INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**COMPUTER ORGANIZATION AND OPERATING SYSTEMS**			
Course Code	A50516			
Regulation	**R13- JNTUH**			
Course Structure	Lectures	Tutorials	Practical's	Credits
	4	1	-	4
Course Coordinator	Ms. A Swapna , Assistant Professor			
Team of Instructors	Ms. A Lakshmi, Mr.Ch.Srikanth, Mr.P.Sunil Kumar Assistant Professor			

I. COURSE OVERVIEW:

Computer Organization course introduces the principles of computer organization and the basic architecture concepts. The aim of the course is to provide a thorough discussion of the fundamentals of computer organization and architecture and to relate these to contemporary design issues. The course emphasizes performance and cost analysis, instruction set design, pipe lining, memory hierarchy, virtual memory management, and I/O systems.. Operating System course presents fundamental concepts related to the design and implementation of operating systems. Topics includes basic operating system structure, process scheduling, process and thread synchronization and concurrency, memory management, file systems and storage servers.

II. PREREQUISITES:

Level	Credits	Periods/Weeks	Prerequisites
UG	4	4	Basic Mathematics, Digital logic design

III. Course Assessment Methods

a) Marks Distribution

Session Marks(25M)	University End Exam Marks	Total Marks
There shall be 2 midterm examinations. Each midterm examination consists of subjective type and objective type tests. The subjective test is for 10 marks, with duration of 1 hour. Subjective test of each semester shall contain 4 questions; the student has to answer 2 questions, each carrying 5 marks. The objective type test is for 10 marks with duration of 20 minutes. It consists of		

10 multiple choice and 10 objective type questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course.	**75**	**100**

IV. **Evaluation Scheme**

S. No	Component	Duration	Marks
1	I Mid Examination	90 minutes	20
2	I Assignment	-	05
3	II Mid Examination	90 minutes	20
4	II Assignment	-	05
5	External Examination	3 hours	75

V. Course Objectives:

i. To have a thorough understanding of the basic structure and operation of a digital computer.
ii. To discuss in detail the operation of the arithmetic unit including the algorithms and implementation of fixed-point and floating-point addition, subtraction, multiplication and division.
iii. To study the different ways of communicating with I/O devices and standard I/O interfaces.
iv. To Study the Hierarchical memory system including cache memories and virtual memory.
v. To Demonstrate the Knowledge of functions of operating system memory management scheduling, file system and interface, distributed systems, security and deadlocks.
vi. To implement a significant portion of an Operating System.

VI. Course Outcome:

1. **Describe** organization of digital computers and explain the basic principles and operations of different components.
2. **Identify** the operation of the arithmetic unit including the algorithms and implementation of fixed-point and floating-point addition, subtraction, multiplication and division.
3. **Compare** various data representations and understand how arithmetic and logical operations are performed by computers.
4. **Differentiate** Instruction formats classification based on number of operands, size of instruction, and way of accessing the data.
5. **Understand** the design of the Control unit.
6. **Illustrate** the hierarchical memory system including cache memories and virtual memory.
7. **Demonstrate** Different ways of Communicating with I/O Devices and standard I/O interfaces.
8. **Identify** different I/O data transfer techniques with performance comparison.
9. **Understand** the objective and functions of modern operating systems.
10. **Demonstrate** how computing resources are used by application software and managed by system software.
11. **Contrast** kernel and user mode in an operating system.
12. **Understand** process management concepts including scheduling, synchronization, and deadlocks.
13. **Understand** concepts of memory management including virtual memory.
14. **Analyze** issues related to file system interface and implementation, disk management.

VII. How program outcomes are assessed:

Program Outcomes		Level	Proficiency assessed by
PO1	An ability to apply knowledge of basic sciences, mathematical skills, engineering and technology to solve complex electronics and communication engineering problems (**Fundamental Engineering Analysis Skills**).	H	Lectures and problem solving
PO2	An ability to identify, formulate and analyze engineering problems using knowledge of Basic Mathematics and Engineering Sciences (**Engineering Problem Solving Skills**).	H	Design Exercises and assignments
P03	An ability to provide solution and to design Electronics and Communication Systems as per social needs **(Social Awareness).**	H	Lectures, Assignments, Exams
PO4	An ability to investigate the problems in Electronics and Communication field and develop suitable solutions (**Creative Skills**).	H	Lectures, Tutorials, Problem solving
PO5	An ability to use latest hardware and software tools to solve complex engineering problems (**Software and Hardware Interface**).	S	Lectures
PO6	An ability to apply knowledge of contemporary issues like health, Safety and legal which influences engineering design (**Social Awareness).**	N	**----**
PO7	An ability to have awareness on society and environment for sustainable solutions to Electronics and Communication Engineering problems (**Social Awarene**s).	N	_
PO8	An ability to demonstrate understanding of professional and ethical responsibilities (**Professional Integrity**).	S	Lectures, Motivation
PO9	An ability to work efficiently as an individual and in multidisciplinary teams (Team work).	S	Assignments, Tutorials, Exams
PO10	An ability to communicate effectively and efficiently both in verbal and written form (**Communication Skills**).	N	__
PO11	An ability to develop confidence to pursue higher education and for life-long learning (**Continuing Education Awareness**).	S	Discussions,Exams
PO12	An ability to design, implement and manage the electronic projects for real world applications with optimum financial resources (**Practical Engineering Analysis Skills**).	S	Lectures

VIII.HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity.	H	Lectures, Assignments
PSO2	**Problem-solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	H	Projects

PSO3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies.	S	Guest Lectures

VIII. Syllabus

UNIT-I

Basic Structure of Computers: Computer Types, Functional Unit, Basic OPERATIONAL Concepts , Bus Structures , Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating- point Representation.

Register Transfer Language and Micro Operations: Register Transfer Language, Register transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction codes, Computer registers Computer Instructions-Instruction Cycle.

Memory- reference Instructions, Input-Output and Interrupt, Stack Organization , Instruction Formats, Addressing Modes, DATA transfers and Manipulation , Program control , Reduced Instruction Set Computer

UNIT-II

Micro Programmed Control: Control Memory, Address Sequencing , Micro Program Examples, Design of Control Unit, Hard wired Control , Micro Programmed Control

The Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache memories Performance Considerations, Virtual memories Secondary Storage, Introduction to RAID

UNIT-III

Input-Output organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority interrupt, Direct Memory Access, Input-Output Processor(IOP),Serial Communication; Introduction to Peripheral Components , Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB , IEEE 1394

UNIT-IV

Operating Systems Overview: Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating Systems Generation

Memory Management:

Swapping, Contiguous Memory Allocation ,Paging, Structure of the Page table, Segmentation, virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation and Avoidance ,Recovery From Deadlock.

Principles of Deadlock:

System model, deadlock characterization, Deadlock prevention, Detection and avoidance, Recovery from deadlock.

UNIT-V

File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection,

File System Implementation: File System Structure, File System Implementation , Directory Implementation, Allocation Methods, Free Space Management

TEXT BOOKS:

1. Computer Organization - Carl Hamacher , Zvonksvranesic , SafeaZaky, 5th Edition, McGraw Hill.
2. Computer system architecture: Morris Mano .
3. Operating System Concepts- Abraham Silberchatz, Peter B.Galvin Greg Gagne, 8th Edition, John Wiley.

REFERENCES

1. Computer organization and architecture –c 6th Edition, Pearson/PHI.
2. Structured Computer Organization –Andrew S.Tanenbaum, 4th Edition PHI/Pearson.
3. Fundamentals or Computer Organization and Design, - SivaraamaDandamudi Springer Int.Edition.
4. Operating Systems - Internals and design Principles , Stallings, 6th Edition-2009,Pearson Education.

IX. Course Plan

At the end of the course, the students are able to achieve the following Course Learning Outcomes.

Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
1	**Identify** the basic elements of hardware and explain their functions and how they fit together to form an architecture.	**Basic structure of computers:** Computer Types, Functional units, Basic Operational Concept**s.**	T1:1.1
2	**Differentiate** the Bus structures and different processor register to evaluate the performance.	Bus Structures, Software, Performance, Multiprocessors and Multi computers.	T1:1.2,1.3-1.7
3-4	**Learn** how data is represented, manipulated and stored within a computer system.	Data Representation, Fixed and Floating point.	T2:3-1,3-3,3-4
5-6	**Understand** different types of data transfer between bus and memory using several processor registers.	**Register Transfer Language and Micro-operations:** Register Transfer Bus and Memory Transfer.	T2:4-1,4-3
7	**Describe** how arithmetic and logical operations are performed by computers.	Arithmetic Micro-operations and Logic Micro-operations	T2:4-4,4-5
8	**Understan**d the Design of Arithmetic Logic Shift Unit	Shift Micro-operations and Arithmetic logic Shift Unit	T2:4-6,4-7
9-11	**Learn** the Structure of Instruction codes. **Explain** different types of instructions and different steps involved in instruction execution.	Instruction Codes ,Computer registers and Computer instructions ,Instruction Cycle ,Memory- Reference instructions	T2:5-1,5-2,5-3 5-5,5-6
12	Describe the purpose, function and implementation of interrupts in a computer system.	Input-Output and Interrupt	T2:5-7
13-14	**Identify** different types of instructions and calculate their impact on performance of computer.	STACK Organization , Instruction Formats	T2:8-3,8-4
15	**Understand** different types of addressing modes used in an instruction.	Addressing Modes	T2:8-5
16-17	**Ability to** understand data transfer and manipulation instructions.	Data transfer and manipulation, program control.	T2:8-6,8-7
18	**Describe** the design of the instruction set of the processor	Reduced Instruction Set Computer	T2:8-8
19-20	**Understand** the Micro-code generation for the control memory	Micro Programmed Control: Control memory, Address sequencing micro-program example	T2:7-1,7-2,7-3
21	**Understand** the Micro program sequencer to design the control unit	Design of control Unit, Hardwired Control, Micro programmed control.	T2:7-4
22-23	**Understand** the memory hierarchy and the function of RAM and ROM chips	**The Memory System:** Basic Concept, Semiconductor RAM	T1:5.1,5.2-5.3

	along with Connection between CPU and Memory	memories, Read only Memories	
24-25	**Describe** Cache memory and identify methods for specifying where memory blocks are placed in cache.	Cache memories Performance Considerations	T1:5.5-5.6
26-27	**Analyze** the concept of virtual memory that involves defining address space and memory space	Virtual memories	T1:5.7
28	**Learn** the concept of Secondary Storage.	Secondary storage	T1:5.9
29	**Knowledge** of RAID Architecture	Introduction to RAID	R1:6.2
30	**Identify** different ways of communicating with I/O devices and compare standard input-output interfaces	**Input-Output Organization:** Peripheral Devices, Input-Output Interface	T2:11-1,11-2
31-32	**Understand** the concept of Asynchronous Transfers and modes of transfer. Knowledge of Interrupt Signals	Asynchronous Data Transfer Modes Priority Interrupt	T2:11-3,11-4 T2:11-5
33	**Describe** Speed of transfer using Direct Memory Access technique.	DMA	T2:11-6
34-35	**Identify** Processor with Direct memory access capability and define Communication between CPU and IOP	Input-Output Processor(IOP)	T2:11-7
36-38	**Illustrate** different Serial Communication Protocols	Serial Communication, PCI, RS232,USB,IEEE1394	T2:11-8
39	**Understand** the purpose of the operating system. Explain the objectives and functions of modern operating systems	**Operating Systems Overview:** overview .,Functions	T3:1.1-1.5
40	**Describe** how operating systems have evolved over time from primitive batch systems to sophisticated multiuser systems.	Protection and Security, Distributed Systems. Special purpose systems.	T3:1.9-1.10 1.0-1.11
41	**Describe** the functions of a contemporary operating system with respect to convenience, efficiency, and the ability to evolve.	**Operating systems structures:** Operating system services andSystems calls	T3:2.1-2.4
42	**Understand** the concept of a logical layer, benefits of building abstract layers in hierarchical fashion.	System programs, Operating system structure, Operating systems generations	T3:2.52.9
43-44	**Describe** different Memory allocation techniques.	**Memory Management:** Swapping, contiguous memory allocation**.**	T3:8.1-8.3
45-48	**Summarize** the principles of virtual memory as applied to caching and paging.	Paging, structure of the page table, segmentation .virtual memory, demand paging, page-replacement algorithms	T3:8.4-8.6 9.1-9.4
49	**Evaluate** the trade-offs in terms of memory size (main memory, cache memory, auxiliary memory) and processor speed.	Allocation of frames, Thrashing, case study- UNIX.	T3:9.5-9.6
50	**Analyze** conditions that lead to deadlock.	**Principles of Deadlock:** System model, deadlock characterization	T3:7.1-7.2

	Differentiate between deadlock, starvation, and race conditions.		
51-54	**Understand** the difference between preventing and avoiding deadlocks.	Deadlock prevention , Detection and avoidance, Recovery from deadlock	T3:7.4-7.7
55-56	**Compare** and contrast different approaches to file organization, recognizing the strengths and weaknesses of each.	**File System Interface:** Concept of a file, Access Methods, Directory structure	T3:10.1-10.2
57	**Describe** different file Sharing methods	File system mounting, File sharing , protection.	T3:10.4-10.6
58-59	**Understand** different structures for File System.	**File System implementation:** File system structure, file system implementation.	T3:11.1-11.2
60-62	**Analyze** different Directory implementation techniques.	directory implementation, allocation methods ,Free-space management	T3:11.3-11.4 T3:11.5-11.6

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

Course Objectives	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	S	S	H		S								H	S	
II	S	H	S	S									H	S	
III		H	S										S	H	
IV	S	S	S	S								S	H	S	
V	S	S		S	S								H		S
VI	S		S										H	S	S

S= Supportive H = Highly Related

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

Course Outcomes	Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	S			S									H	S	
2	S												S	H	
3	S				S				S				H	S	
4	S			S									S	H	

5					S								S	H	
6			S			S							H	S	
7	H		S					S					S	H	
8					S								H	S	
9		S											S	H	
10	H		S										S	H	S
11	S												H	H	
12			S		S								H		
13				S									H		
14	S		S										H	S	

S= Supportive H = Highly Related

Prepared by: Ms. A Swapna, Ms. A Lakshmi, Mr.Ch.Srikanth, Mr.P.Sunil Kumar.

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