JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTHAPURAMU
COLLEGE OF ENGINEERING (AUTONOMOUS): PULIVENDULA
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Regulation –R15

Course Code	15ACS08				
Course Name	Operating Systems				
Course Structure	Lectures	Tutorials	Practical's	Credits	
	3	1	0	3	
Course Coordinator	Dr.G.Murali				
Team of Instructors	Dr.G.Murali, Asst.Prof,HOD				

I. Course Overview

Introduction to Operating Systems is a graduate-level introductory course in operating systems. This course teaches the basic operating system abstractions, mechanisms, and their implementations. The core of the course contains concurrent programming (threads and synchronization), inter process communication, and an introduction to distributed operating systems. The course is split into four sections: (1) Introduction, (2) Process and Thread Management, (3) Resource Management and Communication, and (4) Distributed Systems.

II. Prerequisite(s):

Level	Credits	Periods / Week	Prerequisites
UG	3	3	Formal ADT representations such as linked lists, analysis of algorithms, algorithm design techniques, programming knowledge in C, C++ or JAVA.

III. Assessment:

FORMATIVE ASSESMENT	
Mid Semester Test I for 20 Marks in first 2 units is conducted at8 the end of 9th week. Mid Semester Test II for 20 Marks in last three units is conducted at the end of the course work. Average of two tests is taken as final	20 Marks
Multiple Choice Mid Semester Test I for 10 Marks in first 2 units is conducted at8 the end of 9th week. Multiple Choice Mid Semester Test I for 10 Marks in first 2 units is conducted at the end of the course work. Average of two tests is taken as final	10 Marks
Total (Formative)	30 Marks
SUMMATIVE ASSESMENT	
End Semester Examination in all units is conducted for 70 Marks	70 marks
Grand Total	100 Marks

IV. Course Objective

- 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

V. Course Outcomes

1. Understand what makes a computer system function and the primary PC components.
2. Understand past and current trends in computer technology.
3. Use basic software applications.
4. Add functionality to the exiting operating systems
5. Design new operating systems

VI. Program outcomes:

a An ability to apply knowledge of computing, mathematical foundations, algorithmic principles, and computer science and engineering theory in the modeling and design of computer-based systems to real-world problems (fundamental engineering analysis skills)

b An ability to design and conduct experiments, as well as to analyze and interpret data (information retrieval skills)

c An ability to design , implement, and evaluate a computer-based system, process, component, or program to meet desired needs, within realistic constraints such as economic, health and safety, manufacturability, and sustainability (Creative Skills)

d An ability to function effectively on multi-disciplinary teams (team work)

e An ability to analyze a problem, identify, formulate and use the appropriate computing and engineering skills for obtaining its solution (engineering problem solving skills)

f Obtaining the knowledge of algorithmic skills regarding data structures. (program oriented skills)

g An ability to communicate effectively both in writing and orally (speaking / writing skills)

h The broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society (engineering impact assessment skills)

i Recognition of the need for, and an ability to engage in continuing professional development and life-long learning (continuing education awareness)

j A Knowledge of structural skills which are related to theoretical skills for programming (detailed subject oriented skills).

k An ability to use current techniques, skills, and tools necessary for computing and engineering practice (practical engineering analysis skills)

l An ability to apply design and development principles in the construction of software and hardware systems of varying complexity (software hardware interface)

m An ability to recognize the importance of professional development by pursuing postgraduate studies or face competitive examinations that offer challenging and rewarding careers in computing (successful career and immediate employment).

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VII. Syllabus:

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B.Tech. II Year –ISem(C.S.E)

L	T	P	C
3	1	0	3

UNIT I

Operating Systems Overview: Operating system functions, Operating system structure,operating systems Operations, protection and security, Kernel data Structures, Computing Environments, Open- Source Operating Systems

Operating System Structure: Operating System Services, User and Operating-SystemInterface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot.

Processes: Process concept, process Scheduling, Operations on processes, Inter processCommunication, Examples of IPC systems.

UNIT II

Threads: overview, Multicore Programming, Multithreading Models, Thread Libraries, Implicitthreading, Threading Issues.

Process Synchronization: The critical-section problem, Peterson‘s Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Alternative approaches.

CPU Scheduling: Scheduling-Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling, Algorithm Evaluation.

UNIT III

Memory Management: Swapping, contiguous memory allocation, segmentation, paging, structure of the page table.

Virtual memory: demand paging, page-replacement, Allocation of frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory

Deadlocks: System Model, deadlock characterization, Methods of handling Deadlocks, Deadlock prevention, Detection and Avoidance, Recovery from deadlock.

UNIT IV

Mass-storage structure: Overview of Mass-storage structure, Disk structure, Disk attachment, Disk scheduling, Swap-space management, RAID structure, Stable-storage implementation.

File system Interface: The concept of a file, Access Methods, Directory and Disk structure, File system mounting, File sharing, Protection.

File system Implementation: File-system structure, File-system Implementation, Directory Implementation, Allocation Methods, Free-Space management.

UNIT V

I/O systems: I/O Hardware, Application I/O interface, Kernel I/O subsystem, Transforming I/O requests to Hardware operations.

Protection: Goals of Protection, Principles of Protection, Domain of protection, Access

Matrix, Implementation of Access Matrix, Access control, Revocation of Access Rights, Capability-Based systems, Language – Based Protection

Security: The Security problem, Program threats, System and Network threats, Cryptography and security tool, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer–security classifications.

VIII. Text Books & Reference Books

Text Books:

T1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Ninth Edition, 2012, Wiley.
T2. Operating Systems: Internals and Design Principles, Stallings, Sixth Edition, 2009, Pearson Education.

Reference Books:

R1. Modern Operating Systems, Andrew S Tanenbaum, Second Edition, PHI.
R2. Operating Systems, S.Haldar, A.A.Aravind, Pearson Education.
R3. Principles of Operating Systems, B.L.Stuart, Cengage learning, India Edition.
R4. Operating Systems, A.S.Godbole, Second Edition, TMH.
R5. An Introduction to Operating Systems, P.C.P. Bhatt, PHI.
R6. Operating Systems, G.Nutt, N.Chaki and S.Neogy, Third Edition, Pearson Education.
R7. Operating Systems, R.Elmasri, A,G.Carrick and D.Levine, McGraw Hill.

Websites:

W1. http://codex.cs.yale.edu/avi/os-book/OS9/practice-exer-dir/index.html
W2.http://www.tutorialspoint.com/operating_system/

IX. Course Plan:

The course plan is meant as a guideline. There may probably be changes.

Dates	Topics to be covered	Course Learning Outcomes	No of Periods	Reference
	UNIT – I			
19-7-2018	**Operating Systems Overview:** Operating system functions, Operating system structure	Learn about the introduction to operating systems and functions and its structure	2	T1: P: 15 – 17 T2: P: 48 – 51
20-7-2018	Operating system operations, protection and security, Open- Source Operating Systems	An understanding of operations of os, how to protect and provide security for the os	2	T1: P:17 – 20,26 – 28, Refer W2
23-7-2018	Kernel data Structures, Computing Environment	Learn about the kernel structure and environment	2	T1: P: 31 – 33
26-7-2018	**Operating System Structure:** Operating System Services, User andOperating-SystemInterface	Learn about the services of os	2	T1: P: 39 – 42
30-7-2018	systems calls, Types of System Calls, system programs	An understanding about the types of system calls	1	T1: P: 43 – 55 R1: 1.6 P:44 – 53
30-7-2018	operating system debugging, System Boot.	An understanding about the debugging process and how to boot the system.	1	T1: P: 71 – 72
2-8-2018	**Processes: Introduction to** Process concept	Study about the introduction to processes	1	T1: P: 81 – 84 T2:108 – 110 R6: 2.3 P: 60-62
2-8-2018	process Scheduling, Operations on processes,	Learn about the scheduling and operations of processes	1	T1: P: 85 – 95
6-8-2018	Inter Process Communication, Examples of IPC systems.	Learn about the examples of IPC systems	1	T1: P: 96 – 107 R1: P: 100
	UNIT II			
6-8-2018	**Threads:** overview, Multicore Programming, Multithreading Models,	Learn about the Multi programming and introduction to threads	1	T1: P: 127 – 130 T2: P: 157 – 177 R6 :81 – 93
9-8-2018	Thread Libraries, Implicit - Threading, Threading Issues.	An understanding of issues and libraries of thread	1	T1: P: 131 – 142
9-8-2018	**Process Synchronization:** The critical-section problem,	Find out the solution for the critical section	1	T1: P: 191 – 195 Refer w1
13-8-2018	Peterson‘s Solution, Synchronization Hardware	Find out the solution for Peterson’s problem	1	T1: P: 195 – 200
13-8-2018	Mutex Locks, Semaphores	Learn about semaphores	1	T1: P: 200 – 204 T2:P:213 – 225 Refer W2
16-8-2018	Classic problems of synchronization, Monitors	Learn about problems of synchronization and types of monitors	1	T1: P: 204 – 216 T2:P: 226 – 233

16-8-2018	Synchronization examples, Alternative approaches	Examples of synchronization	1	T1: P: 217 – 222
27-8-2018	**CPU Scheduling:** Scheduling-Criteria	Introduction to CPU scheduling	1	T1: P: 153 – 158 Refer W2
27-8-2018	Scheduling Algorithms	Learn about the scheduling algorithms and find out the saluting to the problems	1	T1: P: 158 – 168 T2:P: 400 - 421 Refer W2
30-8-2018	Thread Scheduling, Multiple-Processor Scheduling	Learn about the Scheduling types	1	T1: P: 172 – 173 T2:P: 431 -441
30-8-2018	Real-Time CPU Scheduling, Algorithm Evaluation	How to use Scheduling algorithms in real time	1	T1: P: 181 – 184 T2:P: 442 – 456
	UNIT – III			
3-9-2018	**Memory Management:** Swapping, contiguous memory allocation	Introduction to Memory	1	T1: P: 282 – 287 Refer W2
3-9-2018	segmentation, paging, structure of the page table	Different types of paging and segmentation techniques	1	T1: P: 288 – 304 T2: P: 321 – 326 Refer W2
6-9-2018	**Virtual memory:** demand paging	Learn about virtual memory	1	T1: P: 319 – 324 R5: P: 90
6-9-2018	page-replacement, Allocation of frames	Discuss about page – replacement algorithms	1	T1: P: 327 – 342 R1: P: 214 – 227
10-9-2018	Thrashing, Memory-Mapped Files, Allocating Kernel Memory	Allocation of Memory	1	T1: P: 343 – 356
10-8-2018	**Deadlocks:** System Model, deadlock characterization	Introduction to Deadlocks	1	T1: P: 245 – 252 R1: P: 168 – 173
17-9-2018	Methods of handling Deadlocks, Deadlock prevention	How to analyze the deadlocks	1	T1: P: 252 – 255 T2: P: 259 – 270
17-9-2018	Detection and Avoidance, Recovery from deadlock	Solve the deadlock problems	1	T1: P: 256 – 266 T2:P: 270 – 278
	UNIT – IV			
24-9-2018	**Mass-storage structure:** Overview of Mass-storage structure, Disk structure	Architecture of storage structure	1	T1: P: 451- 454
24-9-2018	Disk attachment, Disk scheduling	Understanding about Disk processing	1	T1: P: 455 – 461 T2: P: 487 – 493
27-9-2018	Swap-space management, RAID structure, Stable-storage implementation	Implementation of Memory management	1	T1: P: 466 – 477 T2:P: 494 – 501
27-9-2018	**File system Interface:** The concept of a file	Learn about the concept of a file	1	T1: P: 373 – 382 R6: P:381
1-10-2018	Access Methods, Directory and Disk structure	Discuss about the Access Methods	1	T1: P: 382 – 395 T2:P: 535 – 540
1-10-2018	File system mounting, File sharing, Protection	How to share and protect the file system	1	T1: P: 395 – 406 T2:P: 540 – 541
4-10-2018	**File system Implementation:** File-system structure	Architecture of File system	1	T1: P: 411 – 412 R1:P: 399
4-10-2018	File-system Implementation, Directory	Implementation of file system and directory	1	T1: P: 413 – 420, R1:P: 405 – 428

	Implementation			
8-10-2018	Allocation Methods, Free-Space management	Learn about the free space management	1	T1: P: 421 – 430
	UNIT – V			
8-10-2018	**I/O systems:** I/O Hardware, Application I/O interface	An understanding about the I/O system	1	T1: P: 496- 510 T2:P: 475 - 477 Refer W2
11-10-2018	Kernel I/O subsystem, Transforming I/O requests to Hardware operations	Transformation of I/O requests to the Hardware.	1	T1: P: 511 – 520
11-10-2018	**Protection:** Goals of Protection, Principles of Protection	Learn about the goals and principles of protection	1	T2: P: 531 – 533, R1:P: 645 -650
15-10-2018	Domain of protection, Access Matrix	Learn about the domain of protection	1	T1: P: 533 – 541
15-10-2018	Implementation of Access Matrix, Access control	Implementation of Access matrix		T1: P: 542 – 546 T2:P: 646 – 652
15-10-2018	Revocation of Access Rights, Capability-Based systems, Language – Based Protection	Learn about the Access rights	1	T1: P: 546 – 554
18-10-2018	**Security:** The Security problem, Program threats	Find out the security problems and threats	1	T1: P: 559 – 570T2: P: 607 – 615
18-10-2018	System and Network threats, Cryptography and security tool	An understanding of security tool		T1: P: 571 – 586 R6: P: 442 -446
18-10-2018	User authentication, Implementing security defenses	Learn about the authentication, implementation of security defences	1	T1: P: 587 – 598
18-10-2018	Firewalling to protect systems and networks, Computer–security classifications	Classifications of computer security		T1: P: 599 – 602

X. Mapping course outcomes leading to the achievement of the program outcomes:

Course Outcomes	Program Outcomes												
	a	**b**	**c**	**D**	**E**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**M**
1	S												
2	S										S		
3			H								H	H	
4		H				S						S	
5	H	H				S						H	

S = Supportive **H = Highly Related**

Justification of Course syllabus covering Course Outcomes:

By Covering the Course provides a comprehensive introduction to understand the underlying principles, techniques and approaches which constitute a coherent body of knowledge in operating systems. In particular, the course will consider inherent functionality and processing of program execution.

The emphasis of the course will be placed on understanding how the various elements that underline operating system interact and provides services for execution of application software.

Justification of CO's –PO's Mapping Table:

By mapping CO-1 to the PO's A which are related to the course CO1: The student is able to analyzefunctionality of computer system and components and software, hardware of PC.

By mapping CO-2 to the PO's A and K, which are related to the course CO2: The student is able to learn about different technologies in present trend

By mapping CO-3 to the PO's C, K and L which are related to the course CO3: The student is able to design an application.

By mapping CO-4 to the PO's B, F and L, which are related to the course CO4: The student is able to understand the drawbacks of existing operating systems and add some functionalities to the operating systems.

By mapping CO-5 to the PO's A, B, F and L which are related to the course CO5: The student is able to design new operating systems.