINGS**

**Open Elective-I**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

**UNIT – 1: INTRODUCTION**

Introduction – Characteristics-Physical Design - Protocols – Logical Design – Enabling technologies – IoT Levels – Six Levels of IoT - Domain Specific IoTs.**Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · L2
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · L3

**UNIT – II: M2M, IoT vs M2M**

M2M, IoT vs M2M, SDN and NFV for IoT, IOT system Management with NETCONF-YANG.

. **Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · L2
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · L3

**UNIT – III: IOT SYSTEM MANAGEMNT**

IoT Systems Management – IoT Design Methodology – Specifications Integration and Application Development.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · L2
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · L3

**UNIT – IV: SENSORS**

Sensors- Types of sensor nodes, Internet communications, IP addresses, MAC Address, TCP and UDP Ports, Application layer protocols

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · L2
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · ·L3

**UNIT – V: IOT APPLICATIONS**

IOT application for industry-Future factory concepts, Brownfield IoT, Smart objects, Smart applications, Study of existing IoT platforms/middleware, IoT- A, Hydra etc.

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to understand the application areas of IOT · **L2**
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · **L3**

**Text Books:**

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A Hands-on Approach", Universities Press, 2015.

**Reference Books:**


1. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
2. Marco Schwartz, "Internet of Things with the Arduino Yun", Pack Publishing, 2014.
3. *Simon Monk, "Programming the Raspberry Pi: Getting Started with Python"*, McGraw-Hill, *2013.*
4. Charalampos Doukas, "Building Internet of Things With the Arduino", Second Edition, 2012.
5. Dr. John Bates, "Thingalytics: Smart Big Data Analytics for the Internet of Things", Software AG Publisher, 2015.


**Course Outcomes:**

At the end of this Course the student will be able to

Introduction to computer graphics

Able to understand the application areas of IOT · **L2**

Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks · **L3**

Able to understand building blocks of Internet of Things and characteristics **L4**

III B.Tech I SEMESTER

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACS55c- INTRODUCTION TO OPERATING SYSTEMS**

**Open Elective-1**

| L | T | P | C |
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**Course Objectives:**

- To make the students understand the basic operating system concepts such as processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection.
- To get acquaintance with the class of abstractions afford by general purpose operating systems that aid the development of user applications

**UNIT – 1: OPERATING SYSTEMS OVERVIEW**

**Operating Systems Overview:** Operating system functions, Operating system structure, operating systems Operations, protection and security.

**Operating System Structure:** Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand what makes a computer system function and the primary PC components. **L2**
- Understand past and current trends in computer technology. **L3**

**UNIT – II: THREADS**

**Threads:** overview, Multicore Programming, Multithreading Models, Thread Libraries, Implicit threading, Threading Issues.

**CPU Scheduling:** Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling.

. **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand past and current trends in computer technology. **L3**
- Use basic software applications. **L4**

**UNIT – III: MEMORY MANAGEMENT**

**Memory Management:** Swapping, contiguous memory allocation, segmentation, paging, structure of the page table.

**Deadlocks:** System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Use basic software applications. **L4**
- Add functionality to the exiting operating systems **L5**

**UNIT – IV: MASS-STORAGE STRUCTURE**

**Mass-storage structure:** Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation.

**Learning Outcomes:**

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At the end of this unit, the student will be able to

- Add functionality to the exiting operating systems **L5**
- Design new operating systems **L6**

**UNIT – V: I/O systems**

**I/O systems:** I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Add functionality to the exiting operating systems **L5**
- Design new operating systems **L6**

**Text Books:**

1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Ninth Edition, 2012, Wiley.
2. Operating Systems: Internals and Design Principles, Stallings, Sixth Edition, 2009, Pearson Education.

**Reference Books:**

1. Modern Operating Systems, Andrew S Tanenbaum, Second Edition, PHI.
2. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
3. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.
4. Operating Systems, A.S.Godbole, Second Edition, TMH.
5. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.
6. Operating Systems, G.Nutt, N.Chaki and S.Neogy, Third Edition, Pearson Education.
7. Operating Systems, R.Elmasri, A,G.Carrick and D.Levine, Mc Graw Hill.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand what makes a computer system function and the primary PC components. **L2**
- Understand past and current trends in computer technology. **L3**
- Use basic software applications. **L4**
- Add functionality to the exiting operating systems **L5**
- Design new operating systems **L6**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS14a-MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**

**(Humanities Elective-I)(Common to [illegible])**

CE&ME

| L | T | P | C |
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**Course Objectives:**

- To inculcate the basic knowledge of micro economics and financial accounting.
- To make the students learn how demand is estimated for different products, input- output relationship for optimizing production and cost.

**UNIT – 1**

**Introduction to Managerial Economics:**
Definition of Managerial Economics, Nature and Scope – Managerial Economics and its relation with other subjects- Basic economic tools in Managerial Economics.

**Demand Analysis & Elasticity of Demand:** Meaning- Demand distinctions- Demand determinants- Law of Demand and its exceptions, Types of Elasticity of demand - Measurement of price elasticity of demand, Significance of Elasticity of Demand.

**Demand Forecasting:** Meaning - Factors governing demand forecasting - Methods of demand forecasting - Forecasting demand for new products.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the nature and scope of Managerial Economics and its importance. **L1**
- Understand the concept of demand and its determinants. **L2**

**UNIT – II**

**Theory of Production**: Production Function- Isoquants and Isocosts, MRTS, Cobb-Douglas Production function.

**Cost Analysis:** Cost concepts, Opportunity cost, Fixed Vs Variable costs, Explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break even analysis -Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEP.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the production function, Input-Output relationship and different cost concepts. **L1**
- Apply the least-cost combination of inputs. **L2**

**UNIT – III**

**Introduction to Markets:** Market structures: Types of competition, Features of Perfect Competition, Monopoly and Monopolistic Competition. Price-Output Determination under Perfect Competition, Monopoly, Monopolistic Competition.

**Pricing Policies:** Methods of Pricing-Marginal Cost Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Bundling Pricing, and Peak Load Pricing. Internet Pricing Models: Flat rate pricing, Usage sensitive pricing, Transaction based pricing, Priority pricing, charging on the basis of social cost, Precedence model, Smart market mechanism model.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply the price output relationship in different markets. **L1**
- Evaluate price-output relationship to optimize cost, revenue and profit. **L2**

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**UNIT – IV**

**Types of Industrial Organization**: Characteristic features of Industrial organization, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, State/Public Enterprises and their types.

**Capital Budgeting**: Introduction to capital, Meaning of capital budgeting, Need for capital budgeting – Capital budgeting decisions (Examples of capital budgeting) - Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR), IRR and Net Present Value Method (simple problems).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the concept of capital budgeting and its importance in business. **L1**
- Contrast and compare different investment appraisal methods. **L2**

**UNIT – V**

**Introduction to Financial Accounting:** Introduction to Double-entry system, Journal, Ledger, Trial Balance- Final Accounts (with simple adjustments) - Limitations of Financial Statements.

**Interpretation and analysis of Financial Statement:** Ratio Analysis – Liquidity ratios, Profitability ratios and solvency ratios – Preparation of changes in working capital statement and fund flow statement.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the concept, convention and significance of accounting. **L1**
- Apply the fundamental knowledge of accounting while posting the journal entries. **L2**

**Text Books:**

1. **J.V. Prabhakar Rao**: Managerial Economics and Financial Analysis, Maruthi Publications, 2011.
2. **Prof. C.Viswanatha Reddy:** 'Financial Accounting-1' Himalaya Publishing House, Newdelhi.

**Reference Books:**

1. **A R Aryasri** - Managerial Economics and Financial Analysis, TMH 2011.
2. **Suma damodaran**- Managerial Economics, **Oxford** 2011.
3. **S.A. Siddiqui & A.S. Siddiqui**, Managerial Economics and Financial Analysis, New Age International Publishers, 2011.
4. **N. Appa Rao. & P. Vijaya Kumar**: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi, 2011.

**Course Outcomes:**

At the end of this Course the student will be able to

- Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. **L1**
- Be able to perform and evaluate payback period and capitalized cost on one or more economic alternatives. **L2**
- Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives. **L3**
- Evaluate the capital budgeting techniques. **L4**
- Students can analyze how to invest their capital and maximize returns. **L5**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS14b-ENTERPRENUARSHIP AND INNOVATION MANAGEMENT**

**(Humanities Elective-I)(Common to [illegible], [illegible] & CSE)**

CE & ME

| | L | T | P | C |
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| | 3 | 0 | 0 | 3 |

**Course Objectives:**

- To enable students understand the opportunities available to start a business.
- To impart knowledge about various sources of support (Financial and Non-financial) available to start an enterprise.

**UNIT – 1: FUNDAMENTALS OF ENTREPRENEURSHIP**

Fundamentals of Entrepreneurship – Evolution and Theories of Entrepreneurship – Characteristics of Entrepreneurs –Myths of Entrepreneurship – Kakinada Experiment -Elements of leadership –Role of Entrepreneurs in Indian economy – Social and Ethical Perspectives of Entrepreneurship - Corporate entrepreneurship – Social Entrepreneur, women Entrepreneurship - Opportunities & challenges.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Define entrepreneurship and the characteristics of an entrepreneur. **L1**
- Explain the significance of entrepreneurship in the economic development of a nation. **L2**

**UNIT – II: IDEATION AND EVALUATION OF BUSINESS IDEAS**

Opportunity identification – Ideations process - Sources of business ideas – Role of creativity – Sources of Innovation - Business Idea Evaluation - Product/ Service design – Design Thinking - Customer Value Proposition (CVP) – Business models.

**Case study**: Business cases of OYO, Paytm and Flipkart/ Smartmart.

**Activity:** Idea generation in groups and CVP.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Select the right business ideas. **L1**
- Explain the business idea evaluation process **L2**

**UNIT – III: Business Organizations and Venture Establishment**

Forms of business organisations/ownership – Techno-economic feasibility assessment – Financial feasibility – Market feasibility – Preparation of Business plan – Business canvas & Leán canvas – Challenges & Pitfalls in selecting new venture.

**Activity:** Preparation of business plan (draft).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recall different forms of business organizations. **L1**
- Develop business canvas. **L2**

**UNIT – IV: Introduction to Innovation**

Creativity, Invention and innovation, Types of Innovation, Relevance of Technology for Innovation, The Indian innovations and opportunities.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to develop new ideas to discover new ways of looking problems and opportunities. **L1**
- Apply technology to innovation. **L2**



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**UNIT – V: Promoting and managing innovation**

Innovators and Imitators, Patents, Trademarks, Intellectual Property, Exploring, Executing, Leveraging and renewing innovation, Enhancing Innovation Potential & Formulating strategies for Innovation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Intellectual Property Licensing. **L1**
- Summarize the importance of IPR. **L2**

**Text Books:**

1. Robin Lowe and Sue Marriott, Enterprise: Entrepreneurship and Innovation Concepts, Contexts and Commercialization.
2. John Bessant and Joe Tidd, Innovation and Entrepreneurship.

**Reference Books:**

1. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
2. Peter F. Drucker, Innovation and Entrepreneurship.
3. EDII "Faculty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development" Institute of India, Ahmadabad, 1986.
4. Philips, Bonefiel and Sharma (2011), Social Entrepreneurship, Global vision publishing house, New Delhi.

**Course Outcomes:**

At the end of this Course the student will be able to

- Choose entrepreneurship as an alternative career. **L1**
- Distinguish between corporate and social entrepreneurs. **L2**
- Examine and build customer value proposition. **L3**
- Analyze feasibility of business ideas. **L4**
- Compare various supports schemes provided by GOI. **L5**

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME56 – THERMAL ENGINEERING LAB**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Understand the functioning and performance of I.C. Engines
- To find heat losses in various engines

**List of Experiments**

1. Demonstration of diesel and petrol engines by cut models.
2. Valve timing diagram of 4-stroke diesel engine.
3. Port timing diagram of 2-stroke petrol engine.
4. Performance of 2-stroke single cylinder petrol engine.
5. Morse test on multi cylinder petrol engine.
6. Performance of 4-stroke single cylinder diesel engine.
7. Performance of two stage reciprocating air compressor.
8. Performance of Refrigeration system.
9. Performance of Air conditioning system.
10. Assembly and disassembly of diesel and petrol engines.
11. Performance of heat pump.
12. Performance of variable compression ratio of petrol engine.
13. Demonstration of heat pipe

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain different working cycles of engine **L2**
- Describe various types of combustion chambers in IC engines **L3**
- Illustrate the working of refrigeration and air conditioning systems **L5**
- Evaluate heat balance sheet of IC engine. **L6**

Head
Mechanical Engineering Department,
JNTUA College of Engineering,
PULIVENDULA - 516 390.

**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME57 – MANUFACTURING PROCESSES - II LABORATORY**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize the construction and working of various machine tools.
- Teach selection of parameters for different machining processes.

**List of Experiments**

1. Demonstration of construction and operations of general purpose machines: Lathe, drilling machine, milling machine, shaper, slotting machine, cylindrical grinder and surface grinder.
2. Measure the characteristic features of lathe with simple step turning operation.
3. Job on step turning, taper turning, knurling, thread cutting on lathe machine.
4. Perform drilling, reaming and tapping operations.
5. Job on milling (Groove cutting/Gear cutting).
6. Job on shaper.
7. Job on slotting.
8. Job on cylindrical and surface grinding.
9. Job on grinding of tool angles.

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain the concept of machining with various machine tools. **L2**
- Get hands on experience on various machine tools and machining operations. **L6**

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**B.Tech III Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS16-ORGANIZATIONAL BEHAVIOR**

**(Common to CE & ME)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 0 |

**Course Objectives:**

- To make the student understand about the organizational behavior
- To enable them to develop self motivation, leadership and management.

**UNIT – 1:**

Organizational Behavior - Introduction to OB - Meaning and definition, scope - Organizing Process – Making organizing effective - Understanding Individual, Behavior – Attitude - Perception - Learning - Personality Types.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of Organizational Behavior. **L1**
- Evaluate personality types. **L2**

**UNIT – II:**

**Individual Behavior** – Diversity – Biographical Characteristics Ability – Implementing Diversity Management – Strategies – Attitudes & Job Satisfaction - Personality – Theories of Personality – Perception – Process of Perception – Perception & Individual Decision Making – Motivation from concepts to Applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of Organizational Behavior. **L1**
- Contrast and compare Individual Behavior and attitude. **L2**

**UNIT – III:**

**Group Behavior** – Foundations of Group Behaviour – Defining and Classifying Groups – Stages of Group Development –` Group Properties – Roles – Norms – Status, Size and Cohesiveness – Group Decision Making – Understanding Work Teams – Types of Teams – Creating Effective Teams.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the concept of Group Dynamics. **L1**
- Contrast and compare Group behavior and group development. **L2**

**UNIT – IV:**

**Leadership and Motivational Theories**: Leadership Theories – Characteristic of effective leader – Finding and Creating Effective Leaders – Power & Polities. Introduction to motivation, Maslow's Hierarchy of Needs, Two- factor theory of Motivation, Mcdregers theory of motivational Model.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Contrast and compare Traits theory and Managerial Grid. **L1**
- Know the difference between Transactional and Transformational Leadership. **L2**

**UNIT – V:**

**Foundation of Organizational Structure**: Conflicts & Negotiations – Organization Structure – Organization Change & Stress Management – Self Management – Managing Careers.

**Learning Outcomes:**



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At the end of this unit, the student will be able to

- Know the importance of organizational change and development. **L1**
- Apply change management in the organization. **L2**

**Text Books:**

1. Stephen P. Robbins, Timothy: Organizational Behaviour, Pearson 14th Edition, 2012.
2. Dr. Anjali Ghanekar, Organizational Behaviour Concepts & Cases, Everest, 19th Edition, 2013.

**Reference Books:**

1. Mirza S Saiyadain, Cases in Organizational Behavior , TMH,2011.
2. Gerard H.Seijts, Cases in Organizational Behavior, Sage,2008.
3. Nelson, Quick and Khandelwala, ORGB, 2/e, Cengage, 2012.
4. P.G. Aquinas: Organizational Behaviour Concepts, Realities, Application & Challenges, 2nd Edition, Excel Books 2012.

**Course Outcomes:**

At the end of this Course the student will be able to

- To bring about the through understanding of entrepreneurship and constraints for the growth of entrepreneurial culture. **L1**
- To demondtrate knowledge in entrepreneurship development. **L2**
- To understand the concept of entrepreneushiptaining and various entrepreneurship training institutes in India. **L3**
- To be able to demontrate progressive learning in the project report and ownership structures. **L4**
- To be able to demontrate progressive learning in the project report and ownership structures. **L5**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS12-ENGLISH LANGUAGESKILLS**

**(Common to CE & ME)**

| L | T | P | C |
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**Course Objectives:**

- Facilitate active listening to enable inferential learning through expert lectures and talks
- Provide training and opportunities to develop fluency in English through participation in formal group discussions and presentations using audio-visual aids

**UNIT – I:** **12 Hrs**

**Listening:** Listening to famous speeches for structure and style
**Speaking:** Oral presentations on general topics of interest.
**Reading:** Reading for meaning and pleasure – reading between the lines.
**Writing:** Appreciating and analyzing a poem –Paraphrasing, note-taking.
**Grammar and Vocabulary: Tenses (Advanced Level)** Correcting errors in punctuation -Word roots and affixes.
**Learning Outcomes:**
At the end of this unit, the student will be able to

- Understand the purpose of rhythm and rhyme and the use of figures of speech in making the presentation lively and attractive. **L1**
- Apply the knowledge of structure and style in a presentation, identify the audience and make note of key points. **L2**

**UNIT – II:** **12 Hrs**

**Listening:** Following the development of theme; answering questions on key concepts after listening to stories online.
**Speaking:** Narrating personal experiences and opinions.
**Reading:** Reading for summarizing and paraphrasing; recognizing the difference between facts and opinions.
**Writing:** Summarizing, precis writing, letter and note-making
**Grammar and Vocabulary:** Subject-verb agreement, noun-pronoun agreement, collocations.
**Learning Outcomes:**

- At the end of this unit, the student will be able to
- Make formal structured presentations on academic topics. **L1**
- Use correct English avoiding common errors in formal speech and writing. **L2**

**UNIT – III:** **12 Hrs**

**Listening:** Identifying views and opinions expressed by different speakers while listening to speeches.
**Speaking:** Small talks on general topics; agreeing and disagreeing, using claims and examples/ evidences for presenting views, opinions and position.
**Reading:** Identifying claims, evidences, views, opinions and stance/position.
**Writing:** Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidences.
**Grammar and Vocabulary:** The use of Active and passive Voice, vocabulary for academic texts.
**Learning Outcomes:**
At the end of this unit, the student will be able to

- Participate in group discussions using appropriate conventions and language. Strategies. **L1**
- Use appropriate vocabulary to express ideas and opinions. **L2**



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**UNIT – IV** **12 Hrs**

**Listening:** Listening to identify important moments - Understanding inferences; processing of information using specific context clues from the audio.
**Speaking:** Group discussion; reaching consensus in group work (academic context).
**Reading:** Reading for inferential comprehension.
**Writing:** Applying for internship/ job - Writing one's CV/Resume and cover letter.
**Grammar and Vocabulary: Phrasal verbs, phrasal prepositions and technical vocabulary.**

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Express thoughts and ideas with acceptable accuracy and fluency **L1**
- Draw inferences and conclusions using prior knowledge and verbal cues **L2**

**UNIT – V** **12 Hrs**

**Listening:** Understanding inferences - processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge.
**Speaking:** Formal team presentations on academic/ general topics.
**Reading:** Intensive and extensive reading.
**Writing:** Structure and contents of a Report – Abstract – Project report features.
**Grammar and Vocabulary:** Correcting common errors, improving vocabulary and avoiding cliches and jargons.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Develop advanced listening skills for in-depth understanding of academic texts. **L1**
- Collaborate with a partner to make effective presentations. **L2**

**Text Books:**

1. "Forging Ahead": A Course Book for B.Tech Students. Orient BlackSwan,2020.
2. Meenakshi Raman &Sangeeta Sharma, "Technical Communication" O U Press2009.

**Reference Books:**

1. Bailey, Stephen. "Academic writing: A handbook for international students "Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, "Speaking and Critical Thinking". Heinley ELT; 2nd Edition,2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. "Cambridge Academic English" (B2). CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD).

**Course Outcomes:**

- At the end of this Course the student will be able to
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English. **L1**
- Apply grammatical structures to formulate sentences and correct word forms **L2**
- Analyze discourse markers to speak clearly on a specific topic in informal discussions. **L3**
- Evaluate reading/listening texts and to write summaries based on global comprehension of the setexts. **L4**
- Create a coherent paragraph interpreting a figure/graph/chart/table. **L5**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME61 – AUTOMOBILE ENGINEERING**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Impart the knowledge of vehicle structure and its components.
- Demonstrate various components of petrol engines and diesel engines.
- Trains about the various electrical system, circuits, and testing of automobiles.
- Explain the concepts of steering, suspension and braking system in automobile.

**UNIT – 1: Introduction to vehicle structure and engine components** **10 Hrs**

Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify different parts of the automobile. **L3**
- Explain various parts of the engine. **L2**
- Describe the lubrication. **L2**

**UNIT – II: Ignition and fuel supply** **6 Hrs**

**Ignition and fuel supply:** Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit Injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI-

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the working principles of ignition, fuel supply and emission control systems **L2**
- Compare the types of ignition systems and fuel systems. **L2**

**UNIT – III: Steering and suspension system** **6 Hrs**

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe the steering and the suspension systems. (L2) **L2**
- Explain power steering system in automobiles.(L2) **L2**
- Identify the shock absorbers applications in automobiles. (L3) **L3**

**UNIT – IV: Wheels, Tires and Braking System:** **6 Hrs**

Wheels and Tires - Construction - Type and specification - Tire wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS).

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**Learning Outcomes:**
At the end of this unit, the student will be able to
- Understand the various types of wheels and tires. **L1**
- Classify the brakes in automobile. **L1**
- Illustrate working principle of anti-lock breaking system. **L2**

**UNIT – V: Electrical systems and advances in automobile engineering** **6 Hrs**
Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP) Traction Control System (TCS) - Global Positioning System (GPS) - Hybrid vehicle.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- Explain the working principles of various automobile electrical systems. **L2**
- Identify the various electrical components in automobile. **L3**
- Explain about ASS, ESP, EBD, TCS and GPS in automobile. **L2**
- Examine the recent developments of automobile engineering. **L4**

**Text Books:**
1. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications year.
2. William.H.Crouse, Automotive Mechanics, 10/e Edition, McGraw-Hill, (2006).
3. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, (2009).
4. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International (2004).

**Reference Books:**
1. Bosch, Automotive Hand Book, (2007), 6/e SAE Publications year.
2. K. Newton and W. Steeds, The motor vehicle, 13/e Butterworth-Heinemann Publishing Ltd. (year).
3. Joseph Heitner, Automotive Mechanics Principles and Practices, 2/e, CBS publishing 2004.

**Course Outcomes:**
At the end of this Course the student will be able to
- Identify different parts of automobile **L3**
- Explain the working of various parts like engine and brakes **L2**
- Describe the working of steering and the suspension systems **L2**
- Summarize the wheels and tires **L2**
- Outline the future developments in the automobile industry **L2**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME62 – HEAT TRANSFER**

| L | T | P | C |
|---|---|---|---|
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**Course Objectives:** The objectives of the course are to make the students learn about

- To impart the basic laws of conduction, convection and radiation heat transfer and their applications
- To familiarize the convective heat transfer concepts
- To explain basics of radiation heat transfer
- To make conversant with the heat transfer analysis related to thermal systems like heat exchangers, evaporator, and condenser.

**UNIT – 1: Introduction to heat transfer** **10 Hrs**

**Introduction**: Basic modes of heat transfer- rate equations- generalized heat conduction equation - steady state heat conduction solution for plain and composite slabs - cylinders - critical thickness of insulation- heat conduction through fins of uniform cross section- fin effectiveness and efficiency.

**Unsteady State Heat Transfer Conduction-** Transient heat conduction- lumped system analysis and use of Heisler charts.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the phenomenon related to different modes of heat transfer **L1**
- Compare different types of conduction heat transfer **L2**
- Apply concept of thermal resistance and its importance in practical problems **L3**

**UNIT – II: Convection** **10 Hrs**

**Convection:** Basic concepts of convection–heat transfer coefficients - types of convection –forced convection and free convection.

**Free Convection** -development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation

**Forced convection** in external flow–concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders. Fluid friction – heat transfer analogy, approximate solution to laminar boundary layer equation for external flow. Internal flow – Use of empirical relations for convective heat transfer in horizontal pipe flow.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply the convective heat transfer principles **L3**
- Use analogy between fluid friction and heat transfer to solve engineering problems **L3**

**UNIT – III: Radiation** **10Hrs**

Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies – shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply the principles of radiation heat transfer **L3**
- Calculate the radiation heat transfer between two bodies **L2**
- Design a radiation shield for given conditions **L3**
- Examine the effect of greenhouse gases on atmosphere **L4**



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**UNIT – IV: Heat Exchangers** **8 Hrs**

**Heat Exchangers**: Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods- fouling in heat exchangers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the working of different types of heat exchangers **L2**
- Calculate the heat transfer in heat exchangers **L2**
- Design a heat exchanger for a given application **L3**

**UNIT – V: Boiling and Condensation & Mass transfer** **8 Hrs**

**Boiling and Condensation**: Different regimes of boiling- nucleate, transition and film boiling – condensation - filmwise and dropwise condensation.

**Mass Transfer**: Conservation laws and constitutive equations - Fick's law of diffusion, isothermal equi-mass - Equimolal diffusion- - diffusion of gases and liquids- mass transfer coefficient.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- interpret the basic modes of condensation heat transfer **L2**
- identify different regimes of boiling in design of boilers **L3**
- explain the basic mechanism of mass transfer **L2**
- differentiate between mass transfer due to convection and diffusion **L4**

**Text Books:**

1. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.
2. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill,2008.
3. S. C. Arora & S. Domkundwar , A Course in Heat and Mass Transfer, Dhanpat Rai & CO.(P) LTD-Delhi , 2007.

**Reference Books:**

1. F. P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6/e, John Wiley, 2007.
2. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.
3. S.P. Sukhatme, A Textbook of Heat Transfer, Universities Press, 2005
4. Lienhard and Lienhard, A Heat and Mass Transfer, Cambridge Press, 2011.
5. C.P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer databook, New Age Publications, 2014.

**Course Outcomes:**

At the end of this Course the student will be able to

- Apply the concepts of different modes of heat transfer. **L3**
- Apply knowledge of conduction heat transfer in the design of insulation of furnaces and pipes. **L3**
- Analyze free and forced convection phenomena in external and internal flows **L4**
- Design of thermal shields using the concepts of black body and non-black body radiation **L5**
- Apply the basics of mass transfer for applications in diffusion of gases. **L3**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME63 – OPERATIONS RESEARCH**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about
To impart the basic concepts of modeling, models and statements of the operations research.

- Formulate and solve linear programming problem/situations.
- Model strategic behaviour in different economic situations.
- To solve transportation problems to minimize cost.
- Apply Queuing theory to solve problems of traffic congestion, counters in banks, railway bookings etc.
- Explain scheduling and sequencing of production runs and develop proper replacement policies.
- Learn how to manage and control inventory accuracy.

**UNIT – I: Introduction to Operations Research** **10 Hrs**

**Introduction to Operations Research (OR):** OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models

**Linear Programming(LP):** Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Formulate practical problems given in words into a mathematical model. **L6**
- Quantify OR models to solve optimization problems. **L5**
- Formulate linear programming problems and appreciate their limitations. **L6**

**UNIT – II: Transportation and Assignment Problems** **10 Hrs**

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution – North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, Degenerate Problem. Assignment Problem – Formulation, Hungarian Method for Solving Assignment Problems, Traveling Salesman problem.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Model linear programming problems like the transportation. **L3**
- Solve the problems of transportation from origins to destinations with minimum time and cost. **L6**

**UNIT – III: Game theory & Job Sequencing** **10Hrs**

**Game theory:** Optimal solution of two person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies. Reduction by principles of dominance, arithmetic, algebraic method and graphical method.

**Job Sequencing:** Introduction to Job shop Scheduling and flow shop scheduling, Solution of Job Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify strategic situations and represent them as games. **L3**
- Solve simple games using various techniques. **L6**
- Solve problems of production scheduling and develop inventory policies. **L6**

**UNIT – IV: Queuing Theory & Inventory Control** **8 Hrs**

**Queuing Theory:** Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with infinite and finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with infinite queue length.

**Inventory Control:** Introduction, Deterministic models – EOQ model with and without shortages, Production model, Buffer stock and discount inventory models with single price breaks. Selective inventory control.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Model a dynamic system as a queuing model to compute performance measures. **L3**
- Apply optimality conditions for single- and multiple-variable constrained and unconstrained nonlinear optimization problems. **L3**
- Describe the functions and costs of an inventory system. **L2**
- Determine EOQ, reorder point and safety stock for inventory systems **L2**

**UNIT – V: Replacement and Maintenance Analysis** **8 Hrs**

**Replacement and Maintenance Analysis:** Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

**Dynamic Programming (DP):** Introduction –Bellman's Principle of Optimality – Applications of Dynamic Programming – Shortest Path Problem – Capital Budgeting Problem – Solution of Linear Programming Problem by DP.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve problems using dynamic programming. **L3**
- Apply the concept of replacement model. **L3**

**Text Books:**

1. Sharma S.D., Operations Research: Theory, Methods and Applications, 15th Edition, Kedar Nath Ram Nath, 2010
2. Taha H.A., Operations Research, 9th Edition, Prentice Hall of India, New Delhi, 2010.

**Reference Books:**

1. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7th Edition, Tata McGraw Hill, 2010.
2. Sharma J.K., Operations Research: Theory and Applications, 4th Edition, Laxmi Publications, 2009.
3. Prem kumar Gupta and Hira, Operations Research, 3rd Edition, S Chand Company Ltd., New Delhi, 2003.
4. Pannerselvam R., Operations Research, 2nd Edition, Pentice Hall of India, New Delhi, 2006.
5. Sundaresan.V, and Ganapathy Subramanian.K.S, Resource Management Techniques: Operations Research, A.R Publications, 2015.

**Course Outcomes:**

At the end of this Course the student will be able to

- Develop mathematical models for practical problems. **L3**
- Apply linear programming to transportation problems. **L3**
- Solve games using various techniques. **L3**
- Solve production scheduling and develop inventory policies. **L6**
- Apply optimality conditions for constrained and unconstrained nonlinear problems **L3**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME64a – HYBRID AND ELECTRICAL VEHICLES**

*(Professional Elective-II)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To provide good foundation on hybrid and electrical vehicles.
- To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles.
- To familiarize energy storage systems for electrical and hybrid transportation.
- To design and develop basic schemes of electric vehicles and hybrid electric vehicles.

**UNIT – 1: Introduction to Hybrid and Electric Vehicles** **10 Hrs**

History of hybrid and electric vehicles, Need for hybrid and electric vehicles and their limitations. Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Specifications of hybrid and electric vehicles.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Summaries the concepts and recent trends in electrical and hybrid vehicles. **L2**
- Demonstrate the need for hybrid and electric vehicles and their limitations. **L2**
- Compare modern drive-trains with conventional drive-trains. **L2**
- Outline the specifications of hybrid and electric vehicles. **L2**

**UNIT – II: Hybrid Electric Drive-trains & Electric Drive-trains** **10 Hrs**

**Hybrid Electric Drive-trains:** Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

**Electric Drive-trains:** Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Choose a suitable drive scheme for developing an hybrid and electric vehicles depending on resources. **L1**
- Explain power flow control in hybrid drive-train topologies. **L2**
- Compare hybrid electric drive-trains and electric drive-trains. **L2**
- Analyze the fuel efficiency of hybrid and electric vehicles. **L4**

**UNIT – III: Electric Propulsion unit** **10Hrs**

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Choose a suitable drive scheme for developing a hybrid and electric vehicles depending on resources. **L3**
- Explain power flow control in hybrid drive-train topologies. **L2**
- Compare hybrid electric drive-trains and electric drive-trains. **L2**

**UNIT – IV: Energy Storage** **8 Hrs**

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain fundamental electrochemistry of battery operation and performance requirements for hev, phev, erev and full electric vehicles. **L2**
- Summarize different approaches to estimating state of charge, state of health, power and energy. **L2**
- Outline the functions performed by a battery management system. **L2**
- Select various battery testing procedures and verification of battery performances. **L3**
- Compare different energy storage devices. **L2**

**UNIT – V: Sizing the drive system** **8 Hrs**

**Sizing the drive system:** Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications,

**Design Considerations For Electric Vehicles**: Various Resistance- Transmission efficiency- Vehicle mass- Electric vehicle chassis and Body design considerations- Heating and cooling systems- Power steering- Tire choice- Wing Mirror, Aerials and Luggage racks.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate matching the electric machine and the internal combustion engine. **L2**
- Select the energy storage technology. **L3**
- Design and develop basic schemes of electric and hybrid electric vehicles. **L3**

**Text Books:**

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2/e, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach, illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

**Reference Books:**

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles, 1/e, Wiley-Blackwell, 2018.

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain the working of hybrid and electric vehicles. **L2**
- Choose a suitable drive scheme for developing a hybrid and electric vehicles depending on resources. **L3**
- Develop the electric propulsion unit and its control for application of electric vehicles. **L3**
- Choose proper energy storage systems for vehicle applications. **L3**
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles. **L3**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME64b – SIMULATION AND MODELLING OF MANUFACTURING SYSTEMS**

*(Professional Elective-II)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Explain the concept of modeling and simulation of manufacturing systems.
- Familiarize manufacturing simulation languages.
- Describe the various approaches to analyze the output data.
- Impart knowledge applications of simulation.
- Expose the students G P S S, SIMAN and SIMSCRIPT.

**UNIT – 1: System and Simulation** **10 Hrs**

System – ways to analyze the system – Model – types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages. Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1& 2 errors – Framing – strong law of large numbers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Implement various steps involved in simulation process. **L5**
- Illustrate the advantages and disadvantages of simulation process. **L2**
- List the various types of hypothesis. **L1**
- Apply simulation models to manufacturing systems. **L2**

**UNIT – II: Building of simulation model** **10 Hrs**

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Build the simulation model for manufacturing systems. **L6**
- Apply statistical procedures for developing credible model. **L2**
- Describe modeling of stochastic input elements. **L2**
- Appraise the importance of stochastic input elements. **L5**
- Illustrate the principles of valid simulation modeling. **L2**

**UNIT – III: Generation of random variates** **10Hrs**

Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – weibull – normal Bernoullie – Binomial – uniform – poisson. Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- List the various factors for selection of random variates. **L1**
- Explain how random variables can be generated. **L2**
- Compare various simulation languages used for generation of random varients. **L2**
- Select appropriate simulation software's like., GPSS, SIMAN-SIMSCRIPT etc **L3**

**UNIT – IV: Output data analysis** **8 Hrs**

Output data analysis – Types of Simulation w.r.t output data analysis – warmup period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze the output data in manufacturing system. **L4**
- Illustrate the types of simulation with respect to output data analysis. **L2**
- List the approaches for steady of output data. **L1**
- Explain Welch algorithm for analyze the output data. **L2**

**UNIT – V: Applications of Simulation** **8 Hrs**

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate the applications of simulation in manufacturing systems. **L2**
- Explain simple fixed period inventory system. **L2**
- Describe flow shop and job shop systems. **L2**
- Solve the manufacturing problems using Newboy paper method. **L3**

**Text Books:**

1. Law, A.M. & Kelton, Simulation Modelling and Analysis, McGraw Hill, 2/e, New York, 1991.
2. N. Viswanadham & Y. Narahari, Performance Modeling of Automated Manufacturing Systems, Prentice-Hall (12 March 1992).

**Reference Books:**

1. Banks J. & Carson J.S., PH, Discrete Event System Simulation, Englewood Cliffs, NJ, 1984.
2. Carrie A. Simulation of Manufacturing Systems, Wiley, NY, 1990.
3. Ross, S.M., McMillan, NY, A Course in Simulation / 1990. Simulation Modelling and SIMNET / Taha H.A / PH, Englewood Cliffs, NJ, 1987.

**Course Outcomes:**

At the end of this Course the student will be able to

- Summarizes the various approaches to modelling and simulation of manufacturing systems. **L2**
- Outline the concepts of output data analysis. **L2**
- Identify various software languages for simulation of manufacturing systems. **L3**

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## 19AME64c – DESIGN OF TRANSMISSION SYSTEMS

*(Professional Elective-II)*

| L | T | P | C |
|---|---|---|---|
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**Course Objectives:** The objectives of the course are to make the students learn about
- Explain the various elements involved in a transmission system.
- Focus on the various forces acting on the elements of a transmission system.
- Design the system based on the input and the output parameters.
- Produce working drawings of the system involving pulleys, gears, clutches and brakes.
- Demonstrate the energy considerations in the design of motion control elements.

**UNIT – 1: Flexible power transmission systems** **10 Hrs**

**Flexible power transmission systems:** Design of Belts – Flat Belts and Pulleys – V Belts and Pulleys – Design of chain drives – Wire ropes.

**Design of bearing:** Design of sliding contact bearing using Sommerfield number – Design using Mckee's equation – Selection of rolling contact bearings.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Demonstrate the importance of bearings in the transmission system. **L2**
- Design sliding contact bearing using Somerfield number **L4**
- Solve problem on design of sliding contact bearing using Mckees's equation. **L3**
- Identify the factors required for the selection rolling contact bearings **L2**
- Choose various types of flexible power transmission systems. **L3**

**UNIT – II: Spur and Helical gears** **10 Hrs**

**Spur and Helical gears:** Gear geometry – Kinematics – Forces on gear tooth – Stresses in Gear tooth – Selection of gear material based on bending stress and contact stress – Design of Spur gear – Power transmitting capacity, Parallel Helical Gears – Kinematics – Tooth proportions – Force analysis – Stresses in Helical gear – Design of helical gear – Crossed Helical gears.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Explain Kinematics of different types of gears. **L2**
- Predict various forces and stresses acting on the gear tooth. **L3**
- Select materials for a gear based on bending and contact stresses **L3**
- Analyze the power transmitting capacity of a gear. **L4**
- Design a spur gear **L5**

**UNIT – III: Bevel and Worm gears** **8Hrs**

**Bevel and Worm gears:** Straight Bevel gears – Kinematics – Force analysis – Stresses in straight bevel gear tooth – Design of bevel gear – Worm gearing – Kinematics – Forces - Friction and Efficiencies – Stresses in worm gear tooth.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Identify the differences between the helical gear and a bevel gear. **L2**
- Solve problems on the design of helical gear. **L3**
- Explain the kinematics of helical, straight bevel gears and worm gears. **L3**
- Predict the various forces acting on the worm gear tooth. **L3**
- Select of helical, bevel and worm gears in power transmission **L3**

**UNIT – IV: Design of gear boxes** **8 Hrs**

Design of Speed reducers – Design of multi speed gear boxes for machine tools – Structural and ray diagrams.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Select the speed reducers in power transmission. **L3**
- Design speed reducers. **L5**
- Design of multi speed gear boxes for various applications. **L5**
- Draw ray diagrams of gear boxes. **L2**

**UNIT – V: Elements of motion control** **8 Hrs**

Internal – Expanding Rim clutches and Brakes – External – Contracting Rim clutches and Brakes – Band type Clutches – Cone clutches and Brakes – Energy considerations – Temperature rise – Friction materials.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain on elements of motion control. **L2**
- Outline the importance of clutches and brakes in power transmission. **L2**
- Model various types of clutches and brakes. **L3**
- Solve problems on the design of clutches and brakes **L3**
- Calculate the temperature wise due to friction and select materials according. **L4**

**Text Books:**

1. Joseph Edward Shigley and Charles, R. Mischke, Mechanical Engineering Design, McGraw –Hill International Editions, 2000.
2. Machine Design- an integrated approach, (5th Edition) by Robert L. Norton, Pearson publisher, 2000

**Reference Books:**

1. Design Data, PSG College of Technology, DPV Printers, Coimbatore, 2005.
2. Malisa, Hand Book of Gear Design, Tata Mc Graw Hill, International Edition, 2000.
3. V.B. Bhandari , Design of Machine elements, Tata Mc Graw Hill, 2001.

**Course Outcomes:**

At the end of this Course the student will be able to

- Design pulleys, chain drives, rope drives and belt drives. **L5**
- Determine performance requirements in the selection of commercially available transmission drives. **L4**
- Design Brakes and Clutches **L4**
- Design various types of gear boxes. **L5**
- Select materials for various applications in the transmission elements. **L3**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME64d – SOLAR AND WIND ENERGY SYSTEMS**

*(Professional Elective-II)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize with basics of solar radiation, available solar energy and its measurement.
- Familiarize with solar collectors, construction and operation of solar collectors.
- Understand solar energy conversion systems, applications and power generation.
- Familiarize the wind energy sources assessment
- Explain basics of designing aerofoil

**UNIT – I: Solar radiation and collectors** **12 Hrs**

**Solar radiation and collectors:** Solar angles – Sun path diagrams – Radiation - extra terrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods-evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors.

**Solar thermal technologies:** Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the basic concepts of solar radiation and solar collectors **L2**
- Develop sun path diagrams **L3**
- Explain the concepts of tracking systems **L2**
- Discuss the working principles of solar thermal technologies **L6**
- Develop design and operation of solar heating and cooling systems **L3**
- Explain the principles of thermal storage systems **L2**

**UNIT – II: Solar PV fundamentals** **10 Hrs**

**Solar PV fundamentals:** Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaics.

**SPV system design and applications:** Solar cell array system analysis and performance prediction-Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the properties of a semiconductor **L2**
- Apply the principles of solar thermo photo voltaics **L3**
- Outline the applications of SPV system **L2**

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- Analyze the performance of a solar cell array system **L4**
- Utilize centralized and decentralized SPV systems **L3**

**UNIT – III: Introduction to wind energy** **10Hrs**

**Introduction**: Historical Perspectives on Wind Turbines- Indian Energy Scenario - Global Energy Scenario - Introduction to Indian Wind Industry - Wind Energy potential of India and Global Wind Installations.

**Basics of Wind Resource Assessment:** Power in the wind –Wind Characteristics - Measurement of wind using anemometers (cup anemometer, propeller anemometer, pressure plate anemometer, pressure tube anemometer, sonic anemometer and other remote wind speed sensing techniques) – Turbulence-Wind Power Density –Average wind speed calculation - Statistical models for wind data analysis (Weibull and Rayleigh distribution). Energy estimation of wind regimes – Wind Rose, Wind Monitoring Station Siting and Instrumentation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recall historical perspective of wind turbines **L1**
- Relate Indian and global energy requirements. **L1**
- Interpret power in the wind **L2**
- Classify different wind speed measuring instruments **L2**
- Apply different statistical models for wind data analysis **L3**

**UNIT – IV: Wind Energy Conversion Systems** **8 Hrs**

**Wind Energy Conversion Systems**: Types - Components of Modern Wind Turbine (HAWT and VAWT) - Fixed and Variable Speed operations - Power Control (Passive stall, Active pitch, Passive pitch and Active stall) - Electrical aspects of wind turbine, Safety of wind turbines.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Utilize different wind parameters for design of rotor **L3**
- Make use of power curve for energy estimation **L3**
- List different components of modern wind turbine **L1**
- Explain how to control the power of a wind turbine **L2**
- Name different safety measures of wind turbine **L1**

**UNIT – V: Wind Farm Design and Health (Condition) Monitoring** **8 Hrs**

**Wind Farm Design and Health (Condition) Monitoring**: Planning of wind farm, Site selection, Micro siting, Grid Integration, Power evacuation, Wind Farm Feasibility Studies, Preparation of DPR, Environmental Benefits and Impacts.

**Small Wind Turbines**: Water pumping wind mills, offshore wind energy, Wind turbine testing, future developments.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Plan the wind farm **L3**
- Analyze the feasibility of wind farm **L4**
- List the environmental benefits and impacts **L1**
- Explain about small wind turbines **L2**

**Text Books:**

1. Goswami D.Y., Kreider, J. F. and Francis., "Principles of Solar Engineering', Taylor and Francis, 2000.
2. Chetan Singh Solanki, "Solar Photovoltatics – Fundamentals, Technologies and Applications", PHI Learning Private limited, 2011.

**Reference Books:**


1. Sathyajith Mathew, Wind Energy Fundamentals, Resource Analysis and Economics, Springer Publications, (2006).
2. Sukhatme S.P.,. Nayak.J.P, 'Solar Energy – Principle of Thermal Storage and collection", Tata McGraw Hill, 2008.
3. Wei Tong, Wind Power Generation and Wind Turbine Design, WIT Press, (2010).
4. Wind Power, Revised Edition: Renewable Energy for Home, Farm, and Business, Paul Gipe, 2004, Chelsea Green Publishing.
5. R. Jha, Wind Turbine Technology, CRC Press, (2010).


**Course Outcomes:**

At the end of this Course the student will be able to

- Understand with basics of solar radiation, available solar energy and its measurement **L2**
- Illustrate the solar collectors, construction and operation of solar collectors. **L3**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

## 19AME64e – MECHANICAL BEHAVIOUR OF MATERIALS

*(Professional Elective-II)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Explain the structure of material over the effects of mechanical properties.
- Familiarize the defects inside the structure and their effects on the mechanical properties.
- Train the methods for characterization of the mechanical behavior of materials.
- Impart knowledge about strengthening mechanisms of materials.
- Teach mechanisms of failures of materials (fracture, fatigue and creep) and their relationship with the different types of stress.

**UNIT – I: Elastic and plastic behavior** **10 Hrs**

Elastic behaviour of materials – Hooke's law, plastic behavior: dislocation theory – Burger's vectors and dislocation loops, dislocations in FCC, HCP and BCC lattice, stress fields and energies of dislocations, forces on and between dislocations, slip and twinning.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the elastic behavior of engineering materials. **L2**
- Recall Hooke's law. **L1**
- Explain the dislocation theory. **L2**
- Identify the dislocations in FCC, HCP and BCC lattice. **L3**
- Determine the forces on and between dislocations. **L3**

**UNIT – II: Strengthening mechanisms** **10 Hrs**

Cold Working, Grain Size Strengthening, Solid Solution Strengthening, Martensitic Strengthening, Precipitation Strengthening, Dispersion Strengthening, Fibre Strengthening, Examples. Yield Point Phenomenon, Strain aging and Dynamic strain aging.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe various strengthening mechanisms. **L2**
- Discuss grain size strengthening and solid solution strengthening. **L6**
- Apply dispersion strengthening and fibre strengthening. **L2**
- Differentiate strain aging and dynamic strain aging. **L3**

**UNIT – III: Fracture and fracture mechanics** **10Hrs**

Types of Fracture, Basic Mechanism of Ductile and Brittle Fracture, Griffith's Theory Of Brittle Fracture, Ductile to Brittle Transition Temperature (DBTT), Factors Affecting DBTT, Determination of DBTT. Fracture Mechanics-Introduction, Modes of Fracture, Stress Intensity Factor, Strain Energy Release Rate, Fracture Toughness and Determination of $K_{IC}$.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the basic mechanism of ductile and brittle fracture. **L2**
- Identify importance of Griffith's Theory. **L3**
- Predict factors effecting on DBTT. **L6**
- Classify various modes of fracture. **L1**



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**UNIT – IV: Fatigue behaviour and testing** **8 Hrs**

Stress Cycles, S-N Curves, Effect of Mean Stress, Factors Affecting Fatigue, Structural Changes Accompanying Fatigue, Cumulative Damage, HCF / LCF, Thermo-mechanical Fatigue, Application of Fracture Mechanics to Fatigue Crack Propagation, Fatigue Testing Machines.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain fatigue behaviour and testing. **L2**
- Draw the S-N curves for different materials. **L1**
- Discuss the factors affecting fatigue. **L6**
- Apply fracture mechanics in design. **L2**

**UNIT – V: Creep behaviour and testing** **8 Hrs**

Creep Curve, Stages In Creep Curve And Explanation, Structural Changes During Creep, Creep Mechanisms, Metallurgical Factors Affecting Creep, High Temperature Alloys, Stress Rupture Testing, Creep Testing Machines.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify various stages in creep curve. **L3**
- Determine various structural changes during creep. **L4**
- Predict the metallurgical factors affecting creep. **L6**
- Demonstrate various creep testing machines. **L2**

**Text Books:**

1. Dieter, G.E., "Mechanical Metallurgy", McGraw-Hill, SI Edition, 1995.
2. Davis. H. E., Troxell G.E., Hauck.G. E. W., "The Testing Of Engineering Materials", McGraw-Hill, 1982.

**Reference Books:**

1. Wulff, The Structure and Properties of Materials, Vol. III "Mechanical Behavior of Materials", John Wiley and Sons, 1983.
2. Honey Combe R. W. K., "Plastic Deformation of Materials", Edward Arnold Publishers, 1984.
3. Suryanarayana, A. V. K., "Testing of Metallic Materials", Prentice Hall India, 1979.

**Course Outcomes:**

At the end of this Course the student will be able to

- Apply materials based on their structure and failure modes **L2**
- Characterize materials using different machines **L3**
- Summarize the various strengthening mechanisms with suitable examples **L2**
- Identify the creep in different materials and its influence in selection of materials **L3**

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**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME64f – TOTAL QUALITY MANAGEMENT**

*(Professional Elective – II)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce the students, the basic concepts of Total Quality Management.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of customer satisfaction by the application of various quality concepts.
- Understand the importance of Quality standards in Production.

**UNIT – I** **10 Hrs**

Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Define what is quality. **L2**
- Explain the principles of Quality Planning. **L2**
- Explain the techniques of quality costs. **L2**
- Interpret the concepts of Total Quality Management. **L2**
- Contrast the present quality issues with the past. **L2**

**UNIT – II: Historical Review** **8 Hrs**

Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the importance of Quality council. **L2**
- Identify the barriers of TQM Implementation. **L3**
- Discuss the benefits of TQM. **L6**
- Summarize the essential characteristics of successful quality leader. **L2**
- Outline the contributions of TQM Gurus. **L2**

**UNIT – III: TQM Principles** **10Hrs**

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the importance of customer satisfaction, Service Quality and Customer Retention. **L2**
- Apply the principles of motivation and Empowerment. **L3**
- Compare the perfection and continuous improvement. **L2**
- Measure the Process improvement using Juran Trilogy. **L5**

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**UNIT – IV: TQM Tools** **10Hrs**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Infer the benefits of benchmarking. **L2**
- List the benefits of QFD Process. **L1**
- Identify various zones in House of Quality. **L3**
- Apply Six sigma towards quality improvement. **L3**
- List the seven tools of quality. **L1**

**UNIT – V: Quality Systems** **8 Hrs**

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the importance of ISO Standards. (L2) **L2**
- Discuss the need of ISO9000 and Other Quality systems. (L6) **L6**
- Build awareness on the services of ISO9000. (L6) **L6**
- Infer the process of documentation. (L2) **L2**
- Compare ISO 9000 and ISO 14000. (L2) **L2**

**Text Books:**

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005
1. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017

**Reference Books:**

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, NewAge International, 1996
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995

**Course Outcomes:**

At the end of this Course the student will be able to

- Develop an understanding on quality Management philosophies and frameworks **L3**
- Adopt TQM methodologies for continuous improvement of quality **L6**
- Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement **L4**
- Apply benchmarking and business process reengineering to improve management processes. **L3**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS11-COMPETITIVE & SPOKEN ENGLISH**

**(Open Elective-II)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To train students to use language effectively in everyday conversations and to participate in group discussions.
- To enable them to learn and practice competitive English and ready for competitive examinations.

**UNIT – 1: Grammar**

Sentences-Construction-Types-Affirmative-Interrogative-Nouns-Pronouns-Verbs-Models-Tenses-Adverb-Adjective-Speech-Voice-Articles-Prepositions-Conjunctions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Students will improve their speaking ability in English both in terms of fluency and comprehensibility by enlarging their vocabulary. **L1**
- Students will attain and enhance competence in the four modes of literacy: listening, speaking, reading and writing **L2**

**UNIT – II: Vocabulary**

**Content of the Unit – II**

Competitive Vocabulary List-Word Building Tips- Antonyms-Synonyms-One word Substitutes-Idioms and Phrases-Phrasal Verbs-Reading Comprehension-importance- tips- Cracking unknown passage.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the factors that influence use of grammar and vocabulary in speech and writing **L1**
- Comprehend the meaning of paragraphs and unknown passages **L2**

**UNIT – III: Speaking Skills**

Dynamics of Speaking-Communication Skills -Public Speaking- Significance to Professionals- establishing credibility & Confidence- Preparation of Speech-Audience-Analysis -Topic generation Techniques.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Display competence in oral, written and visual communication **L1**
- Showan understanding of opportunities in the field of communication **L2**

**UNIT – IV: Stage Dynamics**

Organization of Speech- Platform Manners- Body language- Psychology of Persuasion- Speeches for Special Occasions-exercises-Recording and feedback sessions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze your audience and design speeches to reflect your analysis. **L1**
- Evaluate speeches based on a variety of verbal and non-verbal criteria. **L2**



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**UNIT – V:Accent Neutralization**

Realization of past tense and plural forms- Stress Rules– Intonation- Connected speech- weak forms-assimilation-elision- Linking and Intrusion-juncture-contractions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to identify which are stressed and unstressed words. **L1**
- Reproduce in speech, appropriate pattern of intonation and rhythm. **L2**

**Reference Books:**

1. Hari Mohan Prasad, ***Objective English for Competitive Examination,*** Tata McGraw Hill, New Delhi, 2014.
2. V SASIKUMAR and PV DHAMIJA ***: SPOKEN ENGLISH A Self- Learning Guide to Conversation Practice***, 2nd Edition, TATA McGRAW-HILL'S SERIES.
3. M.Sambaiah, ***Technical English***, Wiley publishers India. New Delhi. 2014.
4. JK GANGAL, A PRCACTICAL COURSE IN EFFECTIVE ENGLISHSPEAKING SKILLS, PHI LEARNING Private Ltd. New Delhi. 2012
5. KRISHNA MOHAN and N.P. SINGH,***SPEAKING ENGLISH EFFECTIVELY***, 2nd Edition, Trinity Press, 2015.
6. Wren and Martin,***High School English Grammar and Composition,*** S. Chand Publication, New Delhi, 2014.
7. Neetu Singh, ***English for General Competitions from Plinth To Paramount (Volume-I&II),***Paramount Reader Publications, 2014.
8. Dale Carnegie,***The Quick And Easy Way To Effective Speaking***, Vermilion Publications, 1990.
9. E Suresh Kumar. ***Effective Publish Speaking***, Orient Longman, 2016.

**Course Outcomes:**

At the end of this Course the student will be able to

- Becoming active participants in the learning process and acquiring proficiency in spoken English of the students. **L1**
- Speaking with clarity and confidence thereby enhancing employability skills of the students. **L2**
- Participate in critical conversations and prepare, organize and deliver in public contexts **L3**
- Improving their speaking ability in English both in terms of fluency and comprehensibility **L4**
- Equipped with competitive proficiency in English for various competitive examinations at state, national and international level. **L5**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS23-INTEGRAL TRANSFORMS AND ITS APPLICATIONS**

**(Open Elective -II)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** This course aims at providing the student

- With the concepts and several methods of integral transforms and its applications.
- The concepts of fractional calculus and its applications.

**UNIT – 1: Basic concepts of integral transforms:: Fourier transforms:** **9 Hrs**

Introduction, basic properties, applications to solutions of Ordinary Differential Equations (ODE), Partial Differential Equations (PDE) and Integral Equations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve ordinary differential equations and partial differential equations. **L3**
- Solve Integral equations. **L3**

**UNIT – II: Laplace transforms:**

Introduction, existence criteria, Convolution, differentiation, integration, inverse transform, Tauberian Theorems, Watson's Lemma, solutions to ODE, PDE including Initial Value Problems (IVP) and Boundary Value Problems (BVP).

Applications of joint Fourier-Laplace transform, definite integrals, summation of infinite series, transfer functions, impulse response function of linear systems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve initial and boundary value problems using Laplace transform technique. **L3**
- Apply the techniques of joint Fourier-Laplace transform techniques. **L4**

**UNIT – III: Hankel Transforms & Hilbert Transforms**

**Hankel Transforms:** Introduction, properties and applications to PDE Mellin transforms: Introduction, properties, applications; Generalized Mellin transforms.

**Hilbert Transforms:** Introduction, definition, basic properties, Hilbert transforms in complex plane, applications; asymptotic expansions of 1-sided Hilbert transforms.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve PDE by using the concepts of Hankel transforms. **L4**
- Learn the concepts of Hilbert transforms. **L3**

**UNIT – IV: Stieltjes Transform, Legendre transforms and Radon transforms**

**Stieltjes Transform:**

Definition, properties, applications, inversion theorems, properties of generalized Stieltjestrans form.

**Legendre transforms:**

Introduction, definition, properties, applications.

**Radon transforms:**

Introduction, properties, derivatives, convolution theorem, applications, inverse radon transform.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyzes the Stieltje's and Legender's transforms. **L4**
- Analyzes random transforms and focuses on thier applications. **L3**

**UNIT – V: Fractional Calculus and its applications & Integral transforms in fractional equations**

**Fractional Calculus and its applications:** Introduction, fractional derivatives, integrals, Laplace transform of fractional integrals and derivatives.

**Integral transforms in fractional equations:** fractional ODE, integral equations, IVP for fractional Differential Equations (DE), fractional PDE, green's function for fractional DE.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the basic concepts of fractional calculus. **L2**
- Applies the concepts of integral transforms in fractional calculus. **L4**

**Text Books:**

1. Advanced Topics in Applied Mathematics for Engg. & physical Science: Sudhakar Nair
2. Introduction to Applied Mathematics, Gilbert Strang

**Reference Books:**

1. Fractional Calculus Theory and Applications of Differentiation and Integration to Arbitrary Order: J. Spanier and K. B. Oldham
2. Handbook of Mathematical Functions: M. Abramowitz & I. Stegun

**Course Outcomes:**

At the end of this Course the student will be able to

- Use the basic concepts of integral transforms, Stieltjes Transform, Legendre transforms and Radon transforms etc., in real life problems. **L1**
- Use the concepts of Laplace transforms in solving the initial value and boundary value problems. **L2**
- Applies the concepts of Hankel Transforms & Hilbert Transforms while addressing the various problems related to engineering sciences. **L3**
- Analyze the problems in engineering and technology using various techniques of integral transforms and applications. **L4**
- Uses the ideas of fractional calculus and its applications in solve the real world problems. **L5**

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**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS24-NUMERICAL ANALYSIS**

**(Open Elective –II)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** This course aims at providing the student

- With the concepts and several methods of Numerical methods.
- To explore the solutions of ordinary differential equations, partial differential equations and integral equations.

**UNIT – 1: Solution of Algebraic and Transcendental equations & Solution to System of Nonlinear Equations and Spline Functions** **9 Hrs**

**Solution of Algebraic and Transcendental equations:**

Ramanujan's method – Secant method – Muller's method – Graeffe's root-squaring method – Lin-Bairstow's method – Quotient-Difference method

**Solution to System of Nonlinear Equations and Spline Functions:**

Method of Iteration- Newton-Raphson method. Linear splines - Quadratic splines – Cubic splines : Minimizing property of Cubic splines – Error in the Cubic Spline ad its derivatives – Surface fitting by cubic splines. – Cubic B-Splines: Representation of B- Splines – Least squares solution – Applications of B-Splines.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve the algebraic and transcendental equations **L2**
- Solve the system of nonlinear equations and spline functions. **L4**

**UNIT – II: Numerical Linear Algebra:**

Triangular matrices – LU decomposition of a matrix – vector and matrix norms. – Solutions of linear systems – Direct methods: Gauss elimination – necessary for pivoting – Gauss-Jordan method – modification of the Gauss method to compute the inverse – number of arithmetic operations – LU decomposition method – computational procedure for LU decomposition method – Lu decomposition from Gauss elimination – solution of tridiagonal systems – III conditioned linear systems – Method for III- conditioned systems. – Solution of linear systems –Iterative methods. – Matrix Eigen value problems – Eigen values of a symmetric tridiagonal matrix – Householder's method – QR method.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of numerical linear algebra. **L1**
- Apply the concepts of numerical linear algebra. **L3**

**UNIT – III: Numerical solution of ordinary differential equations:**

Solution by Taylor's series, Picard's method,Euluer's method , Runge-Kutta methods, Predictor-Corrector methods: Adams-Moulton method – Milne's method. – Cubic Spline method – Simultaneous and higher order equations. – Boundary value problems: Finite difference method – Cubic Spline method – Galerkin's method.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve first order initial value problems. **L3**
- Solve ssimultaneous and higher order equations and boundary value problems. **L4**

**UNIT – IV: Numerical solution of Partial differential equations:**

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve Laplace's equation using finite difference technique. **L3**
- Solve Heat equation and wave equation. **L4**

**UNIT – V: Numerical solution of Integral equations:**

Numerical methods for Fredholm equations: Method of degenerate Kernels – method of successive approximations – Quadrature methods – use of Chebyshev series – cubic Spline method – singular Kernels – method of invariant imbedding.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply numerical methods for solving Fredholm equations. **L3**
- Analyzes cubic Spline method, singular Kernels – method of invariant imbedding etc. **L4**

**Text Books:**

1. S. S. Sastry, Introductory Methods of Numerical Analysis( Fifth Edition 2012), PHI Learning Private Limited, New Delhi.

**Reference Books:**

1. M.K.Jain,S.R.K.Iyengar, R.K.Jain, Numerical Methods for Scientific and Engineering Computation (sixth edition),Nee Age International(P) Limited, Publishers, New Delhi.
2. K.E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.S.D. Conte and C. De Boor, Elementary Numerical Analysis 302226 An Algorithmic Approach, McGraw-Hill, 1981.
3. K. Eriksson, D. Estep, P. Hansbo and C. Johnson, Computational Differential Equations, Cambridge Univ. Press, Cambridge, 1996.
4. G.H. Golub and J.M. Ortega, Scientific Computing and Differential Equations: An Introduction to Numerical Methods, Academic Press, 1992.
5. J. Stoer and R. Bulirsch, Introduction to Numerical Analysis, 2nd ed., Texts in Applied Mathematics, Vol. 12, Springer Verlag, New York, 1993.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the need of numerical methods in solving engineering problems of various fields. **L1**
- Learn various numerical techniques to solve initial and boundary value problems. **L2**
- Apply various methods in solving initial and boundary value problems **L3**
- Emphasizes the numerical solutions of Integral equations. **L4**
- Analyze the problems in engineering and technology using various techniques of Numerical methods. **L5**

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**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

## 19ABS25-OPTIMIZATION TECHNIQUES

**(Open Elective -II)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Course Objectives:** This course aims at providing the student

- With the basic concepts and several methods of optimization.
- With the concepts of geometric programming & constrained minimization problems.

**UNIT – 1: Linear programming I : Simplex Method** **9 Hrs**

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve the problems related to linear programming. **L3**
- Lear the simplex method and two phase simplex method. **L3**

**UNIT – II: Linear programming II : Duality in Linear Programming**

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the dual relations and duality theorem **L2**
- Solve transportation problem and assignment problem. **L4**

**UNIT – III: Non-linear programming: Unconstrained optimization techniques & Direct Search Methods**

**Non-linear programming: Unconstrained optimization techniques:** Introduction: Classification of Unconstrained minimization methods

**Direct Search Methods:** Random Search Methods: Random jumping Method, Random Walk method. Grid Search Method.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify Unconstrained minimization methods and direct search methods. **L2**
- Apply the unconstrained minimization methods and direct search methods **L3**

**UNIT – IV: Non-linear programming: Constrained optimization techniques**

Introduction , Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the Constrained optimization techniques. **L2**
- Solve nonlinear programming problems. **L3**

**UNIT – V: Geometric Programming & Constrained minimization Problems**

**Geometric Programming:**

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

**Constrained minimization Problems** :

Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve unconstrained geometric programming using differential calculus and arithmetic-geometric inequality. **L3**
- Solve Solution of a constrained geometric programming problem, primal-dual programming. **L4**

**Text Books:**

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.

**Reference Books:**

1. Chong, E.K.P.and Zak, S. H.. An Introduction to Optimization, John Wiley & Sons, N.Y.
2. Peressimi A.L., Sullivan F.E., Vhl, J.J..Mathematics of Non-linear Programming, Springer – Verlag.

**Course Outcomes:**

At the end of this Course the student will be able to

- Remembers the concepts of linear programming problems. **L1**
- Understand various techniques of linear programming problems. **L2**
- Solve constrained and unconstrained linear programming problems. **L3**
- Analyzes geometric programming using differential calculus and arithmetic-geometric inequality. **L4**
- Analyze optimization problems that occur in real world in engineering and technology using various elegant optimization techniques. **L5**

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*Department of Physics* R19

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA**

**19ABS33-FUNCTIONAL NANOMATERIALS FOR ENGINEERS**

**(Open Elective-II)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To learn and understand the fundamental concepts of functional/smart nanomaterials.
- To understand the classification and important applications of functional materials
- To learn and understand the materials utilized for energy applications
- To learn and understand the principle and applications of nanosensors
- To understand the concept of self-assembling molecular layers and its applications

**UNIT – I: INTRODUCTION TO FUNCTIONAL /SMART NANOMATERIALS 9 Hrs**

Introduction: Nanomaterials and their importance (in brief), Functional/ Smart Nanomaterials, – (Hydrogels, polymer brushes, Carbon nanotubes, Cellulose),Functionalization techniques, Properties of Smart materials (Sensing materials, Actuation materials, Control devices, Self-detection, self-diagnostics, Self-corrective, self-controlled, self-healing, Shock Absorbers, Damage arrest)- components of smart systems (Sensor :- Data Acquisition, Data Transmission; Command and control unit, Actuator:- Data Instructions, Action Devices)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic properties and fictionalization of smart nanomaterials **L1**
- Explain the need of functional/smart nanomaterials for advanced technology **L2**
- Identify engineering applications of sensors **L3**
- Analyze the sensing, control and detection mechanism in smart nanomaterials **L4**
- Illustrate the components of smart systems **L2**

**UNIT – II: CLASSIFICATION AND APPLICATIONS 9 Hrs**

Classification of smart materials (piezoelectric, electrostrictive, Magnetostrictive, Thermoresponsive, Electrochromic and Smart gels), Shape Memory Alloys and their working principle, Quantum Tunneling Composites and their working principle, Applications of smart materials in Aircrafts, Medicine, Robotics, Smart fabrics, Sporting goods and smart glass, Merits and demerits of smart materials.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify smart materials based on electrical, magnetic and thermal characteristics **L1**
- Understand the basic concepts and working principle of memory alloys **L2**
- Identifies the Engineering applications of smart materials **L2**
- Apply the concepts to Aircrafts, Medicine and Robotic fields **L3**
- Explain the working principle of Quantum Tunneling Composites **L2**
- Identify the Merits and demerits of smart materials in engineering field **L2**

**UNIT – III: NANOSENSORS**

Introduction, Sensor definition, Working principle of nanosensors, Types of nanosensors (Physical nanosensors – Pressure, Force, Mass, Displacement, Optical nanosensors – Proximity, Ambient light, Chemical nanosensors- Chemical composition, Molecular concentration). Applications of nanosensors (Medicine, Aerospace, Communication, Structural Engineering).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the working principle and concept of nanosensors **L1**
- Classify the nanosensors based on their working principle and application **L2**

- Summarize various types of nanosensors L2
- Explain the applications of nanosensors in various fields L2
- Apply the concept of nanosensors in Medicine, Aerospace, Communication, Structural Engineering fields L3

**UNIT – IV: SELF-ASSEMBLING MOLECULAR LAYERS** **9Hrs**

Introduction, principles of self-assembly, monolayers, Characteristics of Self assembled monolayers (SAMs), Molecular SAMs, Types of SAMs, Factors influencing Monolayer order, methods of preparation (Langmuir- Boldgett film : Mechanism, Experimental arrangement, Assembly, Advantages and disadvantages of LB films) patterning of SAMs (Locally attract, Locally remove, Modify tail group). Applications (Self-cleaning and moisture repellent).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concept of self-assembling L1
- Understand the significance of molecular layers L2
- Explain the concept of Langmuir- Boldgett film preparation L2
- Explain the important factors influencing Monolayer order L2
- Classify the materials based on patterning of SAMs L2
- Apply the concept of Self-cleaning and moisture repellent L3

**UNIT – V: NANOMATERIALS FOR ENERGY APPLICATIONS**

Introduction, **Solar Cells** (Silicon Solar Cells, Thin film Solar Cells, Organic Solar Cells - Dye Sensitized Solar Cells, Polymer solar cells) Working Principle, Efficiency estimation and advantages, **Hydrogen Fuel Cells** – Working Principle, Structure, Assembly of fuel cell, **Water splitting** – $H_2$ Production, Photocatalytic process.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concept of solar cell L1
- Classify the solar cells based on manufacturing material L2
- Explain the construction and working principle of solar cell L2
- Interpret the efficiency and advantages in various solar cells L2
- Explain the construction and working principle of hydrogen cells L2
- Identify applications of water splitting for $H_2$ production L2
- Explain the photocatalytic process L2

**Text Books:**

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2012
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

**Reference Books:**

1. Gauenzi,P.,Smart Structures, Wiley, 2009.
2. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014.

**Course Outcomes:**

At the end of this Course the student will be able to

- Identify the various functional/smart nanomaterials materials L1
- Classify the smart nanomaterials based their applications and properties L2
- Apply the various functional nanomaterials in various applications L3

*Department of Physics* *R19*

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::PULIVENDULA**

**19ABS34-MATERIALS CHARACTERIZATION TECHNIQUES**

**(Open Elective-II)**

| L | T | P | C |
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| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To learn and understand an exposure to evaluation of special characteristics of materials.
- To understand the principle and important applications of characterization techniques
- To learn and understand the materials structural characteristics
- To learn and understand the materials Mechanical & Thermal characteristics

**UNIT – I: STRUCTURE ANALYSIS BY POWDER X-RAY DIFFRACTION** **9 Hrs**

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams –factors affecting Diffraction Intensities - structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherrer and WH Methods, Small angle X-ray scattering (SAXS) (in brief).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the diffraction phenomenon in crystals **L1**
- Identify the factors affecting diffraction pattern intensities **L2**
- Explain the polycrystalline nature of the material **L3**
- Analyze the crystal structure and crystallite size by various methods **L4**
- Illustrate the Small angle X-ray scattering (SAXS) **L2**

**UNIT – II: MICROSCOPY TECHNIQUE -1 –SCANNING ELECTRON MICROSCOPY(SEM) 9 Hrs**

Introduction, Principle, Construction and working principle of Scanning Electron Microscope, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the basic concepts and working principle of Scanning Electron Microscope **L1**
- Classify the different types of Scanning Electron Microscope modes used **L2**
- Identifies the specimen preparation for Scanning Electron Microscope **L2**
- Analyze the morphology of the sample by using Scanning Electron Microscope **L4**
- Understand the advantages and limitations of Scanning Electron Microscope **L2**

**UNIT – III: MICROSCOPY TECHNIQUE -2 - TRANSMISSION ELECTRON MICROSCOPY (TEM)** **9Hrs**

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantages and Limitations of Transmission Electron Microscopy.

**Learning Outcomes:**

- Explain the basic principle and working principle of Transmission Electron Microscope
- Classify the different types of Transmission Electron Microscope modes used **L1**
- Identifies the specimen preparation for Transmission Electron Microscope **L2**
- Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope **L2**
- Understand the advantages and limitations of Transmission Electron Microscope **L2**
- Explain the basic principle and working principle of Transmission Electron Microscope **L3**

**UNIT – IV:SPECTROSCOPY TECHNIQUES** **9Hrs**

Principle, Experimental arrangement, Analysis and Advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the principle and experimental arrangement of spectrometers **L1**
- Understand the analysis and advantages of the spectroscopic techniques **L2**
- Explain the concept of UV-Visible spectroscopy **L2**
- Explain the principle and experimental arrangement of Raman Spectroscopy **L2**
- Explain the principle and experimental arrangement of Fourier Transform infrared (FTIR) spectroscopy **L2**
- Explain the principle and experimental arrangement of X-ray photoelectron spectroscopy (XPS) **L2**

**UNIT – V: ELECTRICAL & MAGNETIC CHARACTERIZATION TECHNIQUES**

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID (Superconducting Quantum Interference Device)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the various types of electrical properties analysis techniques **L1**
- Classify the solar cells based on manufacturing material **L2**
- Explain the effect of magnetic field on the electrical properties **L2**
- Analyze the magnetization by using induction method **L2**
- Explain the construction and working principle of VSM **L2**
- Explain the construction and working principle of SQUID **L2**

**Text Books:**

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008.

**Reference Books:**

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall ,2001 – Science.

**Course Outcomes:**

At the end of this Course the student will be able to

- Identify the various characterization techniques **L1**
- Classify the characterization techniques based on their applications and properties **L2**
- Apply the various characterization techniques for materials characterization. **L3**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS44-Green Chemistry and Catalysis for sustainable Environment**

**(Open Elective-II)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products

Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

**UNIT – 1: Principles and concepts of green chemistry** **9 Hrs**

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic reactions: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply the Green chemistry Principles for day to day life as well as synthesis L3
- Describe the sustainable development and green chemistry L2
- Explain economic and un-economic reactions L2
- Demonstrate Polymer recycling L2

**UNIT – II: : Catalysis and green chemistry** **10Hrs**

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal ion Catalysis, Organo-catalysis, Greener Lewis Acids, Asymmetric Catalysis, Phase transfer catalysis: Hazard Reduction, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries L2
- Differentiate Homogeneous and Heterogeneous catalysis L2
- Identify the importance of Bio and Photo Catalysis L3
- Discuss Transition metal and Phase transfer Catalysis L3

**UNIT – III: Organic solvents: environmentally benign solutions** **7 Hrs**

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbon dioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalysts and solvents

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Demonstrate Organic solvents and importance of solvent free systems L3
- Discuss Super critical carbondioxide L2
- Explain Super critical water and water as a reaction solvent L2
- Interpret Ionic Liquids as Catalyst and Solvent L2

**UNIT – IV: Emerging greener technologies and alternative energy sources** **8 Hrs**

Biomass as renewable resource, solar power, other forms of renewable energy, introduction and applications of Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources. The Syngas Economy, The Bio-refinery, Design for energy efficiency: Photochemical Reactions and Examples, advantages and Challenges.

Microwave-assisted Reactions-examples and applications, sono-chemical reactions- examples and applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe importance of Biomass and Solar Power L2
- Illustrate Sonochemistry and Green Chemistry L2
- Apply Green Chemistry for Sustainable Development L3
- Discuss the importance of Renewable resources L3

**UNIT – V: Green processes for green nanoscience** **8 Hrs**

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing nanoscience. Green Synthesis of nanophase inorganic materials and metal oxide nanoparticles: microwave-assisted synthesis, green synthesis of metal and metal oxide nanoparticles, green chemistry applications of inorganic nanomaterials

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Discuss green Chemistry Principles for practicing Green nano synthesis L3
- Illustrate Microwave Assisted Synthesis L2
- Differentiate Hydrothermal and Reflux synthesis L2
- Demonstrate Green Chemistry applications of Inorganic nanomaterials L2

**Text Books:**

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA, 1997.

**Reference Books:**

1. Sanjay K. Sharma and AckmezMudhoo, Green Chemistry for Environmental Sustainability, First Edition, , CRC Press, 2010.
2. AlvisePerosa and Maurizio Selva, Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013

**Course Outcomes:**

At the end of this Course the student will be able to

- Apply the Green chemistry Principles for day to day life as well as synthesis for sustainable development. L3
- Differentiate Homogeneous and Heterogeneous catalysis L2
- Demonstrate Organic solvents and importance of solvent free systems L2
- Describe importance of Biomass and Solar Power for green environment. L2
- Discuss green Chemistry Principles for practicing Green nano synthesis using Microwave Assisted technique. L3

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS45-Chemistry of Nanomaterials and applications**

**(Open Elective-II)**

| L | T | P | C |
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**Course Objectives:**

- To understand synthetic principles of Nanomaterials by various methods
- And also characterize the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

**UNIT – 1: Introduction to nanoscience** **8 Hrs**

Introduction, importance of nanomaterials, nanoscience in nature, classification of nanostructured materials, properties, scope of nanoscience and nanotechnology& applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify the nanostructure materials L2
- Describe scope of nanoscience and technology L2
- Explain different synthetic methods of nanomaterials L2
- Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material L3

**UNIT – II: : Synthesis of nanomaterials** **10 Hrs**

Bottom-Up approach:- Sol-gel synthesis, micro emulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis.

Top-Down approach:- Arc discharge Plasma arc method, aerosol synthesis, ion sputtering, laser pyrolysis, laser ablation, chemical vapour deposition method, electro deposition method, and high energy ball milling.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe the top down approach L2
- Explain aerosol synthesis and plasma arc technique L2
- Differentiate chemical vapour deposition method and electrodeposition method L2
- Discuss about high energy ball milling L3

**UNIT – III: Characterization nanomaterials** **7 Hrs**

Techniques for characterization: Dynamic light scattering for particle size determination, Diffraction technique, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Discuss different technique for characterization of nanomaterial L3
- Explain electron microscopy techniques for characterization of nanomaterial L3
- Describe BET method for surface area analysis L2
- Apply different spectroscopic techniques for characterization L3

**UNIT – IV: Structural studies of nanomaterials** **8 Hrs**

Properties of nanomaterials: fullerenes, carbon nanotubes, core-shell nanoparticles. Nano-crystalline materials, magnetic nanoparticles and important properties in relation to nano-magnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain synthesis and properties and applications of nanaomaterials **L2**
- Discuss about fullerenes and carbon nanotubes **L3**
- Differentiate nanomagnetic materials and thermoelectric materials **L2**
- Describe liquid crystals **L2**

**UNIT – V: Applications of Nanomaterials** **7 Hrs**

Engineering, medicine, aerospace applications of nanomaterials

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate applications of nanaomaterials **L2**
- Discuss the magnetic applications of nanomaterials **L3**
- List the applications of non-linear optical materials **L1**
- Describe the applications fullerenes, carbon nanotubes **L2**

**Text Books:**

1. NANO: The Essentials: T Pradeep, MaGraw-Hill, 2007
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012

**Reference Books:**

1. Ludovico Cademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Concepts of Nanochemistry; Wiley-VCH, 2011.
2. Guozhong Cao, Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Imperial College Press, 2007
3. C. N. R. Rao, Achim Muller, K.Cheetham, Nanomaterials Chemistry, , Wiley-VCH, 2007

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the state of art synthesis of nano materials **L1**
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry. **L2**
- Analyze nanoscale structure in metals, polymers and ceramics **L3**
- Analyze structure-property relationship in coarser scale structures **L3**
- Understand structures of carbon nano tubes **L1**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ABS46-Environmental Management and Audit**

**(Open Elective-II)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

- To make the student understand evolution of LCA, stages in product LCA, procedure and applications for LCA.
- To understand the EMS core elements, benefits, certification, ISO 14000 series, evolution, principles, structure.
- To impart knowledge on environmental monitoring, modelling, technology assessment, risk assessment.
- Understand necessity of environmental design, principles, benefits, strategies.
- To understand types of audit, general audit methodology, audit process and apply the various domestic, industrial activities.

**UNIT – 1: Life Cycle Assessment (LCA): 8 Hrs**

Evolution, stages, a code of good conduct for LCA, procedure for LCA-goal and scope, analyzing the inventory, assessing the environmental impact, evaluating environmental profiles, applications in government & private Sector

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate code of good conduct for LCA **L2**
- Discuss scope, analyzing the inventory and assessing the environmental impact **L3**
- List evolution and stages of LCA **L1**
- Describe the applications in government & private Sector **L2**

**UNIT – II: Environmental Management System Standards: 8 Hrs**

Environmental Management Systems – Core Elements, benefits, certification and documentation, EMS Standards – ISO 14000 series – evolution, principles, structure, supporting systems, specification standards, implementation and benefits of Implementing

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain Environmental Management Systems **L3**
- Describe EMS Standards – ISO 14000 series **L2**
- Apply Environmental Management Systems for certification and documentation **L3**

**UNIT – III: Environmental Monitoring, Modeling& Risk Assessment 8 Hrs**

Forecasting & Growth modeling, sensitivity Analysis, Applications of remote sensing and GIS, Environmental technology Assessment. Environmental risk assessment in industry, ecosystem approach to risk assessment, Eco-Mapping, Environmental Education

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate Applications of remote sensing and GIS in Environmental assessment **L2**
- Discuss environmental risk assessment in industry **L3**
- List ecosystem approach to risk assessment, Eco-Mapping, Environmental Education **L1**

**UNIT – IV: Environmental Design & Economics** **10 Hrs**

Principles, Benefits, Motivation, ED for manufactured products- Considerations in product life stages, Tools for products, Eco-labelling, ED for Building – Principles and Strategies for green building construction, ED for development and planning.

Economics and Environment -environmental cost, benefits, taxes, accounting, environmental Valuation – categorization and valuation techniques.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe principles, benefits and motivation of environmental Design for manufactured products **L2**
- Explain principles and Strategies for green building construction **L2**
- Differentiate ED for Building cost, benefits and taxes **L2**
- Discuss about categorization and valuation techniques w.r.t economics and environment **L3**

**UNIT – V: Environmental Auditing** **8 Hrs**

Objectives, Scope, types, Basic structure and steps of EA, Elements of Audit process – What, Who, Why, How, Waste audits, EA in industrial projects, Liability audit and site assessment.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate Basic structure and steps of environmental auditing **L2**
- Discuss environmental auditing in industrial projects in terms of liability audit and site assessment **L3**
- List Scope and types environmental auditing **L1**

**Text Books:**

1. Environmental Management, Vijay Kulkarni & T. V. Ramachandra, Capital Publishing Company, New Delhi, 2006.
2. Concepts of Environmental Management for Sustainable Development, M.C. Dash, Wiley Publications, 2019.

**Reference Books:**

1. Ajith Sankar, Environmental Management, OXFORD publications, 2015
2. Ni Bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, Tata McGraw-Hill Publications, 2006.
3. Gary Skinner, Ken Crafer, Environmental Management, , Cambridge, IGCSE, 2017

**Course Outcomes:**

At the end of this Course the student will be able to

- Classify the stages in LCA with goal and procedures **L2**
- Describe the structure of EMS, Explain benefits of EMS, Differentiate core elements of EMS, Discuss about certification of ISO 14000 series. **L2**
- Discuss Forecasting & Growth modeling and Ecosystem Approach to Risk Assessment and Environmental Education. **L3**
- Explain Principles and Strategies for green building construction. **L2**
- Illustrate Objectives, Scope of Environmental auditing, elements of Audit process, liability audit and site assessment. **L2**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE65a-REMOTE SENSING AND GIS**

**(Open Elective-II)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce the basic principles of Remote Sensing and GIS techniques.
- Teach various types of satellite sensors and platforms
- Impart concepts of visual and digital image analyses
- Teach concepts of principles of spatial analysis
- Teach about the application of RS and GIS in Civil engineering

**UNIT – I:**

**Introduction to photogrammetry**: Principles & types of aerial photograph, geometry of vertical acrial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducially points, parallax measurement using fiducially line.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand concepts of photogrammetry
- Estimate heights and distances.

**UNIT – II:**

**Remote sensing**: Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand advantages of remote sensing
- Demonstrate concepts of remote sensing.

**UNIT – III:**

**Geographic information system**: Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS. Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand concepts of GIS.
- Explain data collection and data interpretation
- Develop terrain characteristics using Mapping

**UNIT – IV:**

GIS spatial analysis: Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know applications of GIS and data interpretation.

**UNIT – V:**

Water resources applications: Land use/Land cover in water resources, Surface water mapping and inventory -Watershed management for sustainable development and Watershed characteristics - Reservoir sedimentation, Fluvial Geomorphology - Ground Water Targeting, Identification of sites for artificial Recharge structures - Inland water quality survey and management, water depth estimation and bathymetry.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know applications of RS & GIS in water resources applications.
- Study technological problems like reservoir sedimentation ground water identification

**Text Books:**

1. Remote Sensing and GIS by B.Bhatta, Oxford University Press,NewDelhi
2. Advanced surveying : Total station GIS and remote sensing – Satheesh Gopi – Pearson publication.

**Reference Books:**

1. Fundamentals of remote sensing by gorge Joseph , Universities press, Hyderabad.
2. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng, Prentice Hall(India) Publications
3. Basics of Remote sensing & GIS by S.Kumar, Laxmi Publications
4. Remote sensing and GIS by M.Anjireddy , B.S.Pubiliications, NewDelhi
5. Remote Sensing and its applications by LRA Narayana University Press1999
6. GIS by Kang – tsungchang, TMH Publications &Co
7. Principals of Geo physical Information Systems – Peter A Burragh and Rachael Mc Donnell Oxford Publishers2004

**Course Outcomes:**

At the end of this Course the student will be able to

- Comparing with ground, air and satellite based sensor platforms.
- Interpret the aerial photographs and satellite imageries.
- Create and input spatial data for GIS application.
- Apply RS and GIS concepts in water resources engineering.
- Applications of various satellite data.

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE65b-ENVIRONMENTAL IMPACT ASSESTMENT & MANAGEMENT**

**(Open Elective-II)**

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**Course Objectives:** The objectives of the course are to make the students learn about

- To impart knowledge on different concepts of Environmental Impact Assessment
- To teach procedures of risk assessment
- To teach the EIA methodologies and the criterion for selection of EIA methods
- To teach the procedures for environmental clearances and audit

**UNIT – I:**

**INTRODUCTION:** Basic concept of EIA : Initial environmental Examination, Elements Of EIA, -factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the elements of EIA

**UNIT – II:**

**EIA METHODOLOGIES:-**

E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the criteria for selection of EIA methodology

**UNIT – III:**

**IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE:-**

Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Study the factors causing impact of development activities
- Decide mitigation measures of pollution on environment

**UNIT – IV:**

**ASSEMENT OF IMPACT ON VEGETATION AND WILDLIFE :**

Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

**ENVIRONEMNTAL AUDIT :**

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand effect of development activities on environment.
- Know the design procedures for assessment of environmental risk

- Learn about the process of environmental auditing.
- Understand procedures for preparation of environmental audit report

**UNIT – V:**

**ENVIRONEMENTAL ACTS (PROTECTION AND PREVENTION)**

Post Audit activities, The Environmental protection Act, The water preventation Act, The Air (Prevention & Control of pollution Act.), and Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the importance of environmental protection acts
- Explain acts and notifications in Environmental legislation

**Text Books:**

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B.S. Publication, Sultan Bazar, Hyderabad.
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers

**Reference Books:**

1. Environmental Science and Engineering, by Suresh K. Dhaneja – S.K.,Katari& Sons Publication., NewDelhi
2. Environmental Pollution and Control, by Dr H.S. Bhatia – Galgotia Publication (P) Ltd, Delhi

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the concept of Environmental impact
- Understand the methodologies related to EIA
- Appreciate various laws related to environmental protection
- Prepare the environmental impact assessment statement and to evaluate it.

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE65c-DISASTER MANAGEMENT AND MITIGATION**

**(Open Elective-II)**

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**Course Objectives:** The objectives of the course are to make the students learn about

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ
- Understand the 'relief system' and the 'disaster victim.'
- Describe the three planning strategies useful in mitigation.
- Identify the regulatory controls used in hazard management.
- Describe public awareness and economic incentive possibilities.
- Understand the tools of post-disaster management

**UNIT – I:**

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about the natural hazards and its management
- To understand about the global warming, cyclones and tsunamis

**UNIT – II:**

Classification of hazards & Disasters: Natural hazards and Disasters - Man Made hazards & Disasters - Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Differentiate different types of hazards
- Understand different consequences of hazards

**UNIT – III:**

Endogenous Hazards - Volcanic Eruption – Earthquakes – Landslides - Volcanic Hazards/ Disasters - Causes and distribution of Volcanoes - Hazardous effects of volcanic eruptions - Environmental impacts of volcanic eruptions - Earthquake Hazards/ disasters - Causes of Earthquakes - Distribution of earthquakes - Hazardous effects of - earthquakes - Earthquake Hazards in India - - Human adjustment, perception & mitigation of earthquake

**Learning Outcomes:**

At the end of this unit, the student will be able to

- understand about earthquakes and volacanicerruptions
- Understand effects of earthquakes and mitigation measures

**UNIT – IV:**

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters

Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves.Floods:- Causes of floods- Flood hazards India- Flood control measures ( Human adjustment, perception & mitigation).Droughts:- Impacts ofdroughts- Drought hazards in India- Drought control measures- Extra Palnetary Hazards/ Disasters- Man induced Hazards /Disasters- Physical hazards/ Disasters

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Obtain knowledge on exogenous hazards and causes
- Obtain knowledge on mitigation measures of cyclones, droughts etc.,

**UNIT – V:**

Soil Erosion:-- Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion.Chemical hazards/ disasters:-- Release of toxic chemicals, nuclear explosion- Sedimentation processes.Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation-Biological hazards/ disasters:- Population Explosion.

Emerging approaches in Disaster Management- Three Stages

1. Pre- disaster stage(preparedness)-HVRA Atlas
2. Emergency Stage
3. Post Disaster stage-Rehabilitation

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Knowledge on soil erosion and its effects
- education related to risk reduction in communities in post and pre stage

**Text Books:**

1. Disaster Management by Rajib Shah, Universities Press, India,2003
2. Disaster Mitigation: Experiences And Reflections by PardeepSahni
3. Natural Hazards & Disasters by Donald Hyndman & David Hyndman – Cengage Learning
4. National Disaster Management Authority-Guidelines

**Reference Books:**

1. Kates,B.I& White, G.F The Environment as Hazards, oxford, New York, 1978
2. R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi, 2000
3. H.K. Gupta (Ed) Disaster Management, Universiters Press, India, 2003
4. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED), University of Tokyo,1994
5. Dr. Satender, Disaster Management in Hills, Concept Publishing Co., New Delhi

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE65a- ENERGY CONSERVATION & MANAGEMENT**

**(Open Elective-II)**

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- To understand energy efficiency, scope, conservation and technologies.
- To design energy efficient lighting systems.
- To estimate/calculate power factor of systems and propose suitable compensation Techniques.
- To understand energy conservation in HVAC systems.
- To calculate life cycle costing analysis and return on investment on energy efficient Technologies.

**UNIT – I:** **09 Hrs**

Basic Principles of Energy Audit and management Energy audit – Definitions – Concept– Types of audit – Energy index – Cost index – Pie charts – Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions – Language – Questionnaire – Check list for top management.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about various types of Energy Audit **L1**
- To know about various types of Energy conservation schemes and Energy Manager functions **L2**

**UNIT – II:** **09 Hrs**

Lighting Modification of existing systems – Replacement of existing systems – Priorities: Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level – Illumination of inclined surface to beam – Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers – Energy conservation measures

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about various Lighting systems and types of lamps. **L1**
- To evaluate illumination level Illumination of inclined surface to beam and Design of Energy efficient lighting systems. **L2**

**UNIT – III:** **09 Hrs**

Power Factor and energy instruments Power factor – Methods of improvement – Location of capacitors – Power factor with non linear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters – Tong testers – Power analyzer.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about various Methods of Power Factor improvement **L1**
- To know about various Energy Instruments **L3**

**UNIT – IV:** **09 Hrs**

Space Heating and Ventilation Ventilation – Air–Conditioning (HVAC) and Water Heating: Introduction – Heating of buildings – Transfer of Heat–Space heating methods – Ventilation and air–conditioning – Insulation–Cooling load – Electric water heating systems – Energy conservation methods

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about analysis of Heating and HVAC **L1**
- To know about Energy conservation methods **L2**

**UNIT – V:** **09 Hrs**

Economic Aspects and Analysis Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts).Computation of Economic Aspects Calculation of simple payback method – Net present worth method – Power factor correction – Lighting – Applications of life cycle costing analysis – Return on investment.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about basic concept of Analysis of Economics and different methods **L1**
- To know about Computation of Economic Aspects Calculation **L2**

**Text Books:**

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy efficient electric motors by John.C.Andreas, Marcel Dekker Inc Ltd-2nd edition,1995.

**Reference Books:**

1. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. New Delhi.
2. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company–1stedition, 1998.
3. Energy management hand book by W.C.Turner, John wiley and sons.
4. Energy management and conservation –k v Sharma and pvenkata seshaiah-I K International Publishing House pvt.ltd, 2011.
5. http://www.energymanagertraining.com/download/Gazette_of_IndiaP art IISecI-37_25-08-2010.pdf

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain energy efficiency, conservation and various technologies. **L1**
- Design energy efficient lighting systems. **L2**
- Calculate power factor of systems and propose suitable compensation techniques. **L3**
- Explain energy conservation in HVAC systems. **L4**
- **L5**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE65b- PLC AND ITS APPLICATIONS**

**(Open Elective-II)**

| L | T | P | C |
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**Course Objectives:** The student will be able to:

- Understand the basic functions and types of PLCs
- Get exposure of Easy Veep software, its applications
- Classification of PLCs and applications
- Programming using PLCs
- Troubleshooting aspects using PLCs

**UNIT – I: Introduction**

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen- Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To understand about basic functions of PLCs & classification of PLCs **L1**
- To distinguish between PLCs and Mechanical relays **L2**
- To know about Processor and I/O cards

**UNIT – II:** **10 Hrs**

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about Easy Veep software & about Logic diagrams **L1**
- To understand about Search engine & interfacing of PC and PLCs **L2**

**UNIT – III: PLC software and applications** **10 Hrs**

Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.

Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about basic features of PLCs & various instructions of PLC **L1**
- To know about various PLC versions & understand about Cascade control and subroutines **L2**

**UNIT – IV: Programming instructions** **10 Hrs**

Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions – Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about various Programming instructions & understand Math instructions in PLCs **L1**
- To know about Logical instructions & understand about Communications with PLC using set up and monitoring **L2**

**UNIT – V: Analog and Digital parameters** **10 Hrs**

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO2), plastic wrapping machines etc.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about analog and digital parameters in certain PLCs & apply PLCs for control system stability aspects **L1**
- To know about troubleshooting techniques & identify few applications of PLCs in Science and Technology fields **L2**

**Text Books:**

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automation direct Siemens)

**Reference Books:**

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers,2002.
2. Programmable Logic Controllers by W. Bolton, 4th Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2nd Edition, Carolina Academic Press, 2006.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand different types of PLCs **L1**
- Understand the usage of Easy Veep software **L2**
- Understand the hardware details of Allen Bradley PLC **L3**
- Programming of PLCs **L4**
- Know about few applications of PLCs in different fields of Science and Technology **L5**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE65c- SYSTEM RELIABILITY CONCEPTS**

**(Open Elective-II)**

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- The Basic concepts, rules for combining probabilities of events, failure density and distribution functions.
- Evaluation of network Reliability / Unreliability and types of redundancies.
- Evaluation of network Reliability / Unreliability using conditional probability method.
- Expected value and standard deviation of Exponential distribution and Measures of reliability.
- Evaluation of Limiting State Probabilities of one, two component repairable models.

**UNIT – I: Basic Probability Theory** **09 Hrs**

Basic concepts – Rules for combining Probabilities of events – Failure Density and Distribution functions – Bernoulli's trials – Binomial distribution – Expected value and standard deviation for binomial distribution – Examples.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about basic rules for probabilities of events **L1**
- Get detailed information about Probability of failure density and distribution Functions and obtain the expected value and standard deviation for binomial distribution. **L2**

**UNIT – II: Network Modeling and Reliability Evaluation** **09 Hrs**

Basic concepts – Evaluation of network Reliability / Unreliability – Series systems, Parallel systems, Series - Parallel systems, partially redundant systems – Types of redundancies - Evaluation of network Reliability / Unreliability using conditional probability method – Paths based and Cutset based approach – complete event tree and reduced event tree methods - Examples.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- How to find the Probability of success and failures of network using different approaches for series-parallel configurations. **L1**
- To find reliability / unreliability of complex systems using different methods **L2**

**UNIT – III: Time Dependent Probability** **09 Hrs**

Basic concepts – Reliability functions f(t), Q(t), R(t), h(t) – Relationship between these functions – Bath tub curve – Exponential failure density and distribution functions - Expected value and standard deviation of Exponential distribution – Measures of reliability – MTTF, MTTR, MTBF – Evaluation of network reliability / Unreliability of simple Series, Parallel, Series-Parallel systems - Partially redundant systems - Evaluation of reliability measure – MTTF for series and parallel systems – Examples.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of time domain functions and relationship between them. and obtain the expected value and standard deviation for exponential distribution. **L1**
- To obtain probabilistic measures for fully redundant and partially redundant configurations **L2**

**UNIT – IV: Discrete Markov Chains & Continuous Markov Processes** **09 Hrs**

Markov Chains: Basic concepts – Stochastic transitional Probability matrix – time dependent probability evaluation – Limiting State Probability evaluation – Absorbing states.

Markov Processes: Modeling concepts – State space diagrams – time dependent reliability evaluation of single component repairable model – Evaluation of Limiting State Probabilities of one, two component repairable models – Frequency and duration concepts – Frequency balance approach - Examples.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of Stochastic Transitional Probability Matrix, Limiting State Probability **L1**
- Understand the concept of Frequency balance approach. And To distinguish between Markov chains and Markov processes **L2**

**UNIT – V: Multi Component & Approximate System Reliability Evaluation** **09 Hrs**

Recursive relation for evaluation of equivalent transitional rates– cumulative probability and cumulative frequency and 'n' component repairable model – Series systems, Parallel systems, Basic probability indices – Series, Parallel systems – Complex Systems– Cutset approach – Examples.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of recursive relation for evaluation of equivalent transitional rates. **L1**
- To know about computation of basic probability indices for series, parallel configurations **L2**

**Text Books:**

1. Reliability Evaluation of Engineering Systems by Roy Billinton and Ronald N. Allan, Reprinted in India B. S. Publications, 2007.
2. Reliability Engineering by E. Balagurusamy, Tata McGraw Hill, 2003.

**Reference Books:**

1. Introduction to Reliability Engineering by E. E. Lewis by Wiley Publications.
2. Reliability and Maintainability Engineering by Charles E. Ebeling, Tata McGraw Hill, 2000.
3. Reliability and Safety Engineering by Ajit Kumar Verma, SrividyaAjit and Durga Rao Karanki, Springer, Second Edition, 2016. System Reliability Theory Marvin Rausand and ArnljotHoyland, Wiley Publictions.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the concepts for combining Probabilities of events, Bernoulli's trial, and Binomial distribution. **L1**
- Network Reliability/Unreliability using conditional probability, path and cutest based approach, complete event tree and reduced event tree methods. **L2**
- Understanding Reliability functions and to develop relationship between these functions, expected value and standard deviation of Exponential distribution and measures of reliabilities. **L3**
- Analyze the time dependent reliability evaluation of single component repairable model, frequency and duration concepts, Frequency balance approach. **L4**
- `Recursive relation for evaluation of equivalent transitional rates, cumulative probability and cumulative frequency and 'n' component repairable model. **L5**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEC65a-INTRODUCTION TO MICROCONTROLLER AND APPLICATIONS**

***(Open Elective-II)***

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**Course Objectives:** The objectives of the course are to make the students learn about

- To understand the basic concepts and architecture of 8051.
- To learn various instructions and addressing modes used in 8051
- To be able to write programs in assembly language for 8051
- To be able to program 8051 Timers and implement serial communication for a given application.
- To learn interfacing of memory, I/O devices and the usage of Interrupts.

**UNIT – I:**

**Architecture of 8051:** Introduction, Block diagram of 8051 Microcontroller, Functions of each block, Pin details of 8051, ALU,ROM, RAM, Memory Organization of 8051, Special function registers, Program Counter, PSW register, Stack, I/O Ports, Timer, Interrupt, Serial Port, Oscillator and Clock, Clock Cycle, Machine Cycle, Instruction cycle, Reset, Power on Reset.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the architecture of 8051 microcontroller. **L2**
- Learn the functions of each block of 8051 microcontroller. **L1**

**UNIT – II:**

**Instruction Set of 8051:** Instruction set of 8051, Classification of 8051 Instructions, Data transfer instructions, Arithmetic Instructions, Logical instructions, Branching instructions, Bit Manipulation Instructions

**Assembler and Addressing Modes:** Assembling and running an 8051 program, Structure of Assembly Language, Assembler directives, Different addressing modes of 8051.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know different instructions available in the Instruction set of 8051. **L1**
- Learn and use different types of addressing modes of 8051 microcontroller. **L1**

**UNIT – III:**

**Programs:** Arithmetic operations, Biggest Number / Smallest Number, Ascending order / Descending order, BCD to HEX Conversion, HEX to BCD Conversion, Odd Parity Generator Even Parity Generator, Time delay routines

**I/O:** Bit addresses for I/O and RAM, I/O programming, I/O bit manipulation programming.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Write assembly language program in 8051 for simple operations. **L6**
- Gain knowledge about different mappings used in 8051 microcontroller. **L1**

**UNIT – IV:**

**Timer:** Programming 8051 Timers, Timer registers, Different modes of Timer, Programming timer in different modes, Counter programming, Different modes of Counter, Sample programs.

**Serial Communication:** Basics of Serial communication, UART, RS 232 Protocol, 8051 interface to RS 232, 8051 UART Programming, SPI and $I^2C$ implementation on 8051.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Write programs to use the 8051 Timers for a given application. **L6**
- Use different types of serial communication devices based on the application. **L3**

**UNIT – V:**

**Interrupt**: 8051 Interrupts, Programming Timer Interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in 8051.**IC 8255:** IC 8255, Block Diagram, Modes of 8255, Interfacing with 8051.

**Interfacing Techniques**: Interfacing external memory to 8051, Sensor interfacing, ADC interfacing, DAC interfacing, Keyboard interfacing, Seven segment LED Display Interfacing, Stepper Motor interfacing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Interface memory and I/O devices for specific applications. **L4**
- Learn and apply Interrupts based on the application and usage. **L3**

**Text Books:**

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, Pearson Education, 2008.
2. Ajit pal, "Microcontrollers, Principles and Applications", – PHI Ltd., - 2011.

**Reference Books:**

1. Ajay V Deshmukh, "Microcontrollers: Theory and Applications", TATA McGraw Hill publications, 2007.
2. Krishna Kanth, "Microprocessors and Microcontrollers", PHI Publications, 2010

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the basic concepts and architecture of 8051. **L2**
- Know the usage of various instructions and addressing modes in 8051 **L1**
- Write programs in assembly language for 8051 **L6**
- Program 8051 Timers and implement serial communication for a given application. **L6**
- Interface memory, I/O devices and use Interrupts. **L4**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

## 19AEC65b-PRINCIPLES OF DIGITAL SIGNAL PROCESSING

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To understand the frequency domain analysis of discrete time signals.
- To learn the properties of discrete fourier series and fourier transforms.
- To design & analyze IIR digital filters from analog filters.
- To know various structures used in implementation of FIR digital filters.
- To grasp the importance and applications of Multirate Digital signal processing.

**UNIT – I:**

**Introduction to Digital Signal Processing:** Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, LTI system Properties. Solution of Linear constant coefficient difference equations , frequency domain representation of discrete time signals and systems. Review of Z-transforms.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze and process signals in the discrete domain. **L4**
- Determine time domain representations and frequency domain analysis of discrete-time signals and systems. **L3**

**UNIT – II:**

**Discrete Fourier Series and Fourier Transforms:** Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the pproperties of discrete fourier series. **L2**
- Describe DFT using FFT algorithms. **L1**

**UNIT – III:**

**Design of IIR Digital Filters and Realizations:** Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Design IIR digital filters from analog filters. **L6**
- Construct IIR digital filters with different realization techniques. **L6**

**UNIT – IV:**

**Design of FIR Digital Filters and Realizations:** Characteristics of FIR Digital Filters, frequency response. Design of FIR digital filters using window techniques and frequency sampling technique, comparison of IIR & FIR filters, basic structures of FIR systems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Design FIR digital filters using window techniques. **L6**
- Construct the basic structures of FIR systems. **L6**

**UNIT – V:**

**DSP Applications:** Introduction to programmable DSPs, Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Adaptive filters: Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming using block diagram representation study only.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply Interpolation and Decimation with help of sampling and filtering. **L3**
- Understand the principle and applications of Forward Linear Predictive filter. **L2**

**Text Books:**

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithmsand Applications", Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing",PHI.
3. B.Venkataramani and M. Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications", TATA McGraw Hill, 2002.

**Reference Books:**

1. Andreas Antoniou, "Digital Signal Processing", TATA McGraw Hill, 2006
2. MH Hayes, "Digital Signal Processing", Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling and Sandra L. Harris, "Fundamentals of Digital Signal Processing using Matlab", Thomson, 2007.

**Course Outcomes:**

At the end of this Course the student will be able to

- Articulate the frequency domain analysis of discrete time signals. **L3**
- Understand the properties of discrete fourier series and fourier transforms. **L2**
- Design & analyze IIR digital filters from analog filters. **L6**
- Design various structures used in implementation of FIR digital filters. **L6**
- Summarize the importance and applications of Multirate Digital signal processing. **L2**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEC65c-INTRODUCTION TO IMAGE PROCESSING**

***(Open Elective-II)***

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To learn the fundamentals of Image Processing and learn the different types of image transforms.
- To study different types of filtering techniques for image enhancement.
- To understand various types of image segmentation and thresholding techniques.
- To gain knowledge on wavelets and multi resolution image processing techniques.
- To comprehend various types of image compression and colour image processing methods.

**UNIT – I:**

**Digital Image Fundamentals:** Fundamental steps of digital image processing, Components of Digital Image processing, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures. Applications of Digital Image Processing.

**Image Transforms:** Fourier Transform and its properties in one dimensional and Two dimensional, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Sine transform, Walsh transform, Hadamard transform, Slant transform, KL Transforms and its properties.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the fundamentals of digital image processing. **L2**
- Analyze the image transforms in one and two dimensions. **L4**

**UNIT – II:**

**Image Enhancements and Filtering:** Gray level transformations, Histogram processing, histogram equalization, Enhancement of Frequency domain, Homomorphic filtering, Filtering in the frequency domain. Image Restoration: A Model of the Image Degradation \ Restoration Process, Noise Models, Inverse filtering, Minimum Mean Square Error (Weiner) Filtering, Constrained least squares filtering.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze the filters in spatial and frequency domains. **L4**
- Understand the image restoration model and various types of noises in image restoration. **L2**

**UNIT – III:**

**Image Segmentation:** Detection of Discontinuities: Point detection, Line detection, Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn the concept of image segmentation. **L1**
- Analyze various types of thresholding techniques. **L4**

**UNIT – IV:**

**Wavelets and Multi-resolution image processing:** Back ground, Image Pyramids, Sub band coding, The Haar Transform.Multi resolution Expansions: Series Expansions, Scaling Functions, Wavelet Functions, Wavelet Transform in One dimension: The wavelet series expansions, The Discrete wavelet transform, The Continuous Wavelet Transform, The Fast wavelet Transform, Wavelet transform in two dimensions, Wavelet Packets.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the wavelets in one dimension and two dimensions. **L2**
- Explain the multi-resolution expansions and fast wavelet transform. **L1**

**UNIT – V:**

**Image Compression:** Redundancy, coding, inter-pixel and psycho-visual; Loss less compression – Huffmann coding, predictive coding; Lossy Image compression- predictive and transform coding; Image compression standards.

**Color Image Processing:** Color Fundamentals, Color models–RGB, CMY, HSI; Pseudo color Image Processing, Basics of Full color Image Processing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the need for image compression and its types. **L2**
- Learn the color image processing and various types of color models. **L1**

**Text Books:**

1. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", Second Edition, Pearson Education, 2008.
2. Anil Kumar Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2nd edition 2004.

**Reference Books:**

1. Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, "Digital Image processing using MATLAB", Tata McGraw Hill, 2010.
2. S Jayaraman, S Esakkirajan and T Veerakumar, "Digital Image processing", Tata McGraw Hill.
3. William K. Pratt, "Digital Image Processing", John Wiley, 3rd Edition, 2004.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the fundamentals of Image Processing and apply different types of image transforms. **L2**
- Correlate different types of filtering techniques for image enhancement. **L4**
- Understand various types of image segmentation and thresholding techniques. **L2**
- Gain knowledge on wavelets and multi resolution image processing techniques. **L1**
- Summarize different types of image compression and colour image processing methods. **L2**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACS65a- INTRODUCTION TO MACHINE LEARNING**

**Open Elective-II**

| L | T | P | C |
|---|---|---|---|
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**Course Objectives:**

- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To understand the basic theory underlying machine learning.

**UNIT – I: INTRODUCTION** **8hrs**

**Introduction:** An illustrative learning task, and a few approaches to it. What is known from algorithms? Theory, Experiment. Biology. Psychology. Overview of Machine learning, related areas and applications. Linear Regression, Multiple Regression, Logistic Regression, logistic functions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Argue the importance and role of software architecture in large-scale software systems. **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

**UNIT – II: DECISION TREE LEARNING** **8hrs**

**Decision Tree Learning: -** Minimum Description Length Principle. Occam's razor. Learning with active queries Introduction to information theory, Decision Trees, Cross Validation and Over fitting. Neural Network Learning: Perceptions and gradient descent back propagation, multilayer networks and back propagation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Design and motivate software architecture for large-scale software systems **L3**
- Recognize major software architectural styles and frameworks. **L4**

**UNIT – III: SAMPLE COMPLEXITY AND OVER FITTING** **8hrs**

**Sample Complexity and Over fitting:** Errors in estimating means. Cross Validation and jackknifing VC dimension. Irrelevant features: Multiplicative rules for weight tuning. Support Vector Machines: functional and geometric margins.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

**UNIT – IV: INSTANCE-BASED TECHNIQUES** **7 Hrs**

**Instance-based Techniques:** Lazy vs. eager generalization. K nearest neighbor, case- based reasoning. Clustering and Unsupervised Learning: K-means clustering, Gaussian mixture density estimation, model selection

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe a software architecture using various documentation approaches and architectural description languages. **L5**

- Generate architectural alternatives for a problem and selection among them. **L3**

**UNIT – V: Genetic Algorithms**

**Genetic Algorithms:** Different search methods for induction - Explanation-based Learning: using prior knowledge to reduce sample complexity. Dimensionality reduction: feature selection, principal component analysis.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems. **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

**Text Books:**

1. Tom Michel, Machine Learning, McGraw Hill, 1997
2. Trevor Has tie, Robert Tibshirani & Jerome Friedman. The Elements of Statically Learning, Springer Verlag, 2001.

**Reference Books:**

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc.,2001 3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.

**Course Outcomes:**

At the end of this Course the student will be able to

- Student should be able to understand the basic concepts such as decision trees and neural networks.Ability to formulate machine learning techniques to respective problems **L2**
- Apply machine learning algorithms to solve problems of moderate complexity. **L3**

**B.Tech III.Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACS65b- INTRODUCTION TO COMPUTER NETWORKS**

**Open Elective-II**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:**

This course is designed to:

- Introduce the basic concepts of Computer Networks.
- Familiarize with the layered approach and different layers of computer networks.
- Familiarize with the design issues of different layers.
- Explain the working of different protocols of a computer network..

**UNIT – I: INTRODUCTION** **8hrs**

**Introduction:** Uses of computer networks, network hardware, Protocol Hierarchies, Design Issues for the layers, Connection oriented vs Connectionless Service. **The physical layer:** The theoretical basis for data communication, Guided transmission media, wireless transmission, communication satellites.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Argue the importance and role of software architecture in large-scale software systems **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

**UNIT – II: THE DATA LINK LAYER** **8hrs**

**The data link layer:** Data link layer design issues, error detection and correction, elementary data link protocols, sliding window protocols

**The medium access control:** The channel allocation problem, multiple access protocols, Ethernet.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Design and motivate software architecture for large-scale software systems. **L3**
- Recognize major software architectural styles and frameworks. **L4**

**UNIT – III: THE NETWORK LAYER** **8hrs**

**The network layer:** Network layer design issues, Flooding, Distance Vector Routing, Link state Routing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

**UNIT – IV: IP VERSION 4 PROTOCOL** **7 Hrs**

The IP version 4 Protocol, IP Addresses, IP version 6, Internet control protocols, OSPF, BGP, Internet multicasting.

**The transport layer:** Elements of transport protocols, congestion control, The internet transport protocols: UDP and TCP.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe a software architecture using various documentation approaches and architectural description languages. **L5**

- Generate architectural alternatives for a problem and selection among them. **L3**

**UNIT – V: THE APPLICATION LAYER**

**The application layer:** DNS- The Domain Name System, Electronic Mail, WWW Architectural Overview, Static Web pages, Dynamic web pages and web applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

**Text Books:**

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.

**Reference Books:**

1. Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication.

**Course Outcomes:**

Students will be able to:

- Recognize the method of using layered approach for design of computer networks. **L2**
- Explain the functionality of each layer of a computer network. **L3**
- Apply the knowledge of layered approach for the design of computer network software **L4**
- Analyze the performance of protocols of a computer network. **L4**
- Recommend the protocols for different applications. **L5**
- Propose new protocols for a computer networks. **L6**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACS65c- WEB DESIGN AND MANAGEMENT**

**Open Elective-II**

| L | T | P | C |
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**Course Objectives:**

- To Learn the basic concepts in HTML, CSS, JavaScript
- To Understand the responsive design and development
- To learn the web project management and maintenance process
- To Design a Website with HTML, JS, CSS / CMS - Word press

**UNIT – I: WEB DESIGN - HTML MARKUP FOR STRUCTURE** **8hrs**

Working of Web - HTML Markup for Structure - Creating simple page - Marking up text - Adding Links - Adding Images - Table Markup - Forms - HTML5.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Argue the importance and role of software architecture in large-scale software systems. **L2**
- Design and motivate software architecture for large-scale software systems. **L3**

**UNIT – II: CSS AND JAVASCRIPT** **8hrs**

CSS - Formatting text - Colours and Background - Padding, Borders and Margins – Floating and positioning - Page Layout with CSS - Transition, Transforms and Animation – JavaScript - Using Java Script.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Design and motivate software architecture for large-scale software systems. **L3**
- Recognize major software architectural styles and frameworks. **L4**

**UNIT – III: RESPONSIVE WEB DESIGN** **8hrs**

Sass for Responsive Web Design - Marking Content with HTML5 - Mobile-First or DesktopFirst - CSS Grids; CSS Frameworks, UI Kits, and Flexbox for RWD - Designing small UIs by Large Finger - Images and Videos in Responsive Web Design - Meaningful Typography for Responsive Web Design.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recognize major software architectural styles and frameworks. **L3**
- Describe a software architecture using various documentation approaches and architectural description languages. **L4**

**UNIT – IV: WEB PROJECT MANAGEMENT** **7 Hrs**

Project Life Cycle - Project Definition - Discovery and Requirements - Project Schedule and Budgeting - Running the project - Technical Documentation - Development, Communicaton, Documentation - QA and testing -Deployment - Support and operations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe a software architecture using various documentation approaches and architectural description languages. **L5**
- Generate architectural alternatives for a problem and selection among them. **L3**

**UNIT – V: PROJECT CASE STUDY**

Using HTML, CSS, JS or using Opensource CMS like Word press, design and develop a Website having Aesthetics, Advanced and Minimal UI Transitions based on the project - Host and manage the project live in any public hosting.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Use well-understood paradigms for designing new systems. **L3**
- Identify and assess the quality attributes of a system at the architectural level. **L4**

**Text Books:**

1. Jennifer Niederst Robbins, "Learning Web Design", O'REILLY 4th Edition
2. Ricardo Zea, "Mastering Responsive Web Design", PACKT Publishing, 2015
3. Justin Emond, Chris Steins, "Pro Web Project Management", Apress,2011

**Reference Books:**

1. Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons, edition 2014
2. Jon Duckett, Jack Moore, "JavaScript & JQuery: Interactive Front-End Web Development", John Wiley and Sons, edition 2014
3. Uttam K. Roy "Web Technologies" Oxford University Press, 13th impression, 2017 4. Word press - http://www.wpbeginner.com/category/wp-tutorials/

**Course Outcomes:**

At the end of this Course the student will be able to

- Recognize the method of using layered approach for design . **L2**
- Explain the functionality of each layer of a computer network. **L3**
- Apply the knowledge of layered approach for the design of computer network software **L4**
- Analyze the performance of protocols of a computer network. **L4**
- Recommend the protocols for different applications. **L5**
- Propose new protocols for a computer networks. **L6**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS15a-MANAGEMENT SCIENCE**

**(Humanities Elective-II)(Common to [illegible])**

CE & ME

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**Course Objectives:**

- Understand the role of entrepreneurship in economic development.
- Identify the general characteristics of entrepreneurs.

**UNIT – I**

**INTRODUCTION TO MANAGEMENT**

Concepts of Management - Nature, importance and Functions of Management - Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Leadership Styles, Social responsibilities of Management.

**DESIGNING ORGANIZATIONAL STRUCTURES**

Basic concepts related to Organization - Departmentation and Decentralization, Types of mechanistic and organic structures of organization (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, team structure) their merits, demerits and suitability.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of management and organization. **L1**
- Apply the concepts & principles of management in real life industry. **L2**

**UNIT – II**

**OPERATIONS MANAGEMENT:**

Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study. Statistical Quality Control: *c* chart, *p* chart, (simple Problems) Deming's contribution to quality.

**MATERIALS MANAGEMENT:** EOQ, Purchase Procedure and Stores Management. Inventory — functions. Types, inventory classification techniques.

**Marketing:** Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the core concepts of Management Science and Operations Management. **L1**
- Evaluate Materials departments & Determine EOQ. **L2**

**UNIT – III**

**HUMAN RESOURCES MANAGEMENT (HRM):**

Concepts of HRM, Personnel Management and Industrial Relations (PMIR), Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation, Merit Rating and methods.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development. **L1**
- Apply Managerial and operative Functions. **L2**



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**UNIT – IV**

**STRATEGIC MANAGEMENT:**

Vision, Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Vaiue Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives.

**PROJECT MANAGEMENT (PERT/CPM):**

Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise. **L1**
- Evaluate PERT and CPM Techniques. **L2**

**UNIT – V**

**CONTEMPORARY MANAGEMENT PRACTICES:**

Basic concepts of MIS, Materials Requirement Planning (MRP), Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma concept, Supply Chain Management, Enterprise Resource Planning (ERP), Performance Management, Business Process outsourcing (BPO), Business Process Re-engineering and Bench Marking, Balanced Score Card.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze CRM, MRP, TQM. **L1**
- Understand modern management techniques. **L2**

**Text Books:**

1. **Management Science**, Aryasri: TMH, 2004.
2. **Management**, Stoner, Freeman, Gilbert, 6th Ed, Pearson Education, New Delhi, 2004.

**Reference Books:**

1. **Marketing Mangement**, Kotler Philip & Keller Kevin Lane: 12/e, PHI,2005.
2. **Essentials of Management** ,Koontz & Weihrich:, 6/e, TMH, 2005.
3. **Management—Principles and Guidelines**, Thomas N.Duening & John M.Biztantra, 2003.
4. **Production and Operations Management**, Kanishka Bedi, , Oxford University Press, 2004.

**Course Outcomes:**

At the end of this Course the student will be able to

- Equipping engineers for a lifelong career addressing the critical technical and managerial needs of private and public organizations. **L1**
- Exploring and developing analytic abilities, making better decisions, developing and executing strategies while also leading people who innovate. **L2**
- Cultivating the technical skills as well as the behavioral challenges of running organizations and complex systems. **L3**
- Emphasizing quantitative analytic skills and an entrepreneurial spirit **L4**
- Have an introductory understanding of global entrepreneurship concepts. **L5**

**B.Tech ~~IV~~ III Year ~~II~~ I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS15b-BUSINESS ENVIRONMENT**

**(Humanities Elective-II)(Common to [illegible])**

CE & ME

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**Course Objectives:**

- To make the student understand about the business environment.
- To enable them in knowing the importance of fiscal and monitory policy.

**UNIT – I: BUSINESS ENVIRONMENT**

Meaning – Various environments affecting business – Social Economic; Political and Legal; Culture; Competitive Demographic; Technological and International environments.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of Business environment. **L1**
- Explain various types of business environment. **L2**

**UNIT – II: FISCAL & MONETARY POLICY**

**FISCAL POLICY** - Public Revenues - Public Expenditure - Public debt - Development activities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - **MONETARY POLICY** - Demand and Supply of Money – RBI - Objectives of monetary and credit policy - Recent trends - Role of Finance Commission.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of public revenue and public Expenditure **L1**
- Explain the functions of RBI and its role. **L2**

**UNIT – III: TRADE POLICY**

**INDIA'S TRADE POLICY** - Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - **BALANCE OF PAYMENTS** – Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the role of Indian international trade. **L1**
- Analyze causes for Disequilibrium and correction measure. **L2**

**UNIT – IV: WORLD TRADE ORGANIZATION**

**WORLD TRADE ORGANIZATION** - Nature and Scope - Organization and Structure - Role and functions of WTO in promoting world trade - Agreements in the Uruguay Round – TRIPS, TRIMS, and GATT - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the Dispute Settlement Mechanism. **L1**
- Compare and contrast the Dumping and Anti-dumping Measures. **L2**

**UNIT – V: MARKETS**

**MONEY MARKETS AND CAPITAL MARKETS** - Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI - Stock Exchanges - Investor protection and role of SEBI.

**Learning Outcomes:**



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At the end of this unit, the student will be able to

- Apply the knowledge in future investments. **L1**
- Understand the role of SEBI in investor protection. **L2**

**Text Books:**

1. Francis Cherunilam (2009), "International Business": Text and Cases, Prentice Hallof India.
2. K. Aswathappa, "Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition.HPH2016.

**Reference Books:**

1. K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases,Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
4. E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

**Course Outcomes:**

At the end of this Course the student will be able to

- Apply the knowledge of Money markets in future investment. **L1**
- Analyze India's Trade Policy. **L2**
- Evaluate fiscal and monitory policy. **L3**
- Develop a personal synthesis and approach for identifying business opportunities. **L4**
- `Understand various types of business environment. **L5**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS13-ENGLISH LANGUAGE SKILLS LAB**

**(Common to CE & ME)**

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**Course Objectives:**

- Students will cultivate the habit of reading passages from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like GRE, TOEFL and GMAT etc.
- students will be trained to use language effectively to face interviews, group discussions, public speaking

**UNIT – I:** **12Hrs**

1. Phonetics for listening comprehension of various accents -2
2. Formal Presentations using PPT slides without Graphic Elements.
3. Paraphrasing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand different accents spoken by native speakers of English **L1**
- Make formal structured presentations on general topics using PPT slides without graphical elements **L2**

**UNIT – II:** **12Hrs**

1. Debate – 2 (Following Argument).
2. Listening to short speeches/ short stories for note-making and summarizing.
3. E-mail Writing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Participate in formal discussions and speak clearly on a specific topic using suitable discourse markers. **L1**
- Make formal structured presentations on academic topics using ppt slides with relevant graphical elements. **L2**

**UNIT – III** **12Hrs**

1. Listening for Discussions.
2. Group Discussions.
3. Writing Persuasive/argumentative essays on general topics.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Participate in group discussions using appropriate conventions and language strategies. **L1**
- Produce logically coherent persuasive/argumentative essays. **L2**

**UNIT – IV** **12Hrs**

1. Reviewing film/book.
2. Group Discussions – reaching consensus in Group Work.
3. Resume Writing – Cover Letter – Applying for Internship.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Express thoughts and ideas with acceptable accuracy and fluency with a view to reach consensus in group discussions **L1**
- Prepare a CV and write a cover letter to seek internship/job **L2**

**UNIT – V** **12Hrs**

1. Writing Project Reports.
2. Editing Short Texts.
3. Answering FAQs in Interviews.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Collaborate with a partner to make effective presentations. **L1**
- Understand the structure and produce an effective project report. **L2**

**Suggested Software**

- Walden Infotech English Language Communication Skills.
- iTell- Orell Digital Language Lab.
- Digital Teacher.
- LES(Learn English Select) by British council.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.
- Lingua TOEFL CBT Insider, by Dreamtech.
- English Pronunciation in Use (Elementary, Intermediate, Advanced)CUP.
- Cambridge Advanced Learners' English Dictionary withCD.

**Reference Books:**


1. Meenakshi Raman &Sangeeta Sharma, "Technical Communication" O U Press2009.
2. Barron's Books on TOEFL/GRE/GMAT/CAT/IELTS /DELTA/Cambridge University Press.2012
3. Butterfield Jeff, "Soft Skills for Everyone", Cengage Publications,2011.
4. "Practice Psychometric Tests": How to familiarize yourself with genuine recruitment tests, 2012.
5. David A McMurrey & Joanne Buckely "Handbook for Technical Writing" CENGAGE Learning2008.
6. "A Textbook of English Phonetics for Indian Students", 2nd Edition, T.Balasubramanyam. (Macmillan),2012.
7. "A Handbook for English Laboratories", E. Suresh Kumar, P. Sreehari, Foundation Books, 2011.
8. Sambaiah.M. ***Technical English***, Wiley publishers India. New Delhi. 2014.


**Course Outcomes:**

At the end of this Course the student will be able to

- Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills. **L1**
- Apply communication skills through various language learning activities. **L2**
- Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. **L3**
- Evaluate and exhibit acceptable etiquette essential in social and professional settings **L4**
- Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English. **L5**

**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME66 – HEAT TRANSFER LAB**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Understand different modes of heat transfer
- Gain knowledge about natural and force convection phenomenon
- Estimate experimental uncertainty in measurements

**List of Experiments**

1. Determine the overall heat transfer coefficient across the width of composite wall
2. Determine the thermal conductivity of a metal rod
3. Determine the thermal conductivity of insulating powder material through concentric sphere apparatus
4. Determine the thermal conductivity of insulating material through lagged pipe apparatus
5. Determine the efficiency of a pin fin in natural and forced convection.
6. Determine the heat transfer coefficient for a vertical cylinder in natural convection
7. Determine the heat transfer coefficient in forced convection of air in a horizontal tube.
8. Determine the heat transfer coefficients on film and drop wise condensation apparatus.
9. Determine the effectiveness of a parallel and counter flow heat exchanger.
10. Study the pool boiling phenomenon and different regimes of pool boiling.
11. Experiment on pool boiling
12. Determine the emissivity of the test plate surface.
13. Experiment on Stefan-Boltzmann apparatus
14. Determine the heat transfer rate coefficient in fluidized bed apparatus

**Course Outcomes:**

At the end of this Course the student will be able to

- Explain different modes of heat transfer **L1**
- Identify parameters for measurement for calculating heat transfer **L1**
- Determine effectiveness of heat exchanger **L5**
- Design new equipment related to heat transfer **L5**
- Apply principles of heat transfer in wide application in industries. **L3**

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**B.Tech III Year II Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AHS17-RESEARCH METHODOLOGY**

**(Common to CE & ME)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 0 |

**Course Objectives:**

- Students should understand a general definition of research design.
- Students should be able to identify the overall process of designing a research study from its inception to its report.

**UNIT – 1:**

Meaning of Research — Objectives of Research — Types of Research — Research Approaches — Guidelines for Selecting and Defining a Research Problem — research Design — Concepts related to Research Design — Basic Principles of Experimental Design.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of research and its process. **L1**
- Explain various types of research. **L2**

**UNIT – II:**

Sampling Design — steps in Sampling Design —Characteristics of a Good Sample Design — Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement — Tests of Sound Measurement — Scaling and Scale Construction Techniques — Time Seri. Analysis — Interpolation and Extrapolation. Data Collection Methods — Primary Data — Secondary data — Questionnaire Survey and Interviews.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of sampling and sampling design. **L1**
- Explain various techniques in measurement and scaling. **L2**

**UNIT – III:**

Correlation and Regression Analysis — Method of Least Squares — Regression on Correlation — Correlation on Determination — Types of Correlations and Their Applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the association of two variables. **L1**
- Understand the importance of correlation and regression. **L2**

**UNIT – IV:**

Statistical Inference: Tests of Hypothesis — Hypothesis Testing Procedure — Sampling Theory — Sampling Distribution — Chi-square Test — Multi-variate Analysis.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the statistical inference. **L1**
- Understand the hypothesis testing procedure. **L2**

**UNIT – V:**

Report Writing and Professional Ethics: Interpretation of Data — Report Writing — Layout of a Research Paper — Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars — Professional Ethics in Research.

**Learning Outcomes:**



1/10/21

At the end of this unit, the student will be able to

- Learn about report writing. **L1**
- Understand how to write research paper. **L2**

**Text Books:**

1. C.R.Kothari, "Research Methodology: Methods and Techniques",2nd edition, New Age International Publishers.
2. A Step by Step Guide for Beginners, "Research Methodology":Ranjit Kumar, Sage Publications.

**Reference Books:**

1. P.Narayana Reddy and G.V.R.K.Acharyulu, "Research Methodology and Statistical Tools", 1st Edition, Excel Books, New Delhi.
2. Donald R. "Business Research Methods", Cooper & Pamela S Schindler, 9th edition.
3. S C Gupta, "Fundamentals of Statistics", 7th edition Himalaya Publications.
4. Dr. P.Satyanarayana, "a Companion to Literary Research", 1st edition 2020, HSRA publications.

**Course Outcomes:**

At the end of this Course the student will be able to

- Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling. **L1**
- Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project. **L2**
- Have basic knowledge on qualitative research techniques. **L3**
- Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting. **L4**
- Have basic awareness of data analysis-and hypothesis testing procedures. **L5**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME71 – METROLOGY AND MEASUREMENTS**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce the basic concepts of metrology and measurement methods.
- Demonstrate the importance of metrology in manufacturing
- Explain the concepts of transducers and its practical applications.
- Expose with various measuring instruments

**UNIT – 1: Concept of Measurement** **8 Hrs**

**Concept of Measurement:** General concept-generalized measurement system, units and standards, measuring instruments, sensitivity, readability, range of accuracy, precision, static and dynamic response, repeatability, systematic and random errors, correction, calibration, terminology and limits fits and tolerances, hole basis and shaft basis system, interchangeability.

**Limit Gauges And Gauge Design:** Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle. Design of Go and No Go gauges.

**Linear and Angular Measurement:** Linear measuring instruments: Vernier instruments, micrometers, slip gauges, tool makers microscope. Comparators: Mechanical, pneumatic and electrical. Angular measurements: Sine bar, bevel protractor and angle dekkor, rollers and spheres used to determine the tapers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify important parameters in metrology. **L3**
- Differentiate interchangeability and selective assembly **L4**
- Select limits and tolerances for different assemblies. **L1**

**UNIT – II: Flatness Measurement & Surface Roughness Measurement** **6 Hrs**

**Flatness Measurement:** Measurement of flatness – straight edges – surface plates, optical flat and autocollimators, interferometers and their applications.

**Surface Roughness Measurement:** Terminology systems, differences between surface roughness and surface waviness- Numerical assessment of surface finish - CLA, R,M,S Values-Ra , Rz values, Methods of measurement of surface finish-profilograph, talysurf, BIS symbols for indication of surface roughness.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Inspect the flatness of surfaces. **L4**
- Recall the terms used in surface roughness measurement. **L1**
- Explain the factors affecting the surface finish in machining. **L2**
- Demonstrate the application of different surface measuring instruments. **L2**

**UNIT – III: Metrology of Screw Threads & Gear measurement** **6Hrs**

**Metrology of Screw Threads:**

Screw thread measurements: Elements of threads, errors in screw threads, various methods for measuring external and internal screw threads, screw thread gauges.

**Gear Measurement:** Gear tooth terminology, measurement of gear elements-runout, lead, pitch backlash, profile, pressure angle, tooth thickness, diameter of gear, constant chord and base tangent method.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the errors in screw threads. **L3**
- Explain the principles of gear measuring instruments **L2**
- Select the tools and methods for measuring screw thread, gear profiles. **L1**

**UNIT – IV: Measurement of Displacement & Strain** **6 Hrs**

**Measurement of Displacement:** Theory and construction of various transducers to measure displacement - Piezo electric, inductive, capacitance, resistance, ionization and photoelectric transducers, calibration procedures.

**Measurements of Strain:** Various types of electrical strain gauges, gauge factor, method of usage of resistance strain gauge for bending, compressive and tensile strains, usage for measuring torque, strain gauge rosettes.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List various types of transducers used for the measurement of displacement. **L1**
- Explain the static and dynamic characteristics of transducers. **L3**
- Classify the transducers with respect to change in resistance, capacitance and inductance **L4**
- Experiment with measurement of strain **L3**

**UNIT – V: Replacement and Maintenance Analysis** **6 Hrs**

**Measurement of Force:** Direct method - analytical balance, platform balance; elastic members – load cells, cantilever beams and proving rings.

**Measurement of Torque:** Torsion bar dynamometer, servo controlled dynamometer and absorption dynamometer.

**Measurement of Pressure:** Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, High and low pressure measurement, Elastic transducers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify various types of transducers used for the measurement of force, torque and pressure **L3**
- Explain methods of measurement of force, torque and pressure **L2**
- Develop the techniques for calibration of force, torque and pressure measuring devices **L3**

**Text Books:**

1. Beckwith, Marangoni, Linehard, Mechanical Measurements, 6/e, PHI, 2013.
2. R.K. Jain, Engineering Metrology, 20/e, Khanna Publishers, 2013.

**Reference Books:**

1. Mahajan, Engineering Metrology, 2/e, Dhanpat Rai, 2013.
2. S.Bhaskar, Basic Principles - Measurments and Control Systems, Anuradha Publications, 2014.
3. Anand K Bewoor & Vinay A Kulkarni, Metrology & Measurement, 15/e, McGrawHill, 2015.

**Course Outcomes:**

At the end of this Course the student will be able to

- List various measuring instruments used in metrology. **L4**
- Examine geometry of screw threads and gear profiles. **L4**
- Measure force, torque and pressure. **L5**
- Calibrate various measuring instruments. **L4**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME72 – INTRODUCTION TO CAD/CAM**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about
- Understand the basics of CAD/CAM, geometric representation, transformations.
- Explain geometric modeling methods in CAD.
- Familiarize numerical control (NC), computer numerical control (CNC) and direct numerical control (DNC) machines.
- Impart knowledge on manual part programming and computer aided part programming.
- Explain the principles robotics, CIM, AR,VR and AI in CIM

**UNIT – 1: CAD/CAM, 2D and 3D geometric transformations** **12 Hrs**

**CAD/CAM:** Introduction, hardware and software, I/O devices, benefits. Graphics standards-Neutral file formats – IGES, STEP.

**2D and 3D geometric transformations:** Translation, scaling, rotation, mirroring, homogenous transformations, concatenation of transformations, viewing transformations.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- List various input and output devices **L1**
- Apply geometric transformations in 2D and 3D **L3**
- Apply window to viewport transformation. **L3**

**UNIT – II: Parametric representation & Geometric Modelling of Solids** **10Hrs**

**Parametric representation:** Representation of curves, Hermite curves, Spline, Bezier and B-spline curves in two dimensions; Geometric modelling of surfaces: Surface patch, Coons and bicubic patches, Bezier and B-spline surfaces, sweep surfaces, surface of revolution, blending of surfaces;
**Geometric Modelling of Solids**: Wireframe, surface modelling, solid entities, boolean operations, CSG approach and B-rep of solid modelling, geometric modelling of surfaces.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- Apply the concepts of parametric representation to curves and surfaces. **L3**
- Create surfaces such as Coons, Bezier and B-spline **L6**
- Differentiate wireframe, surface and solid modeling. **L4**
- Apply the solid modeling concepts. **L3**

**UNIT – III: Computer Aided Manufacturing (CAM)** **8Hrs**

Structure of numerical control (NC) machine tools, designation of axes, drives and actuation systems, feedback devices, computer numerical control (CNC) and direct numerical control (DNC), adaptive control system, CNC tooling, automatic tool changers and work holding devices, functions of CNC and DNC systems.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- Identify the differences between NC, CNC and DNC **L3**
- Use devices and activation systems. **L3**
- Apply adaptive control system **L3**
- Apply different tooling and tool chargers, working holding devices. **L3**

**UNIT – IV: Part programming and APT Programming** **10 Hrs**

**Part Programming:** Part programming instruction formats, information codes, preparatory functions, miscellaneous functions (G-codes, M-codes). Tool codes and tool length offset, interpolations canned cycles.

APT Programming: APT language structure, APT geometry, Definition of point, line, circle, plane.

APT Motion Commands: set-up commands, pint to point motion commands; continuous path motion commands part programming preparation for typical examples (milling and turning operation)

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply the fundamentals of part programming in CNC. **L3**
- Use G codes, M codes in CNC part programs. **L3**
- Apply the concept of canned or fixed cycles for the hole making operations. **L3**
- Identify geometric features in APT language. **L3**

**UNIT – V: Automation** **8Hrs**

**Automation:** Anatomy and configuration of robot, characteristics of robots, grippers, application of robots in manufacturing, robot programming languages. Computer integrated manufacturing (CIM): Elements of CIM, Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI) and expert systems in CIM.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Summarize the fundamentals of robotics. **L2**
- Categorize the CIM environment and its elements. **L4**
- Explain the role VR, AR and AI in manufacturing engineering. **L3**

**Text Books:**

1. P.N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017.
2. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, 2/e, Tata McGraw-Hill, Delhi, 2009.

**Reference Books:**

1. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008.
2. P. Radhakrishnan, S. Subramanyan & V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008.
3. Computer Aided Manufacturing, 3/e, Tien Chien Chang, Pearson, 2008.

**Course Outcomes:**

At the end of this Course the student will be able to

- Apply the basics of geometric representation and transformations in CAD/CAM **L3**
- Choose geometric modeling methods for building CAD models. **L1**
- Compare NC, CNC and DNC **L2**
- Develop manual and computer aided part programming for turning and milling operations. **L3**
- Summarize the principles of robotics AR, VR and AI in CIM **L2**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME73 – FINITE ELEMENT ANALYSIS**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize basic principles of finite element analysis procedure.
- Explain theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, dynamic problem.
- Learn to model complex geometry problems and solution techniques.
- Understand the importance of Quality standards in manufacturing.

**UNIT – 1: Introduction to finite element methods** **12 Hrs**

**Introduction to finite element methods** for solving field problems, applications, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, Rayleigh-Ritz method, Formulation of Finite Element Equations.

**One dimensional Problem:** Finite element modelling of ID bar elements, coordinates and shape functions. Requirements for Convergence and Interpolation functions, Pascal's Triangle, Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the numerical methods involved in Finite Element theory **L2**
- Understand direct and formal (basic energy and weighted residual) methods for deriving finite element equations. **L2**
- Understand the concept of nodes and elements **L2**
- Understand the general steps of finite element methods. **L2**

**UNIT – II: Parametric representation & Geometric Modelling of Solids** **10Hrs**

**Analysis of trusses:** Stiffness Matrix for 1D truss element, Stress Calculations and Problems with maximum of three elements.

**Analysis of beams:** Element Stiffness Matrix and Load vector for 1 D beam element, Hermite shape functions and simple problems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the use of the basic finite elements for structural applications using truss and beam. **L2**
- Formulate and analyze truss and beam problems. **L6**

**UNIT – III: Two dimensional Problems** **10Hrs**

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses.

Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the formulation of two – dimensional elements (Triangular Elements). **L2**
- Apply the formulation techniques to solve two – dimensional problems using triangle elements **L3**
- Formulate and solve axisymmetric problems **L6**

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**UNIT – IV: Quadrilateral Elements** **8 Hrs**

**Quadrilateral Elements:** Isoparametric, Sub parametric and Super parametric elements, Modelling of 4 noded and 8 noded quadrilateral elements and simple problems. Numerical Integration.

**Steady state heat transfer analysis:** One dimensional analysis of composite slab and fin.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the formulation of two – dimensional elements (Quadrilateral Elements). **L2**
- Apply the formulation techniques to solve two – dimensional problems using quadrilateral elements. **L3**
- Explain the application and use of the Finite Element Methods for heat transfer problems **L2**
- Formulate and solve heat transfer problems. **L6**

**UNIT – V: Dynamic analysis** **8Hrs**

Analysis of a 1D uniform shaft subjected to torsion – Simple problems

**Dynamic analysis:** Formulation of finite element model, element – mass matrices, evaluation of Eigen values and Eigen vectors for a bar and shaft.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand problems involving dynamics using Finite Element Methods. **L1**
- Evaluate the Eigen values and Eigen Vectors for steeped bar. **L6**

**Text Books:**

1. Chandraputla, Ashok & Belegundu, Introduction to Finite Element in Engineering, Prentice Hall.
2. S.S.Rao, The Finite Element Methods in Engineering, Elsevier Butterworth Heinemann 2nd Edition

**Reference Books:**

1. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993.
2. S.Md.Jalaludeen, Finite Element Analysis in Engineering, 2nd Edition, Anuradha Publications, 2016.
3. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3rd Edition, John Wiley, New York, 1989.
4. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs,1982.
5. G.Lakshmi Narasaiah, Finite Element Analysis, 1st Edition, B.S. Publications, 2008.
6. O C Zienkiewicz and R L Taylor, the Finite Element Method, 3rd Edition. McGraw-Hill, 1989.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the concepts behind variational methods and weighted residual methods in FEM. **L1**
- Identify the application and characteristics of FEA elements such as bars, beams, and isoparametric elements, and 3-D element. **L2**
- Develop element characteristic equation procedure and generation of global stiffness equation will be applied. **L5**
- Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form. **L6**
- Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer and fluid flow. **L2**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME74a- AUTOMOTIVE TRANSMISSION SYSTEM**

*(Professional Elective-III)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Explain operation and performance of various clutches and gear boxes.
- Familiarize hydrodynamic drives.
- Teach various types of gear boxes used for automotive transmission
- Impart principle of operation and performance of various hydrostatic and electric drives provide.
- Identify the applications of automatic transmission

**UNIT – 1: Clutch & gear box:** **10 Hrs**

Requirements of transmission system and role of clutch in driving system, Types of Clutches, Construction and Working of Single Plate, Multi Plate, Cone Clutch, Centrifugal and Semi Centrifugal clutch and its operating characteristics, Equation for torque capacity of a single plate clutch. Need for a gear box in an automobile and types of Gear boxes – Construction and working of Sliding mesh, Constant mesh gear box, Synchromesh gear box and principle of synchronizers.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the requirements of transmission system **L2**
- Recognize the role of clutch in driving system **L1**
- List various types of clutches **L1**
- Explain the need of gear box in an automobile **L2**

**UNIT – II: Planetary gear trains:** **10Hrs**

Construction and working Principle of Epi-cyclic gear train, Planetary gear box, Ford T Model gear box, Wilson gear box, Cotal electromagnetic transmission and Automatic over drive. Gear ratios for Wilson gear box and Automatic Over drive. Hydraulic control system for Automatic transmission.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate working of epicyclic and planetary gear boxes. **L2**
- Explain electromagnetic transmission. **L2**
- Demonstrate hydraulic control system for automatic transmission. **L2**

**UNIT – III: Hydrostatic drives:** **10Hrs**

Introduction to hydrostatic drives, Working principle, types, Advantages and limitations of Hydrostatic drives, Comparison of hydrostatic drive with hydro dynamic drive, Construction and working of Janny Hydrostatic drive.

**Hydrodynamic and hydrokinetic drives:** Introduction to fluid coupling, Fluid coupling – Construction, Principle of operation and Performance characteristics, Drag torque and various drag reducing devices of fluid coupling, Problems on design and torque capacity of fluid coupling, Construction and working of Torque converter, converter coupling, Multistage torque converter, and Poly phase torque converter - Performance characteristic of multistage and poly phase torque converters.

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**Learning Outcomes:**
At the end of this unit, the student will be able to
- Explain hydrostatic drives **L2**
- Differentiate hydrostatic and hydrodynamic drives. **L2**
- Summarize construction and working of Janny hydrostatic drive **L2**
- Give the advantages and limitations of hydrostatic drives. **L1**

**UNIT – IV: Automatic transmission applications:** **8 Hrs**
Layout of Automatic transmission system, construction and working of Turbo glide transmission, Power glide transmission, ECT- intelligent transmission , Automatic transmission with intelligent electronic control systems, Hydraulic clutch actuation for Automatic transmission.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- Draw layout of automatic transmission system **L3**
- Compare construction and working different types of transmission **L4**
- Explain the working of turbo glide transmission and power glide transmission **L3**
- Identify the importance of intelligent electronic control systems in automatic transmission **L2**

**UNIT – V: Electric Drives:** **8Hrs**
Introduction to Electric drive: Layout Advantages, limitations and performance characteristics of Electric drive, Principle of Early Ward Leonard control system of electric drive. Principle of Modified Ward Leonard control system of electric drive.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- Explain the concepts of electric drives. **L2**
- Contrast the advantages and limitations of electric drives **L2**
- Explain performance characteristics of electric drives **L2**

**Text Books:**
1. Harald Naunheimer , Bernd Bertsche , Joachim Ryborz , Wolfgang Novak "Automotive Transmission:Fundamentals, Selection, Design and Application", 2nd Edition, Springer, 2011.
2. Heldt P.M, "Torque converters", Chilton Book Co., 1992.

**Reference Books:**
1. Newton Steeds & Garrot, "Motor Vehicles", SAE International and Butterworth Heinemann, 2001.
2. CDX Automotive, "Fundamentals of Automotive Technology, Principles and practice", Jones & Barlett Publishers, 2013.
3. SAE Transactions 900550 & 930910.
4. Crouse W.H, Anglin D.L, "Automotive Transmission and Power Train construction", McGraw Hill, 1976.

**Course Outcomes:**
At the end of this Course the student will be able to
- Understand the working principles of clutches and gearboxes **L2**
- Remember the working of planetary gear box. **L1**
- Identify the differences between the hydrostatic and hydrodynamic drives **L2**
- discuss various types of automatic transmission systems **L3**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME74b – ADDITIVE MANUFACTURING**

*(Professional Elective-III)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize of additive manufacturing / rapid prototyping and its applications in various fields.
- Impart reverse engineering technician.
- Explain different processes available in additive manufacturing.
- Bring awareness on mechanical properties of materials and geometric issues related to additive manufacturing applications.

**UNIT – I: Introduction to Additive Manufacturing (AM) Systems:** **10 Hrs**

History and Development of AM, Need of AM, Difference between AM and CNC, Classification of AM Processes: Based on Layering Techniques, Raw Materials and Energy Sources, AM Process Chain, Benefits and Applications of AM, Representation of 3D model in STL format, RP data formats: SLC, CLI, RPI, LEAF, IGES, CT, STEP, HP/GL.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the applications for additive manufacturing processes. **L3**
- Explain the process of additive manufacturing. **L2**
- represent a 3D model in STL format and other RP data formats to store and retrieve the geometric data of the object **L3**

**UNIT – II: CAD & Reverse Engineering:** **10Hrs**

Basic Concept, Digitization techniques, Model Reconstruction, Data Processing for Additive Manufacturing Technology: CAD model preparation, Part Orientation and support generation, Model Slicing, Tool path Generation, Software's for Additive Manufacturing Technology: MIMICS, MAGICS. Reverse Engineering (RE) –Meaning, Use, RE – The Generic Process, Phase of RE Scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply various digitalization techniques. **L3**
- explain the concept of reverse engineering and scanning tools **L2**

**UNIT – III: Solid and Liquid Based AM Systems:** **10Hrs**

Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications. Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the principles, advantages, limitations and applications of solid and liquid based AM systems. (L2) **L2**
- Identify the materials for solid and liquid based AM systems. (L3) **L3**

**UNIT – IV: Powder Based AM Systems:** **8 Hrs**

Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the principles, advantages, limitations and applications of powder based AM systems **L2**
- Apply SLS, LENS and EBM 3D printing methods **L3**

**UNIT – V: Other Additive Manufacturing Systems:** **8Hrs**

Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballistic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain principles and limitation of 3D printing using BPM and SDM **L2**
- Use BPM and SDM 3D printing methods **L3**

**Text Books:**

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e World Scientific Publishers, 2003.
3. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007

**Reference Books:**

1. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001
2. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005
4. RafiqNoorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006

**Course Outcomes:**

At the end of this Course the student will be able to

- Demonstrate various additive manufacturing and rapid prototyping techniques applications **L5**
- Describe different additive manufacturing processes. **L4**
- Apply methods in rapid prototyping. **L5**
- Use powder based AM system. **L6**
- Model 3D printing using SDM and BPM methods. **L6**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME74c- MECHANICAL VIBRATIONS**

*(Professional Elective-III)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Demonstrate basic concepts and definitions of mechanical vibrations. To write equation of motion for discrete spring-mass systems with different configuration using classical and energy methods.
- To train the students about basic concepts of forced vibrations, vibration transmissibility and isolation and seismic instruments. Further to understand about various vibration control methods.
- To familiarize the students about two degree freedom system and various types of vibration absorbers.
- To analyze the two degree and multi degree of freedom systems.

**UNIT – I: Single Degree Freedom Systems:** **10 Hrs**

**Single Degree Freedom Systems:** Un-damped free vibration: Classical method, Energy method, equivalent systems, torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient. Simple problems.

**Whirling of shafts: Transverse vibrations:** Dunkerley's lower bound approximation, Critical speed of shafts.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Find natural frequency of un-damped single degree freedom systems **L4**
- Find the behavior of single degree freedom systems with damping **L4**

**UNIT – II: Forced vibrations of Single Degree Freedom Systems** **10Hrs**

Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solve vibration problems with forcing function. **L5**
- Calculate transmissibility and isolation. **L4**
- Explain different types of isolators and power absorbers. **L2**

**UNIT – III: Two Degree Freedom Systems:** **10Hrs**

Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze the two degree freedom systems with and without damping **L4**
- Solve problems on vibration absorber **L5**

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**UNIT – IV: Multi Degree Freedom Systems:** **8 Hrs**

Lagrangian method for formulation of equation of motion Influence co- efficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of free and forced vibrations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Analyze the multi degree freedom systems using Stodola method, Holzer"s method and Matrix iteration method. **L5**
- calculate natural frequencies with Rayleighs method and Dunkerleys method **L4**

**UNIT – V: Vibration measurement and Applications** **8Hrs**

Transducers: variable resistance transducers, Piezoelectric transducers, electrodynamic transducers and linear variable differential transformer transducer; Vibration pickups: vibrometer, accelerometer, velometer and phase distortion; Frequency-measuring instruments; Vibration exciters- Mechanical exciters and electrodynamic shaker.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify various transducers **L3**
- Use different vibration pickups **L4**
- Explain mechanical exciters and electro dynamic shaker **L2**

**Text Books:**

1. Singrasu S. Rao, Mechanical Vibrations, 6/e, Pearson Education, 2018.
2. G.K.Groover, Mechanical Vibrations, 8/e, 2009

**Reference Books:**

1. L. Meirovich, Elements of Vibrations Analysis, Tata McGraw Hill, 1986
2. S. Graham Kelly, Mechanical Vibrations, Tata McGraw Hill, 1996
3. William Thomson, Theory of Vibrations with Applications, 5/e, Pearson, 2008
4. William Weaver, Timeoshenko, and Young, Vibration Problems in Engineering, 5/e, John Wiley, 2013
5. C. Nataraj, Vibration of Mechanical Systems, 1/e, Cenage Learning, 2012

**Course Outcomes:**

At the end of this Course the student will be able to

- find natural frequency of un-damped single degree freedom systems. **L4**
- analyze the two degree freedom systems with and without damping. **L4**
- Calculate transmissibility and isolation. **L4**
- Solve problems on vibration absorber. **L5**
- Calculate natural frequencies of multi degree freedom system. **L4**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME74d- REFRIGERATION AND AIR CONDITIONING**

*(Professional Elective-III)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Provides insights in how thermodynamic principles are applied within the refrigeration and air conditioning industry.
- Introduce the students how real systems used in commercial, industrial refrigeration and air conditioning industries are built-up.
- Expose the students on various refrigeration methods like VCR, VAR and latest developments.
- Know the various air conditioning methods like summer, winter and year round air conditioning and to make the student to understand the practical applications of refrigeration and air conditioning systems.

**UNIT – 1: Introduction To Refrigeration** **10 Hrs**

**Introduction To Refrigeration:** Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods.

**Air Refrigeration:** Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Numerical Problems - Refrigeration Needs of Air Crafts.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the terminologies associated with refrigeration. **L2**
- Describe the first and second law applied to refrigerating machines. **L2**
- Demonstrate the Bell-Coleman cycle in air refrigeration. **L2**
- Identify the various refrigeration cycles. **L3**

**UNIT – II: Vapour Compression Refrigeration** **10Hrs**

Vapour Compression Refrigeration ( VCR ) System - Basic Cycle - Working Principle and Essential Components of the Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Actual Cycle- Influence of Various Parameters on System Performance - Construction and Use of P-h Charts - Numerical Problems. Refrigerants - Desirable Properties - Classification of Refrigerants Used - Nomenclature- Secondary Refrigerants- Lubricants - Ozone Depletion - Global Warming- Newer Refrigerants.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Appraise the importance of vapour compression refrigeration system. **L5**
- Draw the T-S and P-h charts for representation of cycle **L1**
- Classify various refrigerants used in vapour compression refrigeration systems **L1**
- Model the numerical problems on refrigeration cycles. **L3**
- Demonstrate the influence of various parameters on system performance **L2**

**UNIT – III: Vapor Absorption Refrigeration ( VAR ) System-** **10Hrs**

**Vapor Absorption Refrigeration ( VAR ) System-** Description and Working of $NH_3$ - Water System and Li Br -Water ( Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System

**Steam Jet Refrigeration System:** Working Principle and Basic Components-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (ii) Vortex Tube or Hilsch Tube.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Appraise the importance of vapour absorption refrigeration system. **L5**
- Identify the latest developments of Electrolux, thermo electric vortex tube methods. **L3**
- Illustrate the working of various components of steam jet refrigeration system. **L2**
- Estimate the motive steam required for steam jet refrigeration system **L6**
- Describe the working principle of Themo- Electric refrigerator and bortex tube refrigerator **L2**

**UNIT – IV: Introduction To Air Conditioning** **8 Hrs**

**Introduction To Air Conditioning:** Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads - Need For Ventilation, Consideration of Infiltrated Air - Heat Load Concepts.

**Air Conditioning Systems:** Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Illustrate the psychrometric properties & processes **L2**
- Select the air conditioning systems for different realistic situations **L6**
- Define the terms sensible heat load and latent heat load **L1**
- Draw the psychrometric charts for various air conditioning environments **L1**

**UNIT – V: Air Conditioning Equipment** **8Hrs**

Air Conditioning Equipment - Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.

**Human Comfort:** Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump - Heat Sources - Different Heat Pump Circuits.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Appraise the importance of humidifiers and dehumidifiers. **L5**
- Select the requirements of temperature and humidity for human comfort. **L6**
- Demonstrate the heat pump working and its components. **L2**
- List the various air conditioning equipments. **L1**

**Text Books:**

1. Refrigeration and Air Conditioning ,CPArora,TMH, 15th edition, 2013.
2. A Course in Refrigeration and Air conditioning,S.CArora&Domkundwar, Dhanpatrai

**Reference Books:**

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013
2. Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007
3. Refrigeration and Air Conditioning-P.L.Ballaney, 2nd edition, 2012.
4. Basic Refrigeration and Air-Conditioning - P.N.Ananthanarayanan / TMH, 4th edition, 2013.

***NOTE:*** *Tables/Codes: Thermal Engineering Data Book containing refrigerant and Psychrometric property Tables and charts are permitted in Exam*

**Course Outcomes:**
At the end of this Course the student will be able to

- Summarize the various refrigeration and air conditioning equipments and it's working **L3**
- Apply the basic knowledge to operate the refrigeration systems **L6**
- Evaluate the COP for vapour absorption system **L4**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME74e – MATERIAL CHARACTERIZATION**

*(Professional Elective-III)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about
- Familiarize the fundamentals in material characterization.
- Explain principles in X-ray diffraction and Stereographic projections.
- Describe the fundamental principles of characterization.
- Evaluate the uncertainty of observations and results from the different methods.
- Impart the methods of characterization for different material problems.

**UNIT – 1: Basic crystallography and Need for Material Characterization** **10 Hrs**

**Basic crystallography and Need for Material Characterization** - unit cells, Crystal structure, Primitive and Non- primitive cells, Symmetry elements and point group notations, Stereographic projections - Need for Material Characterization - Methodology for Material Characterization and Analysis.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Appraise the importance of materials structure **L5**
- Define the terminology of crystallography **L1**
- Demonstrate the characterization techniques **L2**

**UNIT – II: Diffraction and Imaging** **10Hrs**

**Diffraction and Imaging** - Phenomena of diffraction; Radiation-matter Interactions and response signals; X-ray diffraction: powder diffraction, phase identification, Scherrer formula, strain and grain size determination; Fundamentals of Imaging: magnification, resolution, depth of field and depth of focus aberration and astigmatism; X-Ray reflectivity.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Explain diffraction techniques **L2**
- Utilize fundamental imaging processes **L3**

**UNIT – III: Optical microscopic & Spectroscopic Techniques** **10Hrs**

**Optical microscopic Techniques** - Special microscopy techniques and applications: Bright field and dark field imaging; confocal microscopy; interference microscopy; polarized light microscopy; phase contrast microscopy. Scanning near field laser microscopy; Image processing and quantification.

**Optical Spectroscopic Techniques** - Principle, Working and Result Analysis of Fourier Transformation Infra-Red Spectroscopy; Raman Spectroscopy; UV-Vis Absorption Spectroscopy; Photoluminescence Spectroscopy - Ellipsometer Spectroscopy.

**Learning Outcomes:**

At the end of this unit, the student will be able to
- Identify the need for microscopy and types of microscopy. **L3**
- Summarize optical microscopy principles and working. **L2**
- Explain basic aspects of optical characterization methods. **L2**
- Explain the concepts of spectroscopy. **L2**

**UNIT – IV: Electron Microscopic Techniques** **8 Hrs**

**Electron Microscopic Techniques** - Basics of Electron Microscopy - Introduction - Principle of SEM, Instrumentation, Contrast formation, Operational variables, Specimen preparation, imaging modes, Applications, Limitations – FE-SEM , FIB, EDAX. TEM - Introduction, Instrumentation, Specimen preparation: Mechanical thinning, electrochemical thinning, ion milling, sputter coating and carbon coating, replica methods. Image modes - mass density contrast, diffraction contrast, phase contrast, Applications, Limitations

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain fundamentals of electron microscopy **L2**
- Outline thinning and coating processes **L2**
- Interpret techniques of polishing for image processing **L2**

**UNIT – V: Thermal analysis** **8Hrs**

**Thermal analysis** - Instrumentation, experimental parameters, Differential thermal analysis, Differential Scanning Calorimetry, Thermogravimetry, Dilatometry, Dynamic mechanical analysis-Basic principles, Instrumentation, working principles, Applications, Limitations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain thermal stability techniques used for materials. **L2**
- Illustrate principles and working of different equipments used for thermal analysis **L2**

**Text Books:**


- Yang Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, 2/e, Wiley Publications, 2013.


**Reference Books:**


1. D. Brandon and W.D. Kaplan, Microstructural Characterization of Materials, John Wiley and Sons, 2008.
2. S. Zhang, Lin Li and Ashok Kumar, Materials Characterisation Techniques, CRC Press, 2009.
3. B.D.Williams and C.B.Carter, Transmission Electron Microscopy –Springer, 2009.
4. E.J. Mittemeijer, Fundamentals of Materials Science - the microstructure-property relationship using metals as model systems, Springer, 2010.


**Course Outcomes:**

At the end of this Course the student will be able to

- Explain the production of characteristic x-rays **L2**
- Use the principles of diffraction (Bragg's Law) in determination of crystal structure determination **L2**
- Interpret the properties of electrons and the affect of accelerating potential **L2**
- Apply basic operational modes of a SEM and TEM **L2**
- Explain the formation of diffraction patterns in the electron microscopes **L2**

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**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME74f- PRODUCTION AND OPERATIONS MANAGEMENT**

*(Professional Elective-III)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Introduction to the technical design and manufacturing operations and supply management to the sustainability of an enterprise.
- Need for forecasting and types of forecasting.
- Import the basic principles of project management and other business functions such as value engineering, purchasing, marketing, finance etc.
- Analyze the new demands of the globally competitive business environment that supply chain managers face today.
- Knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

**UNIT – 1: Introduction:** **10 Hrs**

Operations Management – Definition, Objectives, Types of Production System, Difference between OM & PM, Historical Development of Operations Management, Current Issues in Operation Management, Product Design – Requirements of Good Product Design, Product Development – Approaches, Concepts in Product Development, Standardization, Simplification, Speed to Market, Introduction to Concurrent Engineering.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of operations management, production systems **L1**
- Analyze steps in design a new product. **L4**

**UNIT – II: Forecasting:** **10IIrs**

Introduction, Statistical Forecasting Techniques, Moving Average, Exponential Smoothing Technique, Errors in Forecasting and Evaluation of Forecasting Techniques.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of forecasting. **L1**
- Understand and analyze the various methods of forecasting **L1**

**UNIT – III: Value Engineering and Plant Layout:** **10Hrs**

Value Engineering – Objectives, Types of Values, Function and Cost, Product Life Cycle, Steps in Value Engineering, Methodology in Value Engineering, FAST Diagram and Matrix Method. Facility Location and Layout – Factor Considerations in Plant Location, Comparative Study of Rural and Urban Sites, Methods of Selection of Plant Layout, Objectives of Good layout, Principles, Types of Layout, Line Balancing.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of value engineering **L1**
- Identify the factors for locating a Plant Layout **L3**
- Understand types of plant layout and line balancing **L1**

**UNIT – IV: Aggregate Planning and MRP:** **8 Hrs**

Aggregate Planning – Definition, Different Strategies, Various Models of Aggregate Planning-Transportation and Graphical Models, Master scheduling, Material Requirement Planning(MRP)-Terminology, Types of Demands, Inputs to MRP, Techniques of MRP, Lot Sizing Methods, Benefits and Drawbacks of MRP, Manufacturing Resources Planning (MRP II), Just in Time (JIT) Philosophy, Kanban System, Calculation of Number of Kanbans, Pull Systems vs. Push Systems, Requirements for Implementation of JIT, JIT Production Process, Benefits of JIT.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Understand the concepts of aggregate planning, material requirement planning and JIT **L1**
- Implement the concepts of JIT **L5**

**UNIT – V: Scheduling:** **8Hrs**

Policies, Types of Scheduling, Scheduling Strategies, Scheduling and Loading Guidelines, Forward and Backward Scheduling, Grant Charts, Priority Decision Rules, Flow Shop Scheduling, Job Shop Scheduling, Line of Balance.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Understand types and policies of scheduling. **L1**
- Analyze and implement single machine, parallel machine, flow shop, and job shop scheduling algorithms **L6**

**Text Books:**

1. Buffa E.S. and Sarin R.K., Modern Production / Operations Management, 8th Edition, Wiley India Pvt. Ltd., New Delhi, 2009.
2. Joseph G. Monks, Operations Management-Theory and Problems, 3rd Edition, McGraw Hill Education, 1987.

**Reference Books:**

1. James L. Riggs, Jim Rigs, Production Systems: Planning, Analysis and Control, 4th Edition, Wave Land Press, 1992.
2. Chary S.N., Production and Operations Management, 5th Edition, McGraw Hill Education, 2017.
3. Richard B.Chase, Ravi Shankar, Robert Jacobs F., Operations and Supply Chain Management, 15th Edition, McGraw Hill Education, 2018.
4. Pannerselvam R., Production and Operations Management, 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
5. Steven Nahmias, Tava Lennon Olsen, Production and Operation Analysis: Strategy – Quality – Analytics – Applications, 7th Edition, Waveland Press Inc., 2015.

**Course Outcomes:**
At the end of this Course the student will be able to

- Demonstrate the operations and supply management to the sustainability of an enterprise **L2**
- Identify the need for forecasting and understand different forecasting methods **L3**
- Identify various production and plant layouts **L3**
- Examine the quality control of the production **L4**

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**19AME76a- VEHICLE DIAGNOSIS AND CONTROL**

*(Professional Elective-IV)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce various techniques in Vehicle Diagnosis.
- Familiarize sensors and actuators associated with Oscilloscope Diagnostics
- Identify various faults in the engine system.
- Discuss the concepts of engine system and vehicle systems diagnosis

**UNIT – 1: Introduction To Fault Diagnosis** **10 Hrs**

Introduction To Fault Diagnosis, Safe Working Practices And Techniques. Diagnostics On Paper, Mechanical And Electrical Diagnostic Techniques. Faults Codes, Systems And Standards. On and Off Board Diagnostics. Data Sources, Tools And Equipments. Oscilloscopes, Scanners/Fault Code Readers, Engine Analyzers. Application Methods and Procedures.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the safe working practices and techniques of fault diagnosis. **L2**
- Demonstrate on fault codes, systems and standards. **L2**
- List various tools and equipments used for fault diagnosis. **L1**

**UNIT – II: On and off Board Diagnostics.** **10Hrs**

Introduction to oscilloscope Diagnostics. Sensors And Actuators Associated With Oscilloscope Diagnostics. On-Board Diagnostics Various Perspectives. Petrol/Gasoline On-Board Diagnostics. On-Board Sensors And Actuators. Sensors And Actuators Comparative Case Study.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List various sensors and actuators associated with oscilloscope Diagnostics. **L1**
- Explain Various Perspectives of On-Board Diagnostics. **L2**
- Determine the practical applications of onboard sensors and actuators **L3**

**UNIT – III: Engine Systems Diagnostics** **10Hrs**

Introduction Engine Systems Diagnostics. Engine Operation And Fuel System. Ignition System And Emission System. Fuel Injection, Starting And Charging System. Power Flow Control And Energy Efficiency Analysis. Engine Management and Fault finding Information. Air Supply, Exhaust System, Cooling and Lubrication System.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concepts of engine operation and fuel system **L2**
- Explain the working of fuel injection, starting and charging systems **L2**
- Discuss the importance of engine management and fault finding information **L3**

**UNIT – IV: Chassis and Brake System Diagnosis.** **8 Hrs**

Introduction to Vehicle System Diagnostics, Anti-Lock Braking System Diagnostics. Traction Control System Diagnostics, Steering And Tires. Transmission Systems Diagnostics.

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Demonstration on antilock braking system diagnostics **L2**
- Familiarize with the concepts of traction control system Diagnostics **L3**
- Identify the importance of transmission system diagnostics **L2**

**UNIT – V: Electrical Systems Diagnosis** **8Hrs**

Introduction To Electronic Components And Circuits. Multiplexing And De Multiplexing. Lighting System Faults And Auxiliary Faults. In-Car Entertainment Security And Communications Implementation. Body-Electrical Systems, Instruments System Faults. Heating Ventilation and Air Conditioning. Cruise Control, Air Bags And Belt Tensioners.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recall the concepts of electronic circuits and electronic components **L1**
- Compare multiplexing and demultiplexing **L4**
- Explain the various types of faults in electrical systems **L2**

**Text Books:**

1. Richard.C.Dorf and Robert.H.Bishop , "Modern Control System" 12th edition Pearson Prentice Hall,2013.
2. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.

**Reference Books:**

1. Tom denton "Advanced automotive fault diagnosis", Elsevier butterworth-heinemann linacre house, jordan hill, oxford ox2 8dp, uk - isbn-10: 0-75-066991-8.
2. Tom Denton "Automotive Electronics Handbook", - - McGraw-Hill Publishing Co.; 2nd Revised edition 1999, ISBN10:0070344531
3. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
4. Routledge "Automobile Electrical and Electronic Systems", 4$^{th}$ edition 2012, ISBN10: 0080969429.

**Course Outcomes:**

At the end of this Course the student will be able to

- Perform vehicle diagnosis and apply the fault finding techniques practically **L3**
- Understand the basic concepts of On board and off board diagnosis **L2**
- Recall the concepts of Exhaust, Cooling and Lubrication systems **L1**
- List various faults in the electrical system diagnosis **L3**
- Summarize the principles of traction control system diagnosis and transmission system diagnosis **L2**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME76b- MECHATRONICS AND MEMS**

*(Professional Elective-IV)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize the technologies behind modern mechatronic systems.
- Explain fundamentals for the development of fully automated system.
- Develop a robotic or automated systems focusing on the hardware and software integration.
- Demonstrate the development of mechatronic system and MEMS.

**UNIT – 1: Introduction:** **10 Hrs**

Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the role of mechatronics in industry. **L2**
- Identify the application of mechatronics in automation industry **L3**

**UNIT – II: Sensors:** **10Hrs**

**Sensors:** Static characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify various types of sensors **L2**
- Choose sensors for particular application **L3**
- Measure different quantity's using sensors **L4**

**UNIT – III: Actuators:** **10Hrs**

Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys, Selection criteria for actuators.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify various actuation systems **L2**
- Choose the criterion for different actuators **L1**

**UNIT – IV: Microprocessors, Microcontrollers and Programmable Logic Controllers** **8 Hrs**

**Microprocessors, Microcontrollers and Programmable Logic Controllers:** Architecture of of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Understand the architecture of microprocessors, microcontrollers and PLC **L2**
- Formulate various programs using PLC **L6**

**UNIT – V: Micro Electro Mechanical Systems (MEMS): 8Hrs**
History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, Applications: Lab on chip.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Demonstrate the knowledge of MEMS **L2**
- Classifying different fabrication techniques of MEMS **L4**
- Illustrate the application of MEMS in industry **L2**

**Text Books:**

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering , WBolton, 3/e Pearson Education Press, 2005.
2. Devadas Shetty and Richard A Kolk, Mechatronic System Design, 2/e, Cengage learning, 2010.

**Reference Books:**

1. Clarence W. de Silva, Mechatronics an Integrated Approach, CRC Press, 2004.
2. James J Allen, Micro Electro Mechanical Systems Design, CRC Press Taylor & Francis group, 2005.
3. Ganesh S Hedge, Mechatronics, Jones & Bartlett Learning, 2010.

**Course Outcomes:**
At the end of this Course the student will be able to

- Explain mechatronics systems in industry **L2**
- Identify mechatronic systems encountered in practice **L3**
- Examine the components of a typical mechatronic system **L4**
- Compare the various techniques used for development of MEMS **L4**
- Develop programs using PLC **L6**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME76c- DESIGN OF OIL HYDRAULIC AND PNEUMATIC SYSTEMS**

*(Professional Elective-IV)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize on Fluid Power Engineering and Power Transmission System.
- Introduce the students, the basic concepts of hydraulic and pneumatic systems.
- Expose the students with various hydraulic and pneumatic actuators.
- Familiarize on fluid power systems and its applications to real time.
- Know the problem, which occur in fluid power systems and take necessary troubleshooting/ maintenance activities.

**UNIT – 1: Introduction:** **10 Hrs**

**INTRODUCTION:** Introduction to fluid power - Types, advantages and application of fluid power systems. Properties of hydraulic fluids – General types of fluids – Fluid power symbols as per ISO/ANSI. Basic Components of Oil Hydraulic and Pneumatic Systems. Comparison of Mechanical, Electrical, Hydraulic & Pneumatic systems for force and motion analysis in automation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concepts of fluid power and its types **L2**
- List the advantages and applications of fluid power systems. **L1**
- Explain the properties of hydraulic fluids **L2**
- Draw the ISO/ANSI symbols of fluid power **L1**
- Compare mechanical, electrical, hydraulic and pneumatic systems. **L2**

**UNIT – II: Oil Hydraulic Pumps, Actuators:** **10Hrs**

**OIL HYDRAULIC PUMPS, ACTUATORS:** Types of hydraulic pumps - construction and working principle - design considerations, selection, specifications and characteristics of pumps. Types of actuators-construction and working principle - design considerations, selection, specifications and characteristics of actuators.

**CONTROL AND REGULATION ELEMENTS:** Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. Selection of valves for hydraulic circuits.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the basic working principles of the hydraulic pumps and actuators **L2**
- List the types of pumps and actuators. **L1**
- Explain the design considerations of pumps and actuators. **L2**
- Identify the importance of control and regulation elements in fluid power **L3**
- Select the valves for hydraulic circuits **L1**

**UNIT – III: Design Of Hydraulic Circuits:** **10Hrs**

**Design Of Hydraulic Circuits:** Speed control circuits - Regenerative circuits- Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier–Intensifier circuit. - Reservoir design - Selection of components. Hydraulic circuits - Reciprocating - Quick return - Sequencing synchronizing - Safety circuits - Industrial circuits - Press - Milling Machine - Planner - Fork Lift.

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**Learning Outcomes:**
At the end of this unit, the student will be able to

- Develop the hydraulic circuits for practical applications L6
- Create circuits for various machines. L6
- Discuss the importance of accumulators and intensifiers in hydraulic circuits L6
- Select the size of the accumulators. L1
- Explain the working principles of safety circuits L2

**UNIT – IV: Pneumatic Systems:** **8 Hrs**

Pneumatic fundamentals - Properties of air – Compressors – Filter, Regulator, and Lubricator unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Control Elements - Logic Circuits -Position - Pressure Sensing - Switching – Electro Pneumatic - Electro Hydraulic Circuits - Robotic Circuits.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Explain the fundamental concepts of pneumatic systems L2
- List the properties of air for pneumatic system L1
- Demonstrate on F-R-L UNIT L2
- Identify various control elements in pneumatic system L3
- Develop electro pneumatic and electro hydraulic circuits for robotic applications L6

**UNIT – V: Design Of Pneumatic Circuits:** **8Hrs**

Classic-Cascade-Step counter - Combination -Methods - PLC-Microprocessors -Uses - Selection criteria for Pneumatic components - Installation and Maintenance of Hydraulic and Pneumatic power packs - Fault finding - Principles of Low Cost Automation - Case studies.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Design a pneumatic circuit using classic, cascade and step counter methods L6
- Select pneumatic components for installation and maintenance of power packs L1
- Explain the architectures of PLC and Microprocessors L2
- Develop logical circuits in PLC for automation L6
- Determine the faults in fluid power systems L3

**Text Books:**

1. Anthony Esposito, “Fluid Power with Applications”, Pearson Education 2000.
2. Majumdar S.R, “Oil Hydraulics”, Tata McGraw Hill, 2000.
3. Majumdar S.R, “Pneumatic Systems – Principles and Maintenance”, Tata McGraw Hill, 2001.

**Reference Books:**

1. Dudelyt, A. Pease and John T. Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
2. Andrew Parr, Hydraulic & Pneumatics, 2/e, Jaico Publishing House Elsevier, 1999.
3. Harry L. Stevart D.B, “Practical Guide to Fluid Power”, Taraoeala Sons and Port Ltd. Broadey, 1976.

**Course Outcomes:**
At the end of this Course the student will be able to

- Compare the differences between hydraulic and pneumatic systems L2
- Identify the practical applications in automation L3
- Build the circuits for a given applications L6
- Develop hydraulic and pneumatic power packs L6
- Discuss the importance of PLC and microprocessor in hydraulic and pneumatic systems L6

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME76d- COMPUTATIONAL FLUID DYNAMICS**

*(Professional Elective-IV)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Teach the basics of the major theories, approaches and methodologies used in CFD.
- Familiar with the differential equations for flow phenomena and numerical methods for their solutions.
- Introduce explicit and implicit schemes in hyperbolic equations.
- Expose the students to solve the problems through finite volume method.
- Understand the concepts of linear fluid flow problems, steady state problems and transient problems.

**UNIT – 1: Introduction & Solution methods** **12 Hrs**

**Introduction:** Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

**Solution methods:** Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Compare FDM, FEM, FVM methods **L2**
- List the various solution methods of elliptical equations **L1**
- Identify the types of parabolic equations **L3**

**UNIT – II: Hyperbolic equations:** **10Hrs**

Explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe explicit and implicit schemes **L2**
- List second order one-dimensional wave equations **L1**
- Explain the Runge-Kutta method **L2**
- Explain Von Neumann stability analyses **L2**

**UNIT – III: Formulations Of Incompressible Viscous Flows:** **10Hrs**

**Formulations Of Incompressible Viscous Flows:** Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

**Treatment of compressible flows:** potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- Apply numerical models to fluid flow and heat transfer calculations **L3**
- Determine incompressible viscous flows by FDM, PCM and Vortex methods **L3**
- Formulate potential equation and Euler equations **L6**

**UNIT – IV: Finite Volume Method:** **8 Hrs**
Finite volume method via finite difference method, formulations for two and three-dimensional problems.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- Formulate finite volume method for two and three dimensional fluid flow problems **L3**
- Solve the fluid flow problems using finite volume method **L6**

**UNIT – V: Standard Variational Methods:** **8Hrs**
Linear fluid flow problems, steady state problems, Transient problems.

**Learning Outcomes:**
At the end of this unit, the student will be able to
- Model equations for linear fluid flow, steady state and transient flow problems. **L3**
- Apply standard variational methods to solve fluid flow problems **L3**

**Text Books:**
1. Computational fluid dynamics/ T. J. C'hung/ Cambridge University press,2002.
2. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.

**Reference Books:**
1. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985.
2. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
3. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications.
4. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
5. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford

**Course Outcomes:**
At the end of this Course the student will be able to
- Summarize the major theories, approaches and methodologies used in CFD. **L2**
- Formulate finite volume method for two and three dimensional fluid flow problems. **L3**
- apply numerical models to fluid flow and heat transfer calculations **L3**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME76e – GEOMETRIC DIMENSIONING AND TOLERANCING**

*(Professional Elective-IV)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Teach the basics of the geometric dimensioning and tolerances.
- Familiar with the form and orientation tolerances.
- Introduce tolerances of profiles of lines and surfaces with or without datums.
- Expose the students to various surface roughness parameters and their measurements in two dimensions.
- Understand the concepts of dimensional chains and inspection techniques.

**UNIT – 1: Basic Concepts** **12 Hrs**

General terms and definitions of geometrical features - General principle of sizes - System of limits and fits - Principles of dimensioning - Introduction to geometric dimensioning and tolerancing (GD&T) - Inspection of dimensional and geometrical deviations - Datums and datum systems, Rule #1 and Rule #2- Boundary principle.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the general terms and definitions of geometrical features **L2**
- List the various boundary principle rules **L1**
- Identify the types of datums and datum systems **L3**

**UNIT – II: Form and Orientation Tolerances** **10Hrs**

Form tolerances: types, specifications and interpretations - measurement and evaluation of straightness, flatness and roundness - Orientation tolerances: types, specifications and interpretations, and verification of orientation tolerances. Exercises on each group.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe orientation tolerances **L2**
- List types of form tolerances and its specifications **L1**
- Explain the measurement and evaluation of straightness and flatness **L2**
- Explain the measurement and evaluation of roundness **L2**

**UNIT – III: Location, Runout and Profile Tolerances** **10Hrs**

Tolerances of location: types, specifications and interpretations - verification techniques - Tolerances of profiles of lines and surfaces with or without datums - Tolerances of runout - Tolerancing of angles and cones. Exercises on each group.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List the types of tolerances of locations **L3**
- Explain the concept of tolerances of run out **L2**
- Explain tolerancing of angles and cones **L2**

**UNIT – IV: Surface Roughness** **8 Hrs**

Various parameters and their measurements in two dimensions - filtering and filtering techniques - areal parameters.

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**Learning Outcomes:**
At the end of this unit, the student will be able to

- Understand the concept of surface parameters in two dimensions **L2**
- Explain the filtering techniques **L2**

**UNIT – V: Related Topics** **9Hrs**

Vectorial dimensioning and tolerancing - Statistical tolerancing of mechanical assemblies - Dimensional chains - Measurement uncertainty - Computer-aided tolerancing and verification. Inspection techniques- conventional and CMM.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Compare various statistical tolerancing of mechanical assemblies. **L3**
- Identify the various computer aided tolerancing techniques. **L3**

**Text Books:**

1. Drake, P. J., Dimensioning and Tolerance Handbook, McGraw-Hill, Inc., New York.
2. Meadows, J. D., Geometric Dimensioning and Tolerancing: Applications and Techniques for use in Design, Manufacturing and Inspection, Marcel Dekker, Inc., New York.
3. Gill, P. S., Geometric Dimensioning and Tolerancing, S. K. Kataria & Sons, New Delhi.

**Reference Books:**

1. Gupta, I. C., A Textbook of Engineering Metrology, Dhanpat Rai Publications, New Delhi.
2. Galyer, J. F. W. and C. R. Shotbolt, Metrology for Engineers, Cassell Publishers, London.
3. Henzold, G., Handbook of Geometrical Tolerancing: Design, Manufacturing and Inspection, John Wiley & Sons, Chichester.
4. Muralikrishnan, B. and J. Raja, Computational Surface and Roundness Metrology, Springer, USA.

**Course Outcomes:**
At the end of this Course the student will be able to

- Introduce the essentials of the language of geometric dimensioning and tolerancing (GD&T) based on ASME and ISO standards, as well as the essentials of surface roughness measurements in both 2D and 3D including filtering techniques. **L2**
- Relate concepts of Vectorial dimensioning and tolerancing, dimensional chains, measurement uncertainty, etc. **L2**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME76f- PRODUCT MARKETING**

*(Professional Elective-IV)*

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce the basic concepts of Product marketing.
- Familiarize with market information systems and research.
- Understand the nature and importance of industrial market.
- Discuss the major stages in new product development.
- Identify the factors affecting pricing decisions.

**UNIT – I: Introduction** **12 Hrs**

Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, Characteristics affecting Consumer behavior, Types of buying decisions, buying decision process, Classification of consumer products, Market Segmentation Concept of Marketing Myopia. Importance of marketing in the Indian Socio economic system.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Define Marketing **L1**
- Discuss marketing philosophies **L2**
- Sketch the buying decision process **L3**
- Understand the importance of marketing in the Indian socio economic system **L2**

**UNIT – II: Marketing of Industrial Products** **10 Hrs**

Components of marketing information system–benefits & uses marketing research system, marketing research procedure, Demand Estimation research, Test marketing, Segmentation Research - Cluster analysis, Discriminate analysis. Sales forecasting: objective and subjective methods. Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behavior, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the components of marketing information system **L2**
- List the advantages and uses of marketing research system **L2**
- Demonstrate sales forecasting **L3**
- Explain the major factors influencing industrial buying behavior **L2**

**UNIT – III: Product Management and Branding** **10 Hrs**

The concept of a product, features of a product, classification of products, product policies – product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of "New – product; major stages in new – product development product life cycle. Branding: Reasons for branding, functions of branding features of types of brands, kinds of brand name.

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**Learning Outcomes:**
At the end of this unit, the student will be able to

- Indentify the factors influencing change in product mix **L2**
- Sketch various stages in product life cycle **L2**
- Recall the features of a product and product policies **L1**
- Demonstrate on features, functions and reasons of branding **L3**

**UNIT – IV: Pricing and Packaging** **8 Hrs**

Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions Labeling: Types, functions advantages and disadvantages, Packaging: Meaning, growth of packaging, function of packaging, kinds of packaging.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- List the factors affecting pricing decisions **L1**
- Explain the procedure for price determination **L2**
- Employ Pricing strategies and decisions **L3**
- Understand the functions of labeling and packaging **L2**

**UNIT – V: Product Promotion** **8 Hrs**

Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions. Advertising and sales promotion: Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion. Personal Selling: Objectives of personal selling, qualities of good salesman, types of salesman, major steps in effective selling.

**Learning Outcomes:**
At the end of this unit, the student will be able to

- Discuss the procedures for price determination **L2**
- Explain the objectives of advertisement function of advertising **L2**
- List the advantages and disadvantages of advertising. **L1**
- Describe the major steps in effecting selling **L2**

**Text Books:**

1. Philip Kotler, Principles of Marketing, Prentice – Hall.
2. Philip Kotler, Marketing Management, Prentice – Hall.

**Reference Books:**

1. Wiliam J Stanton, Fundamentals of Marketing, McGraw Hill.
2. R.S.N. Pillai and Mrs.Bagavathi, Marketing, S. Chand & Co. Ltd .
3. Rajagopal, Marketing Management Text & Cases, Vikas Publishing House.

**Course Outcomes:**
At the end of this Course the student will be able to

- Understand basic marketing management concepts and their relevance to business development **L2**
- Prepare a questionnaire for market research **L5**
- Design marketing research plan for business organizations **L5**
- Optimize marketing mix to get competitive advantage **L4**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE75a-ARCHITECTURE AND TOWN PLANNING**

**(Open Elective-III)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To know the western architecture and Indian architecture and also to gain knowledge on the principles of architectural design and historical background of town planning.

## A) ARCHITECTURE:

**UNIT – I:**

At the end of this unit, the student will be able to

**History of Architecture:**

**a) Western Architecture:** Egyptian, Greek, Roman Architectures; influences- Comparative Analysis Orders

**b) Indian Architecture:** Vedic age - Indus Valley civilization - Buddhist period; stambas, Slenstas. Roranas, Chaityans, Viharas with one example for each Hindu temples - Evaluation of Dravidian and Indo Aryan Styles - Principle factors. Temple of Aibole, Mahabalipuram, Madurai, Deograph, Bhuvaneshwar, Mount Abu.

**c)** Indo - Sarsanic Architecture; Mosque - Place- FortTomb

**Learning Outcomes:**

Understand the different architectures of Indian and western countries

Understand the various principle factors of architecture

**UNIT – II:**

**Architectural Design:**

**a) Principle of designing** : Composition of plan Relationship between plan and elevation elements, form, surface Mass, Texture, Color,Tone.

**b) Principle of Compositions:** Unity, contrast, proportion, scale, Bab Rhuthm, character. Principles of Planning a Residence; Site Orientation prospect, Grouping, circulation, privacy, services and otherfactors

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the design pricnciples and compositions of architecture

**UNIT – III:**

Introduction of Post-classic Architecture and contribution of eminent architects to modern period.Brief summary of post - classic architecture - Indian and Western Architectural contribution of Edward Lutyens, Le Corbusier), Frank Lloyd Wrigt, Walter Groping, Vender Rohe, Caarihan, Nervi, Oscar Niemyer, Edward Durell stone

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Obtain the knowledge of contribution of different architects in architecture

## B) TOWNPLANNING:

**UNIT – IV:**

**Historical Back Ground:** Town planning in India - town plans of Magad - town plans of ancient Indian towns; Mourya, Pataliputravijayanagara, Delhi.Town planning in the West-town plans of Acropolis, Rome, Paris, London

**Learning Outcomes:**

PTO

At the end of this unit, the student will be able to

- Understand the need of town planning
- Knowledge on planning of different towns in India and other countries

**UNIT – V:**

**Components of Planning;**

a) Zoning
b) Roads and road Traffic.
c) Housing-Slums, Parks, Playgrounds.
d) Public Utility Services.
e) Surveys and maps for planning.
f) Neighbourhood Planning

Planning New town, planning standards, National and regional Planning, town planning and legislation.Garden cities and satellite town

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the different components of town planning
- Knowledge on national standards in country and town planning

**Text Books:**

**Reference Books:**

**A) ARCHITECTURE**

1. Indian Architecture – Vol:- I and II by Percy Brown, Taraporevala Publications, Bombay.
2. Planning and 'Design of Building -Section of Architecture byY.S.Sane.
3. Modern Architecture and Design by Nikolans,Pevshar.
4. Modcrn Idcal Hol1 1ncs for India byR.S.Deshpande.

**B) TOWNPLANNING**

1. Town and Country .Planning - A.J.Brown andH.M.Sherrard.
2. Town Design .-FederikGibbard, Architectural press,London.
3. National Building Code ofIndia.
4. Town Planning in India - Town and Country Planning Organisation, New Delhi1962.
5. Regional Planning - Misra R.P., Mysore University.
6. Urban and Regional Planning; Principles and case studies by K.S.Rama Gouda, Mysore University Publications.
7. Town and Country Planning - P. Abercrombe, Oxford University press.

**Course Outcomes:**

At the end of this Course the student will be able to

- Learn the importance of architecture and its principles in designing
- The different architectures till date and the contribution of different architects
- The necessity of town planning and different components of planning

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE75b-EXPERIMENTAL STRESS ANALYSIS**

**(Open Elective-III)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To bring awareness on experimental method of finding the response of the structure to different types of load
- Demonstrates principles of experimental approach
- Teaches regarding the working principles of various strain gauges
- Throws knowledge on strain rosettes and principles of non destructive testing of concrete
- Gives an insight into the principles of photo elasticity

**UNIT – I:**

**PRINCIPLES OF EXPERIMENTAL APPROACH**: - Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods –Simplification of problems

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Demonstrate the merits and principles of experimental approach
- Give an insight into the uses and advantages of experimental stress analysis

**UNIT – II:**

**STRAIN MEASUREMENT USING STRAIN GAUGES:-**

Definition of strain and its relation of experimental Determinations Properties of Strain Gauge Systems-Types of Strain Gauges – Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – various types –Gauge factor – Materials of adhesion base.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Introduce various strain gauge systems and their properties
- Give information regarding the gauge factor and materials of adhesion bases

**UNIT – III:**

**STRAIN ROSSETTES AND NON – DESTRUCTIVE TESTING OF CONCRETE:-** Introduction – the three elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge. Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Introduces various strain rosettes and corrections for strain gauges
- Gives an insight into the destructive and non destructive testing of concrete

**UNIT – IV:**

**THEORY OF PHOTOELASTICITY**: - Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polariscope for various arrangements – Fringe Sharpening. Brewster‟s Stress Optic law.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Introduces stress optic laws.
- Gives the arrangements and working principles of polariscope

**UNIT – V:**

**TWO DIMENSIONAL PHOTOELASTICITY:** - Introduction – Iso-chromatic Fringe patternsIsoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photoelastic Materials

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Introduces the understanding of different fringe patterns.
- Introduces model analysis and properties of photo elastic materials

**Text Books:**

1. J.W.Dally and W.F.Riley, "Experimental stress analysis College House Enterprises"
2. Dr.Sadhu Singh, "Experimental stress analysis", khanna Publishers

**Reference Books:**

1. U.C.Jindal, "Experimental Stress analysis", Pearson Publications.
2. L.S.Srinath, "Experimental Stress Analysis", MC.Graw Hill Company Publishers.

**Course Outcomes:**

At the end of this Course the student will be able to

- The student will be able to understand different methods of experimental stress analysis
- The student will be able to understand the use of strain gauges for measurement of strain
- The student will be exposed to different Non destructive methods of concrete
- The student will be able to understand the theory of photo elasticity and its applications in analysis of structures

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACE75c-FINITE ELEMENT ANALYSIS**

**(Open Elective-III)**

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**Course Objectives:** The objectives of the course are to make the students learn about

- Familiarize basic principles of finite element analysis procedure.
- Explain theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, dynamic problem
- Learn to model complex geometry problems and solution techniques

**UNIT – I:**

**INTRODUCTION:** Concepts of FEM – Steps involved – merits & demerits – energy principles – Discretization – Rayleigh –Ritz method of functional approximation.

**PRINCIPLES OF ELASTICITY:** Equilibrium equations – strain displacement relationships in matrix form – Constitutive relationships for plane stress, plane strain and Axi-symmetric bodies of revolution with axi-symmetric loading.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of nodes and elements.(L2)
- Understand the general steps of finite element methods.(l2)
- Understand the role and significance of shape functions in finite element formulations (l2)

**UNIT – II:**

**ONE DIMENSIONAL & TWO DIMENSIONAL ELEMENTS:** Stiffness matrix for bar element – shape functions for one dimensional elements – one dimensional problems .Two Dimensional Elements - Different types of elements for plane stress and plane strain analysis – Displacement models – generalized coordinates – shape functions – convergent and compatibility requirements – Geometric invariance – Natural coordinate system – area and volume coordinates

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the formulation of one dimensional and two – dimensional elements (L2)
- Apply the formulation techniques to solveone dimensional two – dimensional problems (L2)
- Formulate and solve axisymmetric problems.(L6)

**UNIT – III:**

**GENERATION OF ELEMENT :**Generation of element stiffness and nodal load matrices for 3-node triangular element and four noded rectangular elements.

**Learning Outcomes:**

At the end of this unit, the student will be able to

Apply the formulation techniques to solve problems using triangle and quadrilateral elements. (L3)

**UNIT – IV:**

**ISOPARAMETRIC FORMULATION :**Concepts of, isoparametric elements for 2D analysis – formulation of CST element, 4 –Noded and 8-noded iso-parametric quadrilateral elements – Lagrangian and Serendipity elements. **AXI-SYMMETRIC ANALYSIS:** Basic principles-Formulation of 4-noded iso-parametric axi-symmetric element

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand concepts of isoparametric elements(L1)
- Formulate and solve axisymmetric problems.(L6)

**UNIT – V:**

**SOLUTION TECHNIQUES:** Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads

**Learning Outcomes:**

At the end of this unit, the student will be able to

**Text Books:**

1. Finite Element Analysis for Engineering and Technology, Tirupathi R Chandraputla, Universities Press Pvt Ltd, Hyderabad.2003.
2. Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers

**Reference Books:**

1. Finite element analysis and procedures in engineering by H.V.Lakshminaryana, 3rd edition, universities press,Hyderabad
2. Finite element analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, NewDelhi
3. Finite element analysis by S.S. Bhavakatti-New age internationalpublishers

**Course Outcomes:**

At the end of this Course the student will be able to

- Demonstrate the differential equilibrium equations and theirrelationship
- Apply numerical methods tofem
- Demonstrate the displacement models and loadvectors
- Compute the stiffness matrix for isoperimetricelements
- Analyze plane stress and plane strainproblems

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE75a- ELECTRICAL ENGINEERING MATERIALS**

**(Open Elective-III)**

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Classification of materials.
- Properties of materials and its applications.
- Domestic wiring and earthling
- Concept of polarization and dipolar polarization
- Classification of materials.

**UNIT – I: Conducting Materials** **10 Hrs**

Introduction – classification of materials – Metals and Non metals, physical, thermal, mechanical and electrical properties of materials–classification of electrical materials–concept of atom – electron configuration of atom, conductors, general properties of conductors, factors effecting resistivity of electrical materials–electrical / mechanical / thermal properties of copper, aluminum, iron, steel, lead, tin and their alloys–applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

1. Understand the classification of conducting materials. **L1**
2. Analyze the properties of different conducting materials **L2**

**UNIT – II: Dielectric and High Resistivity Materials** **10 Hrs**

Introduction–solid, liquid and gaseous di electrics, leakage current, permittivity, dielectric constant, dielectric loss –loss angle –loss constant, Breakdown voltage and di electric strength of –solid, liquid and gaseous dielectrics, effect of break down–electrical and thermal effects, Polarization – electric, ionic and dipolar polarization. Effect of temperature and Frequency on dielectric constant of polar dielectrics. High Resistivity materials – electrical / thermal /mechanical properties of Manganin, Constantan, Nichrome, Tungsten, Carbon and Graphite and their applications in electrical equipment.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the classification of di electric and high resistivity materials. **L1**
- Analyze the properties of di electric and high resistivity materials **L2**

**UNIT – III: Solid Insulating Materials** **10 Hrs**

Introduction–characteristics of a good electrical insulating materials–classification of insulating materials – electrical, thermal, chemical and mechanical properties of solid insulating materials-Asbestos, Bakelite, rubber, plastics, thermoplastics. Resins, polystyrene, PVC, porcelain, glass, cotton and paper.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand about various characteristics of solid insulating materials **L1**
- Understand the classification of solid insulating materials. **L2**

**UNIT – IV: Liquid & Gas Insulating Materials** **10 Hrs**

Liquid insulating materials – Mineral oils, synthetic liquids, fluorinated liquids–Electrical, thermal and chemical properties – transformer oil – properties – effect of moisture on insulation properties Gaseous insulators– classification based on dielectric strength – dielectric loss, chemical stability properties and their applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the classification of liquid insulating materials. **L1**
- Analyze the properties of liquid insulating materials **L2**

**UNIT – V: Domestic Wiring** **10 Hrs**

Wiring materials and accessories–Types of wiring–Types of Switches-Specification of Wiring–Staircase wiring- Fluorescent lamp wiring-God own wiring–Basics of earthling–single phase wiring layout for residential building.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand about wiring materials and accessories **L1**
- Understand about earthing and wiring layout of domestic buildings **L2**

**Text Books:**

1. Electrical Engineering Materials by G.K. Mithal, Khanna publishers, 2nd edition,1991.
2. Acourse in Electrical Engineering Materials by R.K. Rajput, Laxmi publications,2009.

**Reference Books:**

1. An Introduction to Electrical Engineering Materials by C.S.Indulkar and S.Thiruvengadam, SChand&Company,2008.
2. Electrical engineering Materials by Technical Teachers Training Institute, Madras, McGraw Hill Education,1st Edition,2004.
3. A course in Electrical Engineering Materials Physics Properties & Applications by S P.Seth, Dhanapat Rai & Sons Publications,2018.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the classification of materials, domestic wiring materials and earthing. **L1**
- Analyze the properties of different electrical materials **L2**
- Apply where the materials are applicable based on properties of materials **L3**
- Design and develop Residential wiring, go down wiring and earthing. **L4**
- `Understand the characteristics of materials **L5**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE75b- DIGITAL SIGNAL PROCESSORS AND APPLICATIONS**

**(Open Elective-III)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Provide the basic knowledge of different DSP Processors.
- Interfacing Memory and I/O Peripherals to different Programmable DSP Devices
- Operation of the ADC and programming modes
- Introduction to Field Programmable Gate Arrays
- Provide the basic knowledge of different DSP Processors.

**UNIT – I:** **10 Hrs**

**Introduction to the TMSLF2407 DSP Controller:** Brief Introduction to Peripherals - Types of Physical Memory - Software Tools

**C2XX DSP CPU and instruction set:** Introduction to the C2xx DSP Core and Code Generation - The Components of the C2xx DSP Core - Mapping External Devices to the C2xx Core and the Peripheral Interface -System Configuration Registers –Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction Set

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Able to understand the basic concepts of DSP controller **L1**
- Able to understand the Assembly language programming **L2**

**UNIT – II:** **10 Hrs**

**Parallel and Serial Data Transfer:** Pin Multiplexing (MUX) and General Purpose I/O Overview - Multiplexing and General Purpose I/O Control Registers - Using the General Purpose I/O Ports, Serial Communication

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the Pin Multiplexing and GPIO pins **L1**
- Analyze the serial Communication concepts **L2**
- Understand the concept of control Registers **L3**

**UNIT – III:** **10 Hrs**

**Interrupt system of TMS320LF2407:** Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers - Initializing and Servicing Interrupts in Software, real time control with interrupts

**The analog-to-digital converter (ADC):** ADC Overview - Operation of the ADC and programming modes

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of Interrupts **L1**
- Analyze the concept of Analog to digital converter **L2**

**UNIT – IV:** **10 Hrs**

**Event Managers (EVA, EVB):** Overview of the Event Manager (EV) - Event Manager Interrupts - General Purpose (GP) Timers- Compare Units - Capture Units and Quadrature Encoded Pulse (QEP) Circuitry - General Event Manager Information – PWM Signal Generation with Event Managers and interrupts, Measurement of speed with Capture Units, Implementation of Space Vector Modulation with DSP TMSLF2407A

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of Event Manager and Interrupts **L1**
- Apply the concept of Space Vector Modulation with processor **L2**

**UNIT – V:** **10 Hrs**

**Field Programmable Gate Arrays:** Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA , Configurable logic Blocks (CLB), Input/Output Block (IOB) – Programmable Interconnect Point (PIP)- HDL programming –overview of Spartan 6 & ISE Design Suite, Implementation of PWM technique with SPARTAN-6 FPGA

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the concept of Field Programmable Gate Arrays. **L1**
- Apply the concept of HDL programming and PWM technique implementation **L2**

**Text Books:**

1. Hamid A. Tolyat, "DSP based Electromechanical Motion Control"-CRC press, 2004
2. Wayne Wolf,,,FPGA based system design", Prentice hall, 2004

**Reference Books:**

1. Application Notes from the website of Texas Instruments
2. Spartan-6 FPGA Configurable Logic Block, 2010
3. Xilinx Spartan 6 Data sheets

**Course Outcomes:**

At the end of this Course the student will be able to

- Write Assembly Language Programs for the Digital Signal Processors **L1**
- Configure and use Digital Input / Output lines and ADCs **L2**
- Configure and use Interrupts and Event Managers for PWM generation **L3**
- Employ DSPs & **L4**
- FPGAs for the real time control of Power Electronic Controllers **L5**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEE75c- IOT APPLICATIONS IN ELECTRICAL ENGINEERING**

**(Open Elective-III)**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To learn about a few applications of Internet of Things
- To distinguish between motion less and motion detectors as IOT applications
- To know about Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
- To understand about applications of IOT in smart grid
- To introduce the new concept of Internet of Energy for various applications

**UNIT – I: SENSORS** **10 Hrs**

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about basic principles of sensors and their classification **L1**
- To learn about various motion less sensors **L2**

**UNIT – II: Occupancy and Motion detectors** **10 Hrs**

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about Capacitive occupancy **L1**
- To understand about Motion detectors **L2**

**UNIT – III: MEMS** **10 Hrs**

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To understand about the basic concept of MEMS **L1**
- To know about electrostatic actuation **L2**

**UNIT – IV: IOT FOR SMART GRID** **10 Hrs**

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To get exposure fundamental applications of IoT to Smart grid **L1**
- To learn about driving factors of IoT in Generation level **L2**

**UNIT – V: IOE - Internet of Energy** **10 Hrs**

Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IOE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To get exposed the new concept of internet of energy **L1**
- To learn about architecture of IOE **L2**

**Text Books:**

1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017
3. ErsanKabalci and YasinKabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019

**Reference Books:**

1. Raj Kumar Buyya and Amir VahidDastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD SundaramShriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019

**Course Outcomes:**

At the end of this Course the student will be able to

- To get exposed to recent trends in few applications of IoT in Electrical Engineering **L1**
- To understand about usage of various types of motionless sensors **L2**
- To understand about usage of various types of motion detectors **L3**
- To get exposed to various applications of IoT in smart grid **L4**
- To get exposed to future working environment with Energy internet **L5**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME75a – SPECIAL TYPE OF VEHICLES**

*(Open Elective-III)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce the various types of special vehicles.
- Familiarize with the function of graders.
- Identify the applications of haulage vehicles and lift truck
- Understand the functions of scarifiers and scrapers
- Discuss the specifications of special purpose vehicles

**UNIT – I: TRACTORS & CRANES AND EXCAVATORS** **8 Hrs**

**TRACTORS** : General description, specification and functions, light, medium and heavy wheeled tractors, crawler tracks mounted / wheeled - Bull dozers, tilt dozers and angle dozers, front end loaders, factors affecting efficiency of output of tractors, simple problems, merits and demerits.

**CRANES AND EXCAVATORS:** General description, specifications and functions, excavator mounted cranes, mobile cranes with strut and cantilever type jibs, tractor towed and tractor mounted cranes. General description, specification and functions, classification based on attachments, face shovel, drag shovel, hoe, drag-line and grab or clam shell, advantages and limitations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify various types of tractors **L1**
- Calculate the efficiency of output of tractors **L4**
- Discuss the functions of cranes and excavators **L2**
- Recall the advantages and limitations of cranes and excavators **L2**

**UNIT – II: GRADERS** **6Hrs**

Description, specification of tractor towed graders and motor graders, classification and functions of graders, functional details of spreading, mixing, ditching, bank sloping, snow removal, stripping, scarifying, and finishing, elementary details of transmission system (coupling, clutches, gear box, driving axles, propeller shafts), running gear and operating equipment air braking system; hydraulic system and its components, steering system of lights, medium and heavy graders, merits and limitations of graders.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the terms spreading, mixing, ditching, back sloping, scarifying. **L2**
- Discuss elementary details of transmission system **L2**
- Demonstrate the hydraulic system and its components. **L3**
- List the merits and limitations of graders. **L2**

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**UNIT – III: HAULAGE VEHICLES AND LIFT TRUCKS** **6Hrs**

General description, specification and functions, self-propelled and tractor towed haulage vehicles and pneumatic – tires, dumpers – front tipping; trucks – rear tipping, tractor towed semi-trailers and trailers (rear and side tipping, bottom dumping). General description, specification and functions, fork lift trucks, alternative front end equipment (attachments) – Jib arm, shovel bucket, squeeze clamp, boom, fork extensions, barrel forks. Scissors lift trucks - Applications in industry, advantages and disadvantages.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the importance of haulage vehicles and trucks in industries. **L2**
- Select haulage vehicles for a given application **L6**
- Illustrate the function of fork lift trucks. **L3**

**UNIT – IV: Rooters, Scarifiers And Scrapers** **6 Hrs**

General description, specification and functions, tractor towed rooters and scarifiers - Heavy duty, light duty. General description, specification and functions, tractor towed and motorized scrapers, scraper work in cutting, cambering, side hill cutting, spreading on embankments, compaction of fill merits and demerits.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Describe the specifications of rooters **L2**
- Categorize Heavy duty and light duty scarifiers **L4**
- Recall the merits and demerits of scrapers. **L1**

**UNIT – V: Compaction Vehicles And Other Special Purpose Vehicles** **6Hrs**

General description, specification and functions, smooth wheeled rollers, pneumatic tired rollers, agricultural Rollers, sheep's foot rollers, vibrating compactors. General description, specification and functions, Ambulance, oil tankers, surveillance vehicle, television recording mobile UNIT, reefer vehicle, double decker bus, vestibule bus, fire fighting vehicle.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List various types of special purpose vehicles. **L1**
- Choose the rollers for a given application. **L1**
- Discuss the function of compactors. **L2**
- Explain the importance of special purpose vehicles in the society. **L2**

**Text Books:**

1. Peurifoy R L "Construction Planning, Equipment and Methods", Tata McGraw-Hill, NewDelhi, 2002.
2. Ian Graham, "Off-Road vehicles", Heinemann Library, 2008.

**Reference Books:**

1. Wong J "Terramechanics and Off-Road Vehicle Engineering", Butterworth-Heinemann, 2009.
2. Roninson E G, "Motor Graders", MIR Publications, Moscow, 1985.
3. Rodhiev and Rodhiev, "Tractors and Automobiles", MIR Publishers, Moscow, 1984.
4. Greenwich and Soreking, "Tractors", MIR Publishers, Moscow, 1967.

**Course Outcomes:**

At the end of this Course the student will be able to

- Classify excavators based on attachments. **L2**
- Understand the importance of graders. **L2**
- Identify the various types of fork lift attachments. **L2**
- Recall the advantages and disadvantages of special purpose vehicles. **L1**



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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME75b - SIX SIGMA AND LEAN MANUFACTURING**

*(Open Elective-III)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce the students, the basic concepts of six sigma and lean manufacturing.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of cellular manufacturing and 5S.
- Understand the importance of Quality standards in manufacturing.

**UNIT – 1: Introduction to Six-Sigma** **8 Hrs**

Probabilistic models-Six Sigma measures-Yield-DPMO-Quality level-Reliability function using Six-Sigma-MTTF using Six Sigma-Maintenance free operating period- Availability using Six-Sigma-Point availability-Achieved availability-Operational Availability-Examples.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concepts of probabilistic models **L2**
- Determine the reliability function using six-sigma **L3**
- Explain about MTTF using six sigma concepts **L2**
- Illustrate the examples of availability using sigma **L2**

**UNIT – II: The Elements of Six Sigma and their Determination** **6Hrs**

The Quality Measurement Techniques: SQC, Six Sigma, Cp and Cpk- The Statistical quality control (SQC) methods-The relationship of control charts and six sigma-The process capability index (Cp)-Six sigma approach-Six sigma and the 1.5 $\sigma$ shift-The Cpk Approach Versus Six Sigma-Cpk and process average shift- Negative Cpk-Choosing six sigma or Cpk-Setting the process capability index-Examples.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List the quality measurement techniques **L1**
- Discuss the process capability index (Cp).
- Compare the Cpk Approach and Six Sigma
- Explain about different statistical quality control methods
- State the relationship of control charts and six sigma **L2**

**UNIT – III: Introduction To Lean Manufacturing** **6Hrs**

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Illustrate the basic elements of lean manufacturing **L2**
- List the various lean manufacturing tools. **L1**
- Describe the principles of lean manufacturing **L2**
- Compare conventional manufacturing and lean manufacturing system **L2**

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**UNIT – IV: Cellular Manufacturing, JIT, TPM** **6 Hrs**

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concept of cellular manufacturing **L2**
- Indentify the types of layouts. **L3**
- Describe the concepts of JIT and TPM **L2**
- Demonstrate the pillars of TPM **L2**
- Create the cell layout. **L6**

**UNIT – V: Set Up Time Reduction, TQM, 5S, VSM 10** **6Hrs**

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Define set up time reduction. **L1**
- Illustrate the principles and implementation of 5S techniques. **L2**
- Discuss procedure and principles of value stream mapping **L6**
- List the various reduction approaches **L1**

**Text Books:**

1. U Dinesh Kumar, Crocker, Chitra and Harithe Saranga, Reliability and Six Sigma, Springer Publishers.
2. Sung H. Park, Six Sigma for Quality and Productivity Promotion, Asian Productivity Organization

**Reference Books:**

1. Sammy G. Shina, Six Sigma for Electronics Design and Manufacturing, McGraw-Hill.
2. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003.
3. Mikell P. Groover (2002) _Automation, Production Systems and CIM.
4. Rother M. and Shook J, 1999 _Learning to See: Value Stream Mapping to Add Value and Eliminate Muda‘ , Lean Enterprise Institute, Brookline, MA.

**Course Outcomes:**

At the end of this Course the student will be able to

- Summarize various techniques that are related to the six-sigma and lean manufacturing **L2**
- Outline the concepts of cellular manufacturing, JIT and TPM **L2**
- Illustrate the principles and implementation of 5S techniques **L2**
- Discuss procedure and principles of value stream mapping **L6**
- Determine the reliability function using six-sigma. **L3**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME75c – REVERSE ENGINEERING**

*(Open Elective-III)*

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce the concepts of reverse engineering
- Familiarize with the tools and techniques for reverse engineering
- Teach the principles of various rapid prototyping methods
- Discuss the legal aspects of reverse engineering.

**UNIT – 1: Introduction** **8 Hrs**

Scope and tasks of RE, Process of duplicating, Definition and use of Reverse Engineering, Reverse Engineering as a Generic Process

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Recall the definition and use of reverse engineering. **L1**
- Identify reverse engineering as a generic process. **L2**
- List various tasks of reverse engineering. **L1**

**UNIT – II: Tools and Techniques for RE** **6Hrs**

Object scanning: contact scanners, noncontact scanners, destructive method, coordinate measuring machine, Point Data Processing: pre processing and post processing of captured data, geometric model development, construction of surface model, solid model, noise reduction, feature identification, model verification

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Summarize various techniques in reverse engineering. **L2**
- Compare preprocessing and post processing of captured data. **L4**
- Explain noise reduction, feature identification and model verification. **L2**

**UNIT – III: Rapid Prototyping** **6Hrs**

Introduction, current RP techniques and materials, Stereo Lithography, Selective Laser Sintering, Fused Deposition Modelling, Three-dimensional Printing, Laminated Object Manufacturing, Multi – jet Modelling, Laser-engineered Net Shaping, Rapid Prototyping, Rapid Tooling, Rapid Manufacturing

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the developments in the rapid prototyping techniques **L2**
- Classify rapid prototyping techniques. **L2**
- List the advantages and disadvantages of rapid prototyping methods. **L1**

**UNIT – IV: Integration** **6 Hrs**

Cognitive approach to RE, Integration of formal and structured methods in reverse engineering, Integration of reverse engineering and reuse.

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**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the cognitive approach to reverse engineering. **L2**
- Discuss the integration of formal and structured methods in reverse engineering. **L2**

**UNIT – V: Legal Aspects of Reverse Engineering** **6Hrs**

**Legal Aspects of Reverse Engineering:** Introduction, Copyright Law.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the legal aspects of reverse engineering **L2**
- Understand the concepts of copyright law. **L2**

**Text Books:**

1. Biggerstaff T. J., "Design Recovery for Maintenance and Reuse", IEEE Corporation, 1991.
2. Katheryn, A. Ingle, "Reverse Engineering", McGraw-Hill, 1994.

**Reference Books:**

1. Aiken Peter, "Data Reverse Engineering", McGraw-Hill, 1996.
2. Linda Wills,"Reverse Engineering" ,Kluiver Academic Publishers, 1996.
3. Donald R. Honsa , "Co-ordinate Measurement and reverse engineering", American Gear Manufacturers Association, 1996.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the importance of reverse engineering. **L2**
- Make use of tools and techniques of reverse engineering. **L3**
- Identify the applications of rapid prototyping techniques. **L2**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME75d – ENERGY AUDITING**

*(Open Elective-III)*

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce the concepts of energy scenario and need for energy policy for industries in India.
- Familiarize with the Energy Audit concepts and its approaches.
- Teach the principles and objectives of the Energy management.

**UNIT – I: General Aspects** **8 Hrs**

Review of energy scenario in India, General Philosophy and need of Energy Audit and Management, Basic elements and measurements - Mass and energy balances – Scope of energy auditing industries - Evaluation of energy conserving opportunities, Energy performance contracts, Fuel and Energy substitution, Need for Energy Policy for Industries, National & State level energy Policies.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the fundamental aspects of energy scenario in India. **L2**
- List the various national and state level energy policy. **L1**
- Identify the basic elements and measurements of energy audit. **L3**
- Summarize the evaluation of energy conserving balances **L2**

**UNIT – II: Energy Audit Concepts** **6Hrs**

Need of Energy audit - Types of energy audit – Energy management (audit) approach - understanding energy costs - Bench marking – Energy performance - Matching energy use to requirement - Maximizing system efficiencies -Optimizing the input energy requirements - Duties and responsibilities of energy auditors- Energy audit instruments - Procedures and Techniques.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Summarize various concepts of energy audit. **L2**
- Compare various energy management approaches. **L4**
- Explain Bench marking and energy performance in energy auditing. **L2**

**UNIT – III: Principles and Objectives of Energy Management** **6Hrs**

Design of Energy Management Programmes - Development of energy management systems – Importance - Indian need of Energy Management - Duties of Energy Manager - Preparation and presentation of energy audit reports - Monitoring and targeting, some case study and potential energy savings.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the developments of energy management systems **L2**
- Explain the importance of energy management **L2**
- List the various duties of energy manager **L1**

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**UNIT – IV: Thermal Energy Management** **6 Hrs**

Energy conservation in boilers - steam turbines and industrial heating systems - Application of FBC - Cogeneration and waste heat recovery -Thermal insulation - Heat exchangers and heat pumps – HVC industries-Building Energy Management.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concepts of energy conservation in boilers **L2**
- Identify the thermal energy components **L3**
- Illustrate the applications of FBC boilers **L2**

**UNIT – V: Electrical Energy Management** **6Hrs**

Supply side Methods to minimize supply-demand gap- Renovation and modernization of power plants - Reactive power management – HVDC- FACTS - Demand side - Conservation in motors - Pumps and fan systems – Energy efficient motors.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concepts of supply side methods to minimize supply. **L2**
- Explain the reactive power management. **L2**
- Identify the energy conservation methods in motors, pumps and fan systems. **L3**
- List the energy efficient motors. **L2**

**Text Books:**

1. Murphy, W. R., Energy Management, Elsevier, 2007.
2. Smith, C. B., Energy Management Principles, Pergamum, 2007
3. Handbook of Energy Audit, Sonal Desai, Mcgraw Hill Education Private Ltd.,

**Reference Books:**

1. Turner, W. C., Doty, S. and Truner, W. C., Energy Management Hand book, 7th edition, Fairmont Press, 2009.
2. De, B. K., Energy Management audit & Conservation, 2nd Edition, Vrinda Publication, 2010.
3. Energy Management Handbook – W.C. Turner (John Wiley and Sons, A Wiley a. Interscience publication)
4. Industrial Energy Management and Utilisation –L.C. Witte, P.S. Schmidt, D.R. Brown (Hemisphere Publication, Washington, 1988)
5. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982
6. Energy Conservation guide book Patrick/Patrick/Fardo (Prentice hall1993)

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the basic concepts of energy audit and energy management **L2**
- Explain different types of energy audit, maximizing and optimizing system efficiency. **L3**
- Summarize energy management systems, prepare and present energy audit report **L5**
- Identify energy saving potential of thermal and electrical systems **L3**
- Discuss Energy audit instruments, Procedures and Techniques. **L2**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME75e – INTRODUCTION TO COMPOSITE MATERIALS**

*(Open Elective-III)*

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

**UNIT – I: Introduction to composites** **8 Hrs**

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the fundamentals of composites. L2
- Classify the composites based on matrix and structure. L2
- Identify the practical applications of composites. L3
- Summarize the properties and advantages of reinforcement materials L2

**UNIT – II: Polymer matrix composites** **6Hrs**

Polymers - Polymer matrix materials – PMC processes - hand layup process – spray up process – resin transfer moulding – Pultrusion – Filament winding – Auto clave based methods - Injection moulding – sheet moulding compound – properties and applications of PMC's.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the properties of polymer matrix composites. L2
- Identify the polymer matrix composites. L3
- Explain various process used in making the polymer matrix composites L2
- Discuss the auto clave based methods. L6

**UNIT – III: Metal matrix composites** **6Hrs**

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMC's.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Outline the various types of metal matrix composite L2
- Explain liquid state processes and solid state processes in MMCs preparation L2
- Demonstrate In-situ processes L2
- Identify the properties and applications of MMCs L2

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**UNIT – IV: Ceramic matrix composites** **6 Hrs**

Ceramic matrix materials – properties – processing of CMCs – Sintering - Hot pressing – Infiltration – Lanxide process – In-situ chemical reaction techniques – sol-gel polymer pyrolsis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Summarize the various types of ceramic matrix materials. **L2**
- Explain the sintering, hot pressing, infiltration and lanxide process **L2**
- Contrast between cold and hot isostatic pressing. **L2**
- Examine the properties and applications of CCMs. **L3**

**UNIT – V: Advances in composites** **6Hrs**

Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications.

Characterization of composite materials - Mechanical Properties, Thermal Properties.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the advantages and disadvantages of carbon matrix **L2**
- Identify composites for aerospace applications **L3**
- Apply chemical vapour deposition of carbon on carbon fibre perform **L3**
- Select the carbon - carbon composites. **L1**
- Classify various bio- degradable composites **L3**

**Text Books:**

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

**Reference Books:**

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong, Fundamentals of Composite Manufacturing, SME, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bioplastics & Bio-composites for Engineering applications, John Wiley publications.

**Course Outcomes:**

At the end of this Course the student will be able to

- Identify the practical applications of composites. **L3**
- Identify the polymer matrix composites. **L3**
- Classify of bio- degradable composites. **L2**
- Outline the various types of ceramic matrix materials. **L2**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME75f – CUSTOMER RELATIONSHIP MANAGEMENT**

*(Open Elective-III)*

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:** The objectives of the course are to make the students learn about

- Introduce basic concepts and principles of customer relationship management (CRM).
- Familiarize with appreciate the role and changing face of CRM as an IT enabled function.
- Describe concept of managing and sharing customer data.
- Explain the principles of CRM links in e-Business.
- Expose the students on Enterprise resource planning (ERP),supply chain management (SCM) and Supplier relationship management (SRM).

**UNIT – 1: CRM concepts** **8 Hrs**

CRM concepts - Acquiring customers, - Customer loyalty and optimizing customer relationships - CRM defined - success factors, the three levels of Service/ Sales Profiling - Service Level Agreements (SLAs), creating and managing effective SLAs.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concepts of customer relationship management **L2**
- Define customer relationship management (CRM) **L1**
- Illustrate the service level agreements (SLAs) **L2**

**UNIT – II: CRM in Marketing** **6Hrs**

CRM in Marketing - One-to-one Relationship Marketing - Cross Selling & Up Selling - Customer Retention, Behaviour Prediction - Customer Profitability & Value Modeling, - Channel Optimization - Event-based marketing. - CRM and Customer Service - The Call Centre, Call Scripting - Customer Satisfaction Measurement.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concept of one-to-one relationship marketing **L2**
- Develop the skills related to predict the behaviour and retention of the customer **L6**
- Discus about customer profitability and value modeling. **L6**
- Illustrate the various methods for CRM and customer service **L2**

**UNIT – III: Sales Force Automation** **6Hrs**

Sales Force Automation - Sales Process, Activity, Contact- Lead and Knowledge Management - Field Force Automation. - CRM links in e-Business - E-Commerce and Customer Relationships on the Internet - Enterprise Resource Planning (ERP), - Supply Chain Management (SCM), - Supplier Relationship Management (SRM), - Partner relationship Management (PRM).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concept of CRM links in e-Business. **L2**
- Discus E-commerce and customer relationship on the internet. **L6**
- Describe Enterprise resource planning (ERP), Supply chain management (SCM). **L2**
- Explain terms supplier relationship management and partner relationship management. **L2**

**UNIT – IV: Analytical CRM** **6 Hrs**

Analytical CRM - Managing and sharing customer data - Customer information databases - Ethics and legalities of data use - Data Warehousing and Data Mining concepts - Data analysis - Market Basket Analysis (MBA), Click stream Analysis, Personalization and Collaborative Filtering.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain how to manage and sharing the customer data **L2**
- List the various ethics and legalities of customer database use **L1**
- Describe various data warehousing and data mining concepts **L3**
- Discus about market basket analysis (MBA) **L6**

**UNIT – V: CRM Implementation** **6Hrs**

CRM Implementation - Defining success factors - Preparing a business plan requirements, justification and processes. - Choosing CRM tools - Defining functionalities - Homegrown versus out-sourced approaches - Managing customer relationships - conflict, complacency, Resetting the CRM strategy. Selling CRM internally - CRM development Team - Scoping and prioritizing - Development and delivery - Measurement.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Define success factors for implementing the customer relationship management. **L1**
- Define functionalities of CRM. **L1**
- Explain the functions of CRM development team. **L2**
- Compare Home grown and out-sourced approaches. **L2**

**Text Books:**

1. Alok Kumar Rai, Customer Relationship Management Concept & Cases, Prentice Hall Of India Private Limted, New Delhi. 2011.
2. S. Shanmugasundaram, Customer Rela Tionship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.

**Reference Books:**

1. Kaushik Mukherjee, Customer Relationship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.
2. Jagdish Seth, Et Al, Customer Rela Tionship Management.
3. V. Kumar & Werner J., Customer Rela Tionship Management, Willey India, 2008.

**Course Outcomes:**

At the end of this Course the student will be able to

- Summarizes the how CRM works in industries. **L2**
- Discus about market basket analysis (MBA). **L6**
- Develop the skills related to predict the behaviour and retention of the customer. **L6**
- Explain the concepts of customer relationship management. **L2**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEC75a-EMBEDDED SYSTEMS & IOT**

***(Open Elective-III)***

| L | T | P | C |
|---|---|---|---|
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**Course Objectives:** The objectives of the course are to make the students learn about

- To understand the basics of Embedded Systems and IOT.
- To learn the architecture and programming of ARM Microcontroller.
- To be able to work with Raspberry Pi using Python Programming.
- To know about the IOT standards, communication technologies and protocols.
- To implement real time projects using the tools and techniques of IOT Platform.

**UNIT – I:**

**Introduction to Embedded Systems and Internet of Things (IOT):** Architecture of Embedded Systems, Embedded Systems Development process, Architecture of Internet of Things, Applications of Embedded Systems and IOT, Design Methodology for IOT Products

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Gain knowledge on basics of embedded systems and IOT Architectures. **L1**
- Understand the design methodology and applications of embedded systems and IOT. **L2**

**UNIT – II:**

**ARM Microcontrollers Architecture and Programming:** Architecture, Instruction set, Programming ports, Timer/Counter, Serial communication, interrupts in C, Introduction ARM mBed platform.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the architecture and programming of ARM Microcontrollers. **L2**
- Work with ARM Microcontrollers in implementing real time projects. **L6**

**UNIT – III:**

**Fundamentals of Python Programming & Raspberry Pi:** Introduction to python programming, Working with functions, classes, REST full Web Services, Client Libraries, Introduction & programming Raspberry Pi3, Integrating Input Output devices with Raspberry Pi3.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Write programs using Python to implement the given task. **L6**
- Use Raspberry Pi3 for integrating Input & Output devices. **L3**

**UNIT – IV:**

**IOT Technologies, Standards and Tools:** Fundamental characteristics and high level requirements of IOT, IOT Reference models; Introduction to Communication Technologies & Protocols of IOT: BLE, Wi-Fi, LORA, 3G/4G Technologies and HTTP, MQTT, COAP protocols; Relevant Practicals on above technologies.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the characteristics and high level requirements to design new IoT devices. **L2**
- Summarize different Communication Technologies & Protocols of IoT. **L2**

**UNIT – V:**

**IOT Platform, Cloud Computing Platforms for IoT Development:** IOT Platform Architecture (IBM Internet of Things & Watson Platforms); API Endpoints for Platform Services; Devices Creation and Data Transmission; Introduction to NODE-RED and Application deployment.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn how to use API Endpoints for Platform Services, Devices Creation and Data Transmission. **L1**
- To implement real time projects using the tools and techniques of IoT Platform. **L6**

**Text Books:**

1. ArsheepBahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", 1st Edition, VPT, 2014.
2. K.V.K.K.Prasad, "Embedded Real Time Systems: Concepts, Design and Programming", 1st Edition, Dreamtech Publication, 2014.
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2013

**Reference Books:**

1. Jonathan W Valvano, "Embedded Microcomputer Systems: Real-Time Interfacing", 3rd Edition, Thomson Engineering, 2012.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", 2nd Edition, Wiley Publications, 2012.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand the basics of Embedded Systems and IOT. **L2**
- Correlate the architecture and programming of ARM Microcontroller. **L4**
- Work with Raspberry Pi using Python Programming. **L6**
- Summarize IOT standards, communication technologies and protocols. **L2**
- Implement real time projects using the tools and techniques of IOT Platform. **L6**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEC75b-ELECTRONIC INSTRUMENTATION**

***(Open Elective-III)***

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- To know about the performance characteristics of instruments and measurement of electrical quantities.
- To understand the construction, working and applications of different types of CRO"s.
- To analyze the working of different types of bridges.
- To study the working of signal & function generators.
- To analyze the working of transducers in measuring physical parameters

**UNIT – I:**

**Measuring Instruments:** Introduction, Errors in Measurement, Accuracy, Precision, Resolution and Significant figures. Basic PMMC Meter- construction and working, DC and AC Voltmeters-Multirange, Range extension, DC Ammeter, Multimeter for Voltage, Current and resistance measurements.

**Digital Instruments:** Digital Voltmeters – Introduction, DVM's based on V–T, V–F and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multimeters, Digital frequency meters, Digital measurement of time.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Learn about the performance characteristics of the instruments. **L1**
- Understand the working of different types of ammeters, voltmeters and multimeters. **L2**

**UNIT – II:**

**Oscilloscopes:** Introduction, Block diagram of CRO, Basic principle of CRT, CRT Construction and features, vertical amplifiers, horizontal dPeflection system- sweep, trigger pulse, delay line, sync selector circuits. Dual beam and dual trace CROs, Sampling and Digital storage oscilloscopes.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Grasp the construction and working of different types of oscilloscopes. **L1**
- Use CRO to measure the amplitude, frequency, phase and time period of given signals. **L3**

**UNIT – III:**

**Bridges**: DC Bridges for Measurement of resistance - Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge, Measurement of capacitance - Schearing Bridge, Wien Bridge, Errors and precautions in using bridges.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the construction and working of different types of bridges. **L2**
- Measure parameters like resistance, capacitance, and inductance using bridges. **L3**

**UNIT – IV:**

**Signal Generators:** Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the working and applications of signal generators. **L2**
- Gain knowledge on the working and applications of function generators. **L1**

**UNIT – V:**

**Transducers:** Introduction, Types of Transducers, Electrical transducers, Selecting a transducer, Resistive transducer, Strain gauges, Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Temperature transducers-RTD, LVDT.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic working principle and applications of transducers. **L2**
- Measure physical parameters using different types transducers. **L3**

**Text Books:**

1. H.S.Kalsi, "Electronic Instrumentation", Third edition, Tata McGraw Hill, 2010.
2. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 6th Edition, 2010.

**Reference Books:**

1. A.K. Sawhney, Dhanpat Rai & Co., "A course in Electrical and Electronic Measurements and Instrumentation", $9^{th}$ Edition, 2010.
2. David A. Bell, "Electronic Instrumentation & Measurements", PHI, 2nd Edition, 2006.

**Course Outcomes:**

At the end of this Course the student will be able to

- Know about the performance characteristics of instruments and measurement of electrical quantities. **L1**
- Understand the construction, working and applications of different types of CRO"s. **L2**
- Compare the working of different types of bridges. **L2**
- Learn the working of signal & function generators. **L1**
- Analyze the working of transducers in measuring physical parameters. **L4**

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AEC75c-BASICS OF VLSI DESIGN**

***(Open Elective-III)***

| L | T | P | C |
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**Course Objectives:** The objectives of the course are to make the students learn about

- To give exposure to different steps involved in the fabrication of ICs and electrical properties of MOS devices.
- To know the design rules in drawing the layout of any logic circuit.
- To design different types of logic gates using CMOS inverter and analyze their transfer characteristics.
- To learn the concepts scaling and designing building blocks of data path of any system using gates.
- Understand the design and operation of basic programmable logic devices.

**UNIT – I:**

**MOS Technology**: Introduction to IC Technology. The IC Era, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, nMOS and CMOS Fabrication processes.

**Basic Electrical Properties of MOS Circuits:** $I_{ds}$ versus $V_{ds}$ Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Transconductance and Output Conductance, nMOS Inverter, Determination of Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, CMOS Inverter.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand different steps involved in the fabrication of ICs and electrical properties of MOS devices. **L2**
- Analyze the operation of NMOS, CMOS and BiCMOS inverters. **L4**

**UNIT – II:**

**MOS Circuit Design Processes**: MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2μm Double Metal, Double Poly CMOS rules, Layout Diagrams-A Brief Introduction, Symbolic Diagrams-Translation to Mask Form.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Know the VLSI design flow and stick diagrams. **L1**
- Understand the design rules in drawing the layout of any logic circuit. **L2**

**UNIT – III:**

**Basic Circuit Concepts**: Sheet Resistance. Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, standard unit of capacitance, area Capacitance calculations, the Delay Unit, Inverter Delays, Driving large capacitive loads, Propagation Delays, Wiring Capacitances.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand different types of logics in gate level design. **L2**
- Learn and compare different performance parameters in gate level design. **L1**

**UNIT – IV:**

**Scaling of MOS Circuits**: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling.

**Sub System Design and Layout:** Switch logic, Gate logic, Examples of Structured Design, parity generator, multiplexers, and grey to binary code converter.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Appreciate the importance, models and limitations of scaling. **L1**
- Explain the building blocks of data path of any system using gates. **L1**

**UNIT – V:**

**Programmable Logic Devices:** Read only memories, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL), Complex programmable logic devices, Field programmable gate arrays.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain different programmable logic devices. **L1**
- Compare the performance parameters and applications of different programmable logic devices. **L2**

**Text Books:**

1. Kamran Eshraghian. Douglas, A. Pucknell and Sholeh Eshraghian, "Essentials of LSI Circuits and Systems", Prentice Hall of India Private Limited, 2005 Edition.
2. Neil H.E.WESTE, David Harris andAyan Banerjee, "CMOS VLSI Design A Circuits and systems perspective", Pearson Education, 2006 Third Edition

**Reference Books:**

1. Richa Jain and Amrita Rai, "Principles of VLSI and CMOS Integrated Circuits", S.Chand and Company Limited. First edition.2012.
2. Wayne Wolf, "Modern VLSI Design", Pearson Education, 3rd Edition.

**Course Outcomes:**

At the end of this Course the student will be able to

- Understand different steps involved in the fabrication of ICs and electrical properties of MOS devices. **L2**
- Know the design rules in drawing the layout of any logic circuit. **L1**
- Compare different types of logic gates using CMOS inverter and their transfer characteristics. **L2**
- Learn the concepts to design building blocks of data path of any system using gates. **L1**
- Gain knowledge about basic programmable logic devices and testing of CMOS circuits. **L1**

**IV B.Tech I SEMESTER**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACS75a-MOBILE APPLICATION DEVELOPMENT**

**Open Elective-III**

| L | T | P | C |
|---|---|---|---|
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**Course Objectives:**

- Android Application Development course is designed to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android platform and get to understand the application lifecycle

**UNIT – 1:** **8 Hrs**

**Introduction Android Programming**: What is Android, Activities, Linking Activities Using Intents, Fragments, Calling Built – in Applications using Intents, Displaying Notifications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- demonstrate their understanding of the fundamentals of Android operating systems **L2**
- demonstrate their skills of using Android software development tools **L2**

**UNIT – II:** **8 Hrs**

**Android User Interface**: Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Utilizing the Action Bar, Listening for UI Notifications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- demonstrate their ability to develop software with reasonable complexity on mobile platform. **L3**
- demonstrate their ability to deploy software to mobile devices **L3**

**UNIT – III:** **8 Hrs**

**Designing User Interface with Views**: Basic Views, Picker Views, Using List Views to Display Long Lists.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- demonstrate their ability to debug programs running on mobile devices **L4**
- demonstrate their ability to deploy software to mobile devices **L4**

**UNIT – IV:** **7 Hrs**

**Displaying pictures and menus with views and Data Persistence**: Views to Display pictures, menus with views, additional views, saving and loading user preferences, persisting data to files, creating and using databases.

**Learning Outcomes:**

At the end of this unit, the student will be able to

1. demonstrate their skills of using Android software development tools **L4**
2. demonstrate their ability to develop software with reasonable complexity on mobile platform **L5**

**UNIT – V:** **08Hrs**

**Content Providers:** Sharing data in android, using a content provider, creating your own content providers.

**Messaging and Networking**: SMS Messaging, Sending E-Mail, Networking

**Location-Based Services**: Displaying Maps, Getting Location Data.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- demonstrate their ability to deploy software to mobile devices **L5**
- demonstrate their ability to debug programs running on mobile devices **L5**

**Text Books:**

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India
2. Beginning Swift Programming, Wei-Meng Lee, December 2014, ISBN: 978-1-119-00931-3

**Reference Books:**

1. Enterprise J2ME: Developing Mobile Java Applications, Michael Juntao Yuan, Pearson Education, 2004.
2. Android Application Development for Java programming by James C. Sheusi, Cengage Learning
3. Android A Programmers Guide by Jerome DiMargio, TMH.

**Course Outcomes:**

At the end of this Course the student will be able to

1. demonstrate their understanding of the fundamentals of Android operating systems **L3**
2. demonstrate their skills of using Android software development tools **L4**
3. demonstrate their ability to develop software with reasonable complexity on mobile platform **L5**

**IV B.Tech I SEMESTER**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACS75b-REAL TIME OPERATING SYSTEMS AND APPLICATIONS**

**Open Elective-III**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:**

**COURSE OBJECTIVES:**

The objective of this course is to

- develop an understanding of various Real Time systems Application
- obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
- get in-depth hands-on experience in designing and developing a real operational system.

**UNIT – 1: Introduction** **8 Hrs**

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List a range of different software testing techniques and statergies and be able to apply specific(automated) unit testing method to the projects. **L1**
- Distinguish characterstics of structural testing methods **L2**

**UNIT – II: Real Time Scheduling** **8 Hrs**

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling A periodic and Sporadic jobs in Priority Driven and Clock Driven Systems..

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L3**
- Discuss about the functional and system testing methods **L3**

**UNIT – III: Resources Sharing** **8 Hrs**

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Discuss about the functional and system testing methods. **L4**
- Demonstrate various issues for object oriented testing. **L4**
-

**UNIT – IV: Real Time Communication** **7 Hrs**

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols..

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Distinguish characterstics of structural testing methods. **L5**
- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L4**

**UNIT – V:Real Time Operating Systems and Databases** **08Hrs**

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases..

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Discuss about the functional and system testing methods. **L5**
- Demonstrate various issues for object oriented testing. **L5**

**Text Books:**

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

**Reference Books:**

1. . Real Time Systems – Mall Rajib, Pearson Education.
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

**Course Outcomes:**

At the end of this Course the student will be able to

- List a range of different software testing techniques and statergies and be able to apply specific(automated) unit testing method to the projects. **L3**
- Distinguish characterstics of structural testing methods. **L4**
- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L5**
- Discuss about the functional and system testing methods. **L5**

**IV B.Tech I SEMESTER**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19ACS75c-FUNDAMENTALS OF BLOCKCHAIN AND APPLICATIONS**

**Open Elective-III**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Course Objectives:**

1. To study fundamental concepts in software testing.
2. To discuss various software testing issues and solutions in software unit test, integration and system testing.
3. To expose the advanced software testing topics, such as object--oriented software testing methods.

**UNIT – 1: Introduction** **8 Hrs**

Grasping Blockchain Fundamentals, Tracing Blockchain's Origin,The shortcomings of current transaction systems, The emergence of bitcoin , 5 The birth of blockchain, Revolutionizing the Traditional Business, Network Exploring a blockchain application, Recognizing the key business benefits, Building trust with blockchain.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- List a range of different software testing techniques and statergies and be able to apply specific(automated) unit testing method to the projects. **L1**
- Distinguish characterstics of structural testing methods. **L2**

**UNIT – II: Blokchain working** **8 Hrs**

Taking a Look at How Blockchain Works,Why It's Called "Blockchain", What Makes a Blockchain Suitable for Business, Shared ledger, Permissions Consensus, Smart contracts, Identifying Participants and Their Roles, Fundamentals of Blockchain.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible **L3**
- Discuss about the functional and system testing methods **L3**

**UNIT – III: Business with Blockchain** **8 Hrs**

Propelling Business with Blockchains, Recognizing Types of Market Friction, Information frictions, Interaction frictions, Innovation frictions, Moving Closer to Friction-Free Business, Networks Reducing information friction, Easing interaction friction, Easing innovation friction, Transforming Ecosystems through Increased Visibility.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Discuss about the functional and system testing methods. **L4**
- Demonstrate various issues for object oriented testing. **L4**

**UNIT – IV: Blockchain in Action** **7 Hrs**

Blockchain in Action: Use Cases, Financial Services, Commercial financing, Trade finance, Cross-border transactions, Insurance, Government Supply Chain Management Healthcare, Electronic medical records, Healthcare payments pre-authorization, The Internet of Things (IoT).

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Distinguish characterstics of structural testing methods. **L5**

- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L4**

**UNIT – V:Hyperledger** **10 Hrs**

Hyperledger, a Linux Foundation Project, Hyperledger Vision, Hyperledger Fabric, How Can IBM Help Developers Innovate With Blockchain?, Offering an easily accessible cloud and development platform, Individualized attention and industry expertise.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Discuss about the functional and system testing methods. **L5**
- Demonstrate various issues for object oriented testing. **L5**

**Text Books:**

1. Fundamentals of Blockchain., RavindharVadapalli

**Reference Books:**

1. Block chain Technology Concepts and Applications, Kumar Saurabh, Ashutosh Saxena

**Course Outcomes:**

At the end of this Course the student will be able to

- List a range of different software testing techniques and statergies and be able to apply specific(automated) unit testing method to the projects. **L3**
- Distinguish characterstics of structural testing methods. **L4**
- Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible. **L5**
- Discuss about the functional and system testing methods. **L5**

OE - III

**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME70 – METROLOGY AND MEASUREMENTS LAB**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Objectives:** The objectives of the course are to make the students learn about

- To experiment with measuring equipments used for linear and angular measurements.
- To find common types of errors in measurement equipment.
- To experiment with different types of sensors, transducers and strain gauges equipment.
- To make use of thermocouples for measurement of temperature.

**List of Experiments**

**Section A:**

1. Measurement of bores by internal micrometers and dial bore indicators.
2. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
3. Alignment test on the lathe and milling machine using dial indicators
4. Study of Tool makers microscope and its application
5. Angle and taper measurements by Bevel protractor, Sine bars, spirit level etc.
6. Thread measurement by Two wire/Three wire method.
7. Surface roughness measurement by Talysurf instrument.
8. Use of straight edge and sprit level in finding the flatness of surface plate.

**Section B:**

1. Calibration of Pressure Gauges
2. Study and calibration of Mcleod gauge for low pressure.
3. Calibration of transducer or thermocouple for temperature measurement.
4. Calibration of LVDT transducer for displacement measurement.
5. Calibration of capacitive transducer for angular measurement.
6. Calibration of photo and magnetic speed pickups for the measurement of speed.
7. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.

**Section C:**

1. Experiment on static and dynamic balancing.
2. Experiment on universal governor.
3. Experiment on CAM analysis machine.
4. Study of Inversion of Four Bar Mechanism.

**Course Outcomes:**

At the end of this Course the student will be able to

- Apply different instruments to measure length, width, depth, bore diameters, internal and external tapers, tool angles, and surface roughness. **L3**
- Measure effective diameter of thread profile **L5**
- Conduct different machine alignment tests **L6**
- Measure temperature, displacement, and pressure **L3**

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**B.Tech IV Year I Semester**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA**

**19AME77 – CAD and CAM Lab**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 1.5 |

**Course Objectives:** The objectives of the course are to make the students learn about
- To write program for CAD modeling.
- To learn part programming and program generation from a CAD model.
- To analyze structural and thermal related problems.
- Machining of various parts on CNC Lathe, Milling and Drilling machines.
- To programme an industrial robot for pick and place operation.

**List of Experiments**
1. Write program for translation, scaling and rotation.
2. Write program for generating spline, Bezier and B-spline.
3. Write program for sweep surfaces and surface of revolution.
4. Blend surfaces using any software.
5. Create wireframe, surface and solid models.
6. Assembling of simple machine component.
7. Analysis of a truss member under loading.
8. Static Analysis of beam
9. Analysis of a components considering conduction and convection
10. Dynamic analysis of stepped bar.
11. Introduction to CNC Machines and G-Code, M-Codes
12. CNC part programming for operations face turning and step turning.
13. CNC part programming for operations taper turning and threading.
14. CNC part programming for vertical milling operations.
15. CNC part programming for drilling and pocketing operations.
16. Development of APT programming for 2D objects
17. Programmings for Robot pick and place.

**Course Outcomes:**
At the end of this Course the student will be able to
- Generate CAD models. **L3**
- Analyze structural and thermal related problems. **L6**
- Write programs for various machining operations. **L6**
- Operate an industrial robot for pick and place operation. **L5**

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