Government of Karnataka
Department of Technical Education
Bengaluru

	Course Title: Operating System		
	Scheme (L:T:P) : **4:0:0**	Total Contact Hours: **52**	Course Code: **15CS43T**
	Type of Course: **Lectures, Self Study & Student Activity.**	Credit :**04**	Core/ Elective: **Core**
CIE- 25 Marks			SEE- 100 Marks

Prerequisites

Basic Computer Concepts

Course Objectives

1. Understand the services of an operating system provides to its users and system itself.
2. Apply various CPU scheduling algorithms and recognize the classic synchronization problems.
3. Compare methods for handling deadlocks and apply various memory management techniques.
4. Describe file systems.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

	Course outcome	CL	Linked PO	Teaching Hours
CO1	Describe operating system operations and operating system structures.	U	1,2,9,10	08
CO2	Understand process management and apply process scheduling algorithms	U, A	2,3,9,10	12
CO3	Recognize Synchronization and discover the methods for handling deadlocks.	U, A	2,3,9,10	08
CO4	Explain the memory management techniques.	U, A	2,3,9,10	08
CO5	Discover the concepts related to virtual memory management	U, A	2,3,9,10	08
CO6	Identify file systems concepts.	U, A	2,3,9,10	08
		Total sessions		52

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Operating System	-	**3**	**3**	-	-	-	-	-	**3**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks Weightage	Marks Weightage (%)
			R	U	A	A	
I	Introduction to operating systems	8	-	22	-	22	15.38
II	Process management	12	-	22	10	32	23.10
III	Synchronization & Deadlocks	08	-	12	10	22	15.38
IV	Memory management	08	-	14	10	24	15.38
V	Virtual memory management	08	-	13	10	23	15.38
VI	File system	08	-	12	10	22	15.38
	Total	**52**	**-**	**95**	**50**	**145**	**100**

UNIT I : Introduction to Operating System   08 Hrs

What operating systems do? Computer System architecture, Operating System structure, Operating System operations, Process management, Memory management, Storage management, Protection and security, Distributed system, Special-purpose systems, Computing environments, Open-source Operating Systems..

UNIT II: Process Management   12 Hrs

Process concept, Process scheduling, Operations on processes, Inter-process communication, Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms.

UNIT III: Synchronization & Deadlocks   08 Hrs

Synchronization – Background, The critical section management and semaphores (Concepts only)

Deadlocks- System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock

UNIT IV: Memory Management Strategies	08 Hrs

Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation

UNIT V: Virtual Memory Management	08 Hrs

Background, Demand paging, Copy-on-write, Page replacement, Allocation of frames .

UNIT VI: File System	08 Hrs

File concept, Access methods, Directory and disk structure, File system mounting, File Sharing , Protection.

📚Text books

1. **Operating System Principles –** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India. (Chapters-1, 3, 5, 6, 7, 8, 9, 10 and 11)
   ISBN- 9788126520510

References

1. Operating Systems, I. Chandra Mohan, PHI, 2013, ISBN – 9788120347267
2. http://www.tutorialspoint.com/operating_system/
3. http://courses.cs.vt.edu/~csonline/OS/Lessons/index.html
4. http://www.nptel.ac.in

Suggested list of student activities

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

Student activity like mini-project, surveys, quizzes, etc. should be done in group of 3-5 students.

1.   Each group should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned course coordinator and programme coordinator.

2**.**   Each group should conduct different activity and no repeating should occur

1	How to install and Uninstall an Operating System on a New Computer
2	How to Remove a Second Operating System from a PC
3	A Survey of recent Operating System
4	Case study on real time deadlock situation
5	A case study on real time process synchronization
6	Comparison of OS working in single core and multi core environment
7	Comparison of 32 bits and 64 bits OS
8	Operating system is responsible for following activities in connection with management of memory: • Allocation and de allocation of memory as and when needed • Keeping track of used and unused memory space. • Deciding what process to be loaded into memory in case space becomes available.
9	For secondary space management: • Swap space and free space management • Disk scheduling

	• Allocating space to the data and programs onto the secondary storage device.	
10	For process management: • Creation, deletion of both user and system process. • Handling process synchronization. • Deadlock handling.	

Course Delivery

The course will be delivered through lectures and Power point presentations/ Video

Course Assessment and Evaluation Scheme

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1,2,3,4
				Student activities	05	Report	1,2,3,4
				Total	**25**		
	SEE	End Exam		**End of the course**	**100**	Answer scripts at BTE	1,2,3,4
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1 & 2 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4 Effectiveness of Delivery of instructions & Assessment Methods

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off

to the next higher digit.

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	Bloom's Category	%
1	Remembrance	20
2	Understanding	50
3	Application	30

Note to IA verifier: ***The following documents to be verified by CIE verifier at the end of semester***
1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

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FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM		20
	Year:		

Name of Course coordinator :   Units:__

CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th week of sem 10-11 AM	IV SEM	Operating System	20
	Year: 2015-16	Course code:15CS43T	

Name of Course coordinator :

Units:1,2 Co: 1,2

Note: Answer all questions

Question no	Question	CL	CO	PO
1	Explain OS in user's view and system's view. (5)	U	1	1,2
2	Explain the computer system architecture (5)	U	1	1,2
3	Consider the following set of process with the length of the CPU burst time given in milliseconds Process Burst time Priority P1 9 3 P2 11 1 P3 3 3 The processes are assumed to have arrived in the order P_1, P_2, P_3 all at time 0. What is the waiting time and turnaround time of each process for FCFS & PRIORITY scheduling algorithms? (5)	A	2	1,2
4	What is a process? Draw and explain the state transition diagram of a process.	U	2	1,2

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Format for Student Activity Assessment

DIMENSION	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collects some basic information; refer to the topic	Collects relevant information; concerned to the topic	Collects a great deal of information; all refer to the topic	3
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs all duties	Performs all duties of assigned team roles with presentation	4
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Does the assigned job without having to be reminded.	Always does the assigned work without having to be reminded and on given time frame	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Listens, but sometimes talk too much	Listens and contributes to the relevant topic	Listens and contributes precisely to the relevant topic and exhibit leadership qualities	3
					TOTAL	13/4=3.25=4

*All student activities should be done in a group of 4-5 students with a team leader.

Diploma in Computer science & Engineering
IV- Semester
Course Title: Operating System

Time: **3 Hours**   Max Marks**: 100**

PART-A

Answer any <u>SIX</u> questions. Each carries 5 marks.   5X6=30 Marks

1. Write a note on client/server computing.

2. Explain the contents of PCB with neat diagram.

3. Explain the different scheduling criteria.

4. Write a note on critical-section problem and the solution to solve it.

5. How deadlock can be avoided using resource allocation graph? Explain

6. What is fragmentation? Differentiate between internal and external fragmentation.

7. Explain swapping technique with a neat diagram

8. Write a note on Copy-on-write.

9. Discuss briefly client-server model of file sharing

PART-B

Answer any <u>SEVEN</u> full questions each carries 10 marks.   10X7=70 Marks

1. What are the different operating system operations.

2. Different activities in connection with process management, memory management and storage management

3. Consider the following set of process with the length of the CPU burst time given in milliseconds

Process	Burst Time	Priority
P_1	10	3
P_2	13	1
P_3	3	3
P_4	8	4

The processes are assumed to have arrived in the order P_1, P_2, P_3 & P_4 all at time 0.

a. Draw the Gantt chart for FCFS and PRIORITY scheduling algorithms.
b. What is the waiting time and turnaround time of each process for FCFS & PRIORITY scheduling algorithms.
c. Calculate the average waiting time and average turnaround time for FCFS & PRIORITY scheduling algorithms.

4. Explain the different operations on processes.

5. Explain the banker's algorithm.

6. List and explain different structure of the page table with a neat diagram

7. Explain the contiguous memory allocation.

8. Consider the following reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6. How many page faults would occur for the following page replacement algorithm assuming 3 page frames: 1) LRU 2) FIFO 3) Optimal Page Replacement.

9. List out common file types with their extension and functions

10. Explain Tree-structured directory and Acyclic-graph directory with a neat diagrams

Diploma in Computer Science & Engineering
IV Semester
Course Title: Operating System

CO	Question	CL	Marks
I	Write a note on protection and security.	U	**05**
	Write a note on client/server computing.	U	
	Discuss time sharing system.	U	
	Explain distributed system.	U	
	Explain the peer-to-peer computing.	U	
	Explain OS in user's view and system's view.	U	
	List the advantages and disadvantages of multiprogramming system	U	
	What is an operating system? Explain the computer system architecture.	U	**10**
	What are the different operating system operations?	U	
	Compare process management and memory management.	U	
	Explain the special-purpose systems.	U	
	Explain clustered system.	U	
	Different activities in connection with process management, memory management and storage management.	U	
II	What is a process? Draw and explain the state transition diagram of a process.	U	**05**
	Explain the contents of PCB with neat diagram.	U	
	Compare long-term, short-term and medium-term scheduler.	U	
	Explain the different scheduling criteria.	U	
	Explain the different operations on processes.	U	**10**
	What is inter-process communication (IPC). Explain the two models of IPC with neat diagram.	U	
	Consider the following set of process with the length of the CPU burst time given in milliseconds 　　　Process　　　Burst time　　　priority 　　　P1　　　　　10　　　　　3 　　　P2　　　　　13　　　　　1 　　　P3　　　　　3　　　　　3 　The processes are assumed to have arrived in the order P_1, P_2, P_3 all at time 0. 　　　a. Draw the Gantt chart for FCFS and PRIORITY scheduling algorithms. 　　　b. What is the waiting time and turnaround time of each process for FCFS & PRIORITY scheduling algorithms? 　　　c. Calculate the average waiting time and average turnaround time for FCFS & PRIORITY scheduling algorithms. **Similar Problems**	A	
III	Write a note on semaphores.	U	**05**
	Explain the 3 requirements for the solution to critical-section problem.	A	
	Write a note on critical-section problem and the solution to solve it.	A	

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	What is deadlock? What are the necessary conditions for deadlock?	U	
	How deadlock can be prevented? Explain.	U	
	How deadlock can be avoided using resource allocation graph? Explain.	A	
	Explain how to recover from deadlock.	U	
	How deadlock can be detected? Explain.	U	10
	Explain the banker's algorithm.	U	
	Explain resource-allocation graph with deadlock and without deadlock with examples.	A	
IV	Write a note on shared pages.	U	
	Explain First-fit, Best-fit and Worst-fit strategies for memory allocation.	U	
	What is fragmentation? Differentiate between internal and extern fragmentation.	U	
	Explain basic concept of memory allocation using paging	U	05
	Explain how memory is protected in paging with a neat diagram.	U	
	Differentiate between logical and physical address space	U	
	Explain address binding with a neat diagram.	U	
	Explain swapping technique with a neat diagram.	U	
	Explain the contiguous memory allocation.	U	
	Explain hardware implementation of page table with a neat diagram	A	10
	List and explain different structure of the page table with a neat diagram.	A	
	What is segmentation? Draw and explain its hardware support.	A	
V	Explain the virtual memory concept with a neat diagram	U	
	Explain virtual address space with a neat diagram.	U	
	Explain demand paging with a neat diagram.	U	
	Explain the steps for handling page fault with a neat diagram.	U	05
	Write a note on Copy-on-write.	U	
	Explain the need for page replacement.	U	
	How frames are allocated? Explain.	U	
	Explain the steps involved in the basic page replacement with diagram.	U	
	Consider the following reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6. How many page faults would occur for the following page replacement algorithm assuming 3 page frames: 1) LRU 2) FIFO 3) Optimal Page Replacement. **Similar Problems**	A	10
VI	Briefly explain the operations that can be performed on files.	U	
	What are the different operations performed on a directory.	U	
	Write a note on remote file systems.	U	05
	Discuss briefly client-server model of file sharing.	U	
	Define file and explain the different file attributes.	U	
	List out common file types with their extension and functions.	U	
	Differentiate between sequential access and direct access methods.	U	
	Explain Single-level directory and Two-level directory with a neat diagram.	A	10
	Explain Tree-structured directory and Acyclic-graph directory with a neat diagram.	A	