Ref No:

Sri Krishna Institute of Technology,
Bangalore

COURSE PLAN

Academic Year 2019-2020

Program:	B E – Computer Science & Engineering
Semester :	4
Course Code:	18CS43
Course Title:	Operating Systems
Credit / L-T-P:	3/ 2-1-0
Total Contact Hours:	40
Course Plan Author:	SUSHMA.M

Academic Evaluation and Monitoring Cell

Sri Krishna Institute of Technology
#29,Chimney hills,Hesaraghata Main road, Chikkabanavara Post
Bangalore – 560090, Karnataka, INDIA

Phone / Fax :08023721477/28392221/23721315
Web: www.skit.org.in , e-mail: skitprinci@gmail.com

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A. COURSE INFORMATION

1. Course Overview

Degree:	B E	Program:	CS
Semester:	2019/4	Academic Year:	2019-20
Course Title:	Operating System	Course Code:	18CS43
Credit / L-T-P:	2-1-0	SEE Duration:	3 HOUR
Total Contact Hours:	40	SEE Marks:	60
CIA Marks:	40	Assignment	1 / Module
Course Plan Author:	SUSHMA.M	Sign ..	Dt:
Checked By:		Sign ..	Dt:
CO Targets	CIA Target : 90 %	SEE Target:	75 %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute.

Module	Content	Teaching Hours	Blooms Learning Levels
1	Introduction to operating systems, System structures: What operating systems do; Computer System organization; 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. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication	8	L2 Understand, L4 Analyze
2	Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.	8	L2 Understand, L3 Apply
3	Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.	8	L4 Analyze, L2 Understand
4	Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation	8	L3 Apply, L2 Understand

	methods; Free space management.		
5	Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. 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. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.	8	L3 Apply, L3 Apply
-	**Total**	**40**	

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	-	-
1, 2, 3, 4, 5	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7 th edition, Wiley-India, 2006.	1,2,3,4,5,7,8	In Lib / In Dept
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
1, 2,3,4,5	Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6 thEdition	1,2,3,4,5,7,8	In Lib
1, 2,3,4,5	D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013.	1,2,3,4,5,7,8	In lib
1, 2,3,4,5	P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition,PHI(EEE), 2014.	1,2,3,4,5,7,8	In lib
1, 2,3,4,5	William Stallings Operating Systems: Internals and Design Principles, 6th Edition,Pearson.	1,2,3,4,5,7,8	In lib
C	**Concept Videos or Simulation for Understanding**	-	-
C1	*https://www.tutorialspoint.com/PPS/*		
C2	*https://vtuplanet.com/notes/*		
C3	*https://www.khanacademy.com*		
C4	https://www.slideshare.net/ashanrajpar/operating-system-presentation-60556413		
C5	https://nptel.ac.in/contactus.php		
D	**Software Tools for Design**	-	-
E	**Recent Developments for Research**	-	-
	Improve efficiency - https://ieeexplore.ieee.org/abstract/document/6891996		
F	**Others (Web, Video, Simulation, Notes etc.)**	-	-
1	How Electron / Vacuum Tubes work ? https://www.youtube.com/watch?v=nA_tglygvNo		

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	18CPS13	C Programming For Problem Solving	Introduction to Operating system	1	-	L2 Understand
3	17CS34	Computer Organization	Memory system	3	-	L2 Understand
4	17CS35	UNIX system programming	Introduction to file system and its implementation	3	-	L2 Understand
7,8,9	15CS64	OPERATING SYSTEM	Deadlock handling	6		L2 Understand
-						

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
3	Deadlock detection algorithms	Higher Study	Gap A seminar on detection algorithms	Analyze L4
5	Design principles of Ubuntu OS	Higher Study	Gap A seminar on Ubuntu OS	Apply L3

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Instr Method	Assessment Method	Blooms' Level
1	18CS43.1	Summarize the basic concepts and functions of operating system, Analyze different process scheduling algorithms and measure their performance	8	Lecture	Question & Answer Assignment	L2 Understand, L4 Analyze
2	18CS43.2	Understand various threading models, Calculate the performance of various CPU scheduling algorithms	8	Lecture	Question & Answer Assignment	L2 Understand, L3 Apply
3	18CS43.3	Analyze various deadlock methods and memory management schemes, Explain various memory management schemes	8	Lecture	Slip Test Assignment	L4 Analyze, L2 Understand
4	18CS43.4	Interpret various paging	8	Lecture	Question,	L3

		techniques, Understand organization of files and directories.			Slip Test & Answer Assignment	Apply, L2 Understand
5	18CS43.5	Interpret different methods of secondary storage, Show the Design principles of OS w.r.t Linux OS	8	Lecture	Question, Slip Test & Answer Assignment	L3 Apply
-	**-**	**Total**	**40**	**-**	**-**	**L2-L4**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	For developing the custom OS, It helps for developing various various OS functions.	CO1	L4
2	Mobile Computing, web applications, development tools.	CO2	L3
3	Image editing programs, and communication programs, managed resources can be controlled using mutexes.	CO3	L4
4	To develop operating system, To create computer applications.	CO4	L3
5	Companies , Hospital, To build embedded softwares.	CO5	L3

3. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes															-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	17CS64.1	Summarize the basic concepts and functions of operating system, Analyze different process scheduling algorithms and measure their performance	2.3	2.3	2.25	-	-	0.85	-	1.05	-	2.3	-	-				L4
2	17CS64.2	Understand various threading models, Calculate the performance of various CPU scheduling algorithms	2.3	2.3	2.25	-	-	-	-	-	-	2.3	-	-				L3
3	17CS64.3	Analyze various deadlock methods and memory management schemes, Explain various memory management schemes	2.3	2.3	2.25	0.85	-	-	-	-	-	2.3	-	-				L4
4	17CS64.4	Interpret various paging techniques, Understand organization of files and directories.	2.3	2.3	2.25	-	-	-	-	-	1.27	2.3	-	-				L3
5	17CS64.5	Interpret different methods of secondary storage, Show the Design principles of OS w.r.t Linux OS	2.3	2.3	2.25	-	-	-	-	-	1.27	2.3	1.1	-				L3
-	**15EE662.**	Average	2.3	2.3	2.25	0.85	-	0.85	-	1.05	1.27	2.3	1.1	-	-	2.3	2.3	2.25
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																

4. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	Deadlock detection algorithms	Seminar	2nd week / date	-	List from B4 above
2	Design principles of Ubuntu OS	Seminar	3rd Week	-	

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Introduction to operating systems, System structures, Operating System Services, Process Management.	8	2	-	-	1	-	2	CO1	L2,L4
2	Multi-threaded Programming, Process Synchronization.	8	2	-	-	1	-	2	CO2	L2,L3
3	Deadlocks, Memory Management.	8	-	2	-	1	-	2	CO3	L4,L2
4	Virtual Memory Management, File System, Implementation of File System.	8	-	2		1	-	2	CO4	L3,L2
5	Secondary Storage Structures, Protection, Case Study: The Linux Operating System	8	-	-	4	1	-	2	CO5	L3,L3
-	**Total**	**40**	**4**	**4**	**4**	**5**	**-**	**10**	-	-

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	30	CO1, CO2.	L2,L4,L2,L3
3, 4	CIA Exam – 2	30	CO3,CO4.	L4,L2,L3,L2
5	CIA Exam – 3	30	CO5.	L3,L3.
1, 2	Assignment - 1	10	CO1, CO2.	L2,L4,L2,L3
3, 4	Assignment - 2	10	CO3,CO4.	L4,L2,L3,L2
5	Assignment - 3	10	CO5.	L3,L3
1, 2	Seminar - 1		-	-
3, 4	Seminar - 2		-	-
5	Seminar - 3		-	-
1, 2	Quiz – 1		-	-
3, 4	Quiz – 2		-	-
5	Quiz – 3		-	-
				-
1 - 5	Other Activities – Mini Project	-	-	
	Final CIA Marks	**40**	**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:	Introduction to operating systems, System structures	Appr Time:	8 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	The student should be able to:	-	**Level**
1	Summarizing the basic concepts and functions of operating system	CO1	L2
2	Apply different process scheduling algorithms and measure their performance	CO1	L4
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
1	introduction to operating systems, System structures: What operating systems do; Computer System organization	CO1	L2
2	Computer System architecture; Operating System structure; Operating System operations;	CO1	L2
3	Process management; Memory management; Storage management; Protection and Security	CO1	L2
4	Distributed system; Special-purpose systems	CO1	L2
5	Computing environments. Operating System Services	CO1	L2
6	User - Operating System interface; System calls; Types of system calls	CO1	L4
7	System programs; Operating system design and implementation	CO1	L4
8	Operating System structure; Virtual machines	CO1	L4
9	Operating System generation; System boot	CO1	L4
10	Process Management -Process concept; Process scheduling	CO1	L4
11	Operations on processes;Inter process communication	CO1	L4
c	**Application Areas**		
-	Students should be able employ / apply the Module learnings to . . .		
1	web applications, development tools, image editing programs, and communication programs	CO1	L2
2	To create computer applications,embedded softwares	CO1	L4
d	**Review Questions**		
-			
1	What is an OS? List out the different services that an OS provides. Explain.	CO1	L2
2	Explain the layered approach to structuring of an OS along with a relevant diagram	CO1	L2
3	What are the major activities of an OS with regard to (i) Process management (ii) Memory management.	CO1	L2
4	Explain the fundamental difference between (i) N/W OS and Distributed OS (ii) Web-Based Computing and Embedded Computing.	CO1	L2
5	What is a process? Draw and explain the process state diagram	CO1	L4
6	Explain different scheduling criteria that must be kept in mind while choosing different scheduling algorithms.	CO1	L4
7	What are virtual machines? Explain its advantages with a diagram.	CO1	L4
8	List and explain services provided by an OS that are designed to make using computer system more convenient for users.	CO1	L4
9	What are system calls? With examples explain different categories of system calls.	CO1	L4
10	What is distributed OS? What are the advantages of distributed OS.	CO1	L4
11	Differentiate between (I) Process and thread	CO1	L4

	(ii) short-term and medium term scheduler (iii) User level and Kernel level threads (iv) Waiting and Turn-Around time		
12	What is a PCB? Explain with a neat diagram.	CO1	L4
13	What is interprocess communication? Explain direct and indirect communication with respect to message passing system.	CO1	L4

Module – 2

Title:	Multithreaded programming and process synchronization	Appr Time:	8 Hrs
a	***Course Outcomes***	**CO**	**Blooms**
-	The student should be able to:	-	**Level**
1	Understanding various threading models	CO2	L2
2	Analyzing the performance of various CPU scheduling algorithms and threading models	CO2	L3
b	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
12	Multi-threaded Programming: Overview;Multithreading models	CO2	L2
13	Thread Libraries;Threading issues;	CO2	L2
14	Process Scheduling: Basic concepts; Scheduling Criteria	CO2	L3
15	Scheduling Algorithms	CO2	L3
16	Multiple-processor scheduling;Thread scheduling	CO2	L3
17	Process Synchronization: Synchronization: The critical section Problem	CO2	L3
18	Peterson's solution	CO2	L3
19	Synchronization hardware;Semaphores	CO2	L3
20	Classical problems of synchronization; Monitors	CO2	L3
c	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Mobile Computing	CO2	L2
2	web applications, development tools	CO2	L3
d	**Review Questions**	-	-
14	Explain the differences between single-threaded and multi threaded processes using neat diagram.	CO2	L2
15	What are the benefits of multi threading? Explain the multi threading models	CO2	L2
16	Explain the different threading issues.	CO2	L2
17	Define multithreading. Explain the benefits of multithreading.	CO2	L2
18	List and explain the different scheduling criteria. Explain priority scheduling with an example.	CO2	L2
19	Explain critical-section problem and solution to it..	CO2	L2
20	Explain Synchronization Hardware in detail.	CO2	L3
21	Explain Readers-writers problem and provide a semaphore solution using semaphores for reads priority problem.	CO2	L3
22	Explain Dining-Philosopher's problem using monitors.	CO2	L3
23	Explain the range of monitors with a schematic view of its structure; write a monitor solution to bounded-buffer problem.	CO2	L3
24	What is busy waiting in a critical section concept? How semaphore is used to solve critical section problem? What are the advantages of semaphore.	CO2	L3
25	What are the requirements that a critical section problem must satisfy?	CO2	L3

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<table><tr><th>Process</th><th>Burst Time</th><th>Arrival time</th></tr><tr><td>P1</td><td>10</td><td>0</td></tr><tr><td>P2</td><td>1</td><td>0</td></tr><tr><td>P3</td><td>2</td><td>1</td></tr><tr><td>P4</td><td>4</td><td>2</td></tr><tr><td>P5</td><td>3</td><td>2</td></tr></table>i) Draw Ganntt charts using FCFS, SJF Preemptive and non preemptive scheduling.
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<tr><td>28</td><td>For the processes listed below, draw Gantt charts usingb preemptive and non preemptive priority scheduling algorithm. A larger priority number has higher priority.
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ii) What is the turn around time and waiting time of each processes for each of the scheduling algorithms in (I).</td><td>CO2</td><td>L3</td></tr>
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30	Explain multiprocessor scheduling.	CO2	L3

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:			Sem:	I	Marks:		Time:	
Course:								
-	-	**Note: Answer all questions, each carry equal marks. Module : 1, 2**				**Marks**	**CO**	**Level**
1	a	What is an OS? List out the different services that an OS provides. Explain				5	CO1	L2
	b	Explain the following Computer- System Architecture: (i) Multi Processor Systems (ii) Clustered Systems				5	CO1	L2
	c	What are system calls? Explain different types of system calls.				5	CO2	L4
		OR						
2	a	What are the major activities of an OS with regard to: (i) Storage Management (ii) Memory Management				5	CO1	L2
	b	What is Virtual Machine? Explain VM-Ware architecture with neat diagram.				5	CO1	L2
	c	What is a process? Draw and explain the following: (i) process state diagram (ii) Process Control Block(PCB)				5	CO2	L4
		MODULE-2						
3	a	What is Inter-process communication? Explain direct and indirect communication with respect to message passing system.				6	CO2	L4
	b	What are the benefits of multi-threading? Explain multithreading models.				4	CO3	L4
	c	Explain critical-section problem and solution to it..				5	CO3	L4
		OR						
4	a	Explain the different threading issues in Multithreaded Programming				5	CO4	L4
	b	Following is the snapshot of a CPU Process / Burst Time / Arrival Time P1 5 0 P2 1 1 P3 4 2 Draw grant charts and calculate the waiting time and turnaround time using FCFS,Premptive SJF and RR with time quantum=4.				6	CO4	L4
	c	Explain Synchronization Hardware in detail.				4	CO4	L4

b. Assignment -1

Model Assignment Questions

Crs Code:		Sem:		Marks:		Time:	
Course:							

SNo	Assignment Description	Marks	CO	Level
1	What is an OS? List out the different services that an OS provides. Explain.	5	CO1	L2
2	Explain the layered approach to structuring of an OS along with a relevant diagram	7	CO1	L2
3	What are the major activities of an OS with regard to (i) Process management (ii) Memory management.	6	CO1	L2
4	Explain the fundamental difference between (i) N/W OS and Distributed OS (ii) Web-Based Computing and Embedded Computing.	6	CO1	L2
5	What is a process? Draw and explain the process state diagram	5	CO2	L2
6	Explain different scheduling criteria that must be kept in mind while choosing different scheduling algorithms.	6	CO2	L2
7	What are virtual machines? Explain its advantages with a diagram.	8	CO2	L2
8	List and explain services provided by an OS that are designed to make using computer system more convenient for users.	8	CO2	L2
9	What are system calls? With examples explain different categories of system calls.	6	CO2	L4
10	What is distributed OS? What are the advantages of distributed OS.	7	CO2	L4
11	What is a PCB? Explain with a neat diagram.	5	CO2	L4
12	What is interprocess communication? Explain direct and indirect communication with respect to message passing system.	8	CO2	L4
13	Explain the differences between single-threaded and multithreaded processes using neat diagram.	8	CO3	L4
14	What are the benefits of multithreading? Explain the multithreading models	8	CO3	L4
15	Explain the different threading issues.	6	CO3	L4
16	Define multithreading. Explain the benefits of multithreading.	7	CO3	L4
17	List and explain the different scheduling criteria. Explain priority scheduling with an example.	7	CO4	L4
18	Explain critical-section problem and solution to it..	6	CO4	L4
19	Explain Synchronization Hardware in detail.	6	CO4	L4
20	Explain Readers-writers problem and provide a semaphore solution using semaphores for reads priority problem.	7	CO4	L4
21	Explain Dining-Philosopher's problem using monitors.	6	CO4	L4
22	Explain the range of monitors with a schematic view of its structure; write a monitor solution to bounded-buffer problem.	6	CO4	L4

D2. TEACHING PLAN - 2

Module – 3

Title:	Deadlocks and Memory management	Appr Time:	8 Hrs
A	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Analyze various deadlock methods and memory management schemes	CO3	L4
2	Explain various memory management schemes	CO3	L2

<table>
<tr><td>B</td><td>Course Schedule</td><td></td><td></td></tr>
<tr><td>Class No</td><td>Portion covered per hour</td><td>-</td><td>-</td></tr>
<tr><td>21</td><td>Deadlocks : Deadlocks; System model</td><td>CO3</td><td>L4</td></tr>
<tr><td>22</td><td>Deadlock characterization</td><td>CO3</td><td>L4</td></tr>
<tr><td>23</td><td>Methods for handling deadlocks</td><td>CO3</td><td>L4</td></tr>
<tr><td>24</td><td>Deadlock prevention; Deadlock avoidance</td><td>CO3</td><td>L4</td></tr>
<tr><td>25</td><td>Deadlock detection and recovery from deadlock</td><td>CO3</td><td>L4</td></tr>
<tr><td>26</td><td>Memory Management: Memory management strategies</td><td>CO3</td><td>L2</td></tr>
<tr><td>27</td><td>Background; Swapping</td><td>CO3</td><td>L2</td></tr>
<tr><td>28</td><td>Contiguous memory allocation</td><td>CO3</td><td>L2</td></tr>
<tr><td>29</td><td>Paging; Structure of page table</td><td>CO3</td><td>L2</td></tr>
<tr><td>30</td><td>Segmentation.</td><td>CO3</td><td>L2</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>C</td><td>Application Areas</td><td>-</td><td>-</td></tr>
<tr><td>-</td><td>Students should be able employ / apply the Module learnings to . . .</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>Image editing programs, and communication programs</td><td>CO3</td><td>L2</td></tr>
<tr><td>2</td><td>managed resources can be controlled using mutexes</td><td>CO3</td><td>L2</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>D</td><td>Review Questions</td><td>-</td><td>-</td></tr>
<tr><td>-</td><td>The attainment of the module learning assessed through following questions</td><td>-</td><td>-</td></tr>
<tr><td>31</td><td>Explain necessary conditions for deadlock to occur.</td><td>CO3</td><td>L4</td></tr>
<tr><td>32</td><td>Explain resource-allocation graph algorithm with an example.</td><td>CO3</td><td>L4</td></tr>
<tr><td>33</td><td>Explain deadlock detection algorithms.</td><td>CO3</td><td>L4</td></tr>
<tr><td>34</td><td>Explain different methods to recover from deadlock.</td><td>CO3</td><td>L4</td></tr>
<tr><td>35</td><td>Dead lock exists if a cycle exists. Yes or no. Justify your answer with a suitable example.</td><td>CO3</td><td>L4</td></tr>
<tr><td>36</td><td>What are the methods used to handle the deadlocks? Explain how circular wait condition can be prevented from occurring.</td><td>CO3</td><td>L4</td></tr>
<tr><td>37</td><td>What is locality of reference? Differentiate between paging and segmentation.</td><td>CO3</td><td>L4</td></tr>
<tr><td>38</td><td>Why are translation loan-aside bubbles(TLB) important? In a simple paging system, what information is stored in TLB ? Explain.</td><td>CO3</td><td>L2</td></tr>
<tr><td>39</td><td>What is swapping? Does this increase the operating systems overhead? Justify your answers</td><td>CO3</td><td>L2</td></tr>
<tr><td>40</td><td>What do you mean by fragmentation? Explain difference between internal and external fragmentation with neat diagrams.</td><td>CO3</td><td>L2</td></tr>
<tr><td>41</td><td>Explain basic method and hardware required for segmentation.</td><td>CO3</td><td>L2</td></tr>
<tr><td>42</td><td>Distinguish between:
I) Logical versus physical address space
ii) Paging versus segmentation.
Iii) First fit and best fit algorithms.</td><td>CO3</td><td>L2</td></tr>
<tr><td>43</td><td>Given memory partitions of 100K, 500K, 200K, 300K and 600K apply first fit and best fit algorithm to place 212K, 417K, 112K and 426K.</td><td>CO3</td><td>L2</td></tr>
<tr><td>44</td><td>Explain the structure of page table with respect to hierarchy paging.</td><td>CO3</td><td>L2</td></tr>
<tr><td>45</td><td>Consider the following snapshot of a system:
<table>
<tr><td></td><td>Allocation</td><td>MAX</td><td>Availabl e</td></tr>
<tr><td></td><td>A B C</td><td>A B C</td><td>A B C</td></tr>
<tr><td>Po</td><td>0 0 2</td><td>0 0 4</td><td>1 0 2</td></tr>
<tr><td>P1</td><td>1 0 0</td><td>2 0 1</td><td></td></tr>
<tr><td>P2</td><td>1 3 5</td><td>1 3 7</td><td></td></tr>
</table></td><td>CO3</td><td>L2</td></tr>
</table>

	P3 | 6 3 2 | 8 4 2 | P4 | 1 4 3 | 1 5 7 | Answer the following questions using Banker's algorithm: Is the system in a "safe state" ? If a request from process P2 arrives for (002) can the request be granted immediately?		
46	For the given snapshot: Allocation: P1 (0 0 1 2), P2 (1 0 0 0), P3 (1 3 5 4), P4 (0 6 3 2), P5 (0 0 1 4) MAX: P1 (0 0 1 2), P2 (1 7 5 0), P3 (2 3 5 6), P4 (0 6 5 2), P5 (0 6 5 6) Available: P1 (1 5 2 0) Using Banker' algorithm: I) What is need matrix content? II) Is the system in safe state? III) If a request from process from P2(0,4,2,0) arrivers, can it be granted?	CO3	L2
E	**Experiences**	-	-
1		CO6	L2
2			

Module – 4

Title:	Virtual memory management and file system	Appr Time:	8 Hrs
A	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Interpret various paging techniques	CO4	L3
2	Understand organization of files and directories.	CO4	L2
B	***Course Schedule***		
Class No	**Portion covered per hour**	**-**	**-**
31	Virtual Memory Management: Background	CO4	L3
32	Demand paging; Copy-on-write; Page replacement; Allocation of frames	CO4	L3
33	Thrashing	CO4	L3
34	File System;Implementation of File System: File system: File concept; Access methods;Directory structure File system mounting	CO4	L2
35	File sharing;Protection:Implementing File system: File system structure; File system implementation	CO4	L2
36	Director implementation	CO4	L2
37	Allocation methods; Free space management	CO4	L2

C	**Application Areas**	-	-
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	To develop operating system	CO4	L3
2	To create computer applications	CO4	L2
D	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
47	What is page fault ? With a supporting diagram explain the steps involved in handling page fault.	CO4	L3
48	Consider the following page reference stream 7,0,1,2,0,3,0,4,2,3,0. Calculate the number of page faults when number of frames is equal to 3, using FIFO, LRU and Optimal page replacement algorithms.	CO4	L3
49	Explain the different LRU-approximation page replacement algorithms.	CO4	L3
50	Explain copy-on-write process in virtual memory.	CO4	L3
51	Write short note on thrashing.	CO4	L3
52	What are the different allocation methods in disk? Explain in detail any two methods.	CO7	L3
53	What are different types of file sharing? Explain.	CO4	L2
54	List the different Directory Structure. Explain acyclic-graph directory and tree structured directory.	CO4	L2
55	Explain different free space management	CO4	L2
56	What is a file? Also list different file operations	CO4	L2
57	Explain different free space management	CO4	L2
58	What are the different techniques with which a file can be shared among users.	CO4	L2
59	Explain various file protection mechanisms.	CO4	L2
60	Explain briefly different file systems and file attributes.	CO4	L2
E	**Experiences**	-	-
1		CO7	L2
2			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:			Sem:		Marks:		Time			
Course:										
-	**-**	**Note: Answer all questions, each carry equal marks. Module : 3, 4**						**Marks**	**CO**	**Level**
1	A	What are the methods used to handle the deadlocks? Explain how circular wait condition can be prevented from occurring.						7	CO7	L2
	B	Explain different methods to recover from deadlock.						8	CO7	L2
		OR								
2	A	Why are translation look-aside bubbles(TLB) important? In a simple paging system, what information is stored in TLB ? Explain.						6	CO8	L2
	B	What is swapping? Does this increase the operating systems overhead? Justify your answers						5	CO8	L2
	C	What do you mean by fragmentation? Explain difference between internal and external fragmentation with neat diagrams.						4	CO8	L2
		MODULE-4								
3	A	What is page fault ? With a supporting diagram explain the steps involved in handling page fault.						8	CO9	L3
	B	Consider the following page reference stream 7,0,1,2,0,3,0,4,2,3,0. Calculate the number of page faults when number of frames is equal to 3, using FIFO, LRU and Optimal page replacement algorithms.						7	CO9	L3
		OR								
4	A	What are the different techniques with which a file can be shared among users.						8	CO10	L3
	B	Explain briefly different file systems and file attributes.						7	CO10	L3

b. Assignment – 2

Model Assignment Questions							
Crs Code:		Sem:		Marks:		Time:	
Course:							

SNo	Assignment Description	Marks	CO	Level
1	What are the methods used to handle the deadlocks? Explain how circular wait condition can be prevented from occurring.	6	CO3	L2
2	What is locality of reference? Differentiate between paging and segmentation.	7	CO3	L2
3	Why are translation loan-aside bubbles(TLB) important? In a simple paging system, what information is stored in TLB ? Explain.	8	CO3	L2
4	What is swapping? Does this increase the operating systems overhead? Justify your answers	6	CO3	L2
5	What do you mean by fragmentation? Explain difference between internal and external fragmentation with neat diagrams.	6	CO3	L2
6	Explain basic method and hardware required for segmentation.	7	CO3	L2
7	Distinguish between: I) Logical versus physical address space ii) Paging versus segmentation. Iii) First fit and best fit algorithms.	6	CO3	L2
8	Consider the following snapshot of a system: <table><tr><td></td><td>Allocation</td><td>MAX</td><td>Availabl e</td></tr><tr><td></td><td>A B C</td><td>A B C</td><td>A B C</td></tr><tr><td>Po</td><td>0 0 2</td><td>0 0 4</td><td>1 0 2</td></tr><tr><td>P1</td><td>1 0 0</td><td>2 0 1</td><td></td></tr><tr><td>P2</td><td>1 3 5</td><td>1 3 7</td><td></td></tr><tr><td>P3</td><td>6 3 2</td><td>8 4 2</td><td></td></tr><tr><td>P4</td><td>1 4 3</td><td>1 5 7</td><td></td></tr></table>Answer the following questions using Banker's algorithm: Is the system in a "safe state" ? If a request from process P2 arrives for (002) can the request be granted immediately?	6	CO3	L2
9	For the given snapshot: <table><tr><td></td><td>Allocation</td><td>MAX</td><td>Available</td></tr><tr><td></td><td>A B C D</td><td>A B C D</td><td>A B C D</td></tr></table>	6	CO3	L2

	<table><tr><td>P1</td><td>0 0 1 2</td><td>0 0 1 2</td><td>1 5 2 0</td></tr><tr><td>P2</td><td>1 0 0 0</td><td>1 7 5 0</td><td></td></tr><tr><td>P3</td><td>1 3 5 4</td><td>2 3 5 6</td><td></td></tr><tr><td>P4</td><td>0 6 3 2</td><td>0 6 5 2</td><td></td></tr><tr><td>P5</td><td>0 0 1 4</td><td>0 6 5 6</td><td></td></tr></table> Using Banker' algorithm: I) What is need matrix content? II) Is the system in safe state? III) If a request from process from P2(0,4,2,0) arrivers, can it be granted?			
10	What is page fault ? With a supporting diagram explain the steps involved in handling page fault.	6	CO3	L2
11	Consider the following page reference stream 7,0,1,2,0,3,0,4,2,3,0. Calculate the number of page faults when number of frames is equal to 3, using FIFO, LRU and Optimal page replacement algorithms.	7	CO3	L2
12	Explain the different LRU-approximation page replacement algorithms.	7	CO3	L2
13	Explain copy-on-write process in virtual memory.	6	CO4	L2
14	Write short note on thrashing.	6	CO4	L2
15	What are the different allocation methods in disk? Explain in detail any two methods.	6	CO4	L2
16	What are different types of file sharing? Explain.	6	CO4	L3
17	List the different Directory Structure. Explain acyclic-graph directory and tree structured directory.	7	CO4	L3
18	Explain different free space management	7	CO4	L3
19	What is a file? Also list different file operations	6	CO4	L3
20	Explain different free space management	7	CO4	L3
21	What are the different techniques with which a file can be shared among users.	8	CO4	L3

D3. TEACHING PLAN - 3

Module – 5

Title:	Secondary Storage Structures, Protection	Appr Time:	8 Hrs
A	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Interpret different methods of secondary storage	CO5	L3
2	Show the Design principles of OS w.r.t Linux OS	CO5	L3
B	***Course Schedule***	-	-
Class No	**Portion covered per hour**	**-**	**-**
38	Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling	CO5	L3
39	Disk management; Swap space management. Protection: Goals of protection, Principles of protection	CO5	L3

40	Domain of protection, Access matrix, Implementation of access matrix, Access control	CO5	L3
41	Revocation of access rights, Capability- Based systems	CO5	L3
42	Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules	CO5	L3
43	Process management; Scheduling; Memory Management;	CO5	L3
44	File systems	CO5	L3
45	Input and output;Inter-process communication	CO5	L3
C	**Application Areas**	**-**	**-**
-	Students should be able employ / apply the Module learnings to . . .	-	-
1	Companies , Hospital	CO5	L3
2	To build embedded software	CO5	L3
D	**Review Questions**	-	-
-	The attainment of the module learning assessed through following questions	-	-
61	List the different disk scheduling techniques,Explain any two scheduling,considering the following disk queue requests: 98,183,37,122,14,124,65,67.	CO5	L3
62	What is an access matrix? Explain the different methods of implementing access matrix.	CO5	L3
63	Explain bad-block recovery in disk.	CO5	L3
64	Explain the different steps involved in disk formatting	CO5	L3
65	Suppose that a disk has 50 cylinders named 0 to 49. The read/write head is currently serving at cylinder 15. The queue of pending requests are in order: 4, 40,11, 35, 7,14.For each of the scheduling algorithms: SCAN, C-LOOK and C-SCAN. i) Show the graphical representation for above scheduling algorithms.(ii) Find the average head movement for above scheduling algorithms	CO5	L3
66	Differentiate between protection and security.	CO5	L3
67	Explain the various storage mechanisms available to store files with neat diagram.	CO5	L3
68	Write a short notes on: I) Swap space management ii) Revocation of access rights	CO5	L3
69	With supporting diagrams, explain linked and indexed method of allocating disk space.	CO5	L3
70	Explain the following disk scheduling algorithm in brief: I) SSTF ii) SCAN iii) LOOK	CO5	L3
71	Explain in brief the selection of disk scheduling algorithm.	CO5	L3
72	Explain the Design principle of Linux.	CO5	L3
73	Explain the process management in Linux platform.	CO5	L3
74	Explain the interprocess communication mechanism in Linux.	CO5	L3
75	Explain File Systems in Linux.	CO5	L3
76	What do you mean by Cloning? How is it achieved in Linux system.	CO5	L3
77	Write a short notes on: I) Portability issues in LINUX ii) Network structure in LINUX.	CO5	L3
E	**Experiences**	-	-
1		CO5	L2
2		CO5	

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code		Sem:		Marks:		Time:	

18CS43

Course:					
-	**-**	**Note: Answer all questions, each carry equal marks. Module : 5**	**Marks**	**CO**	**Level**
1	A	What is an access matrix? Explain the different methods of implementing access matrix.	6	CO5	L3
	B	Explain bad-block recovery in disk.	7	CO5	L3
		OR			
2	a	List the different disk scheduling techniques,Explain any two scheduling,considering the following disk queue requests: 98,183,37,122,14,124,65,67.	7	CO5	L3
	b	Explain the interprocess communication mechanism in Linux.	8	CO5	L3
		MODULE-5			
3	a	Explain the various storage mechanisms available to store files with neat diagram.	7	CO5	L3
	b	Write a short notes on: I) Swap space management ii) Revocation of access rights	8	CO5	L3
		OR			
4	a	With supporting diagrams, explain linked and indexed method of allocating disk space.	8	CO5	L3
	b	Explain the following disk scheduling algorithm in brief: I) SSTF ii) SCAN iii) LOOK	7	CO5	L3

b. Assignment – 3

Model Assignment Questions							
Crs Code:		Sem:		Marks:		Time:	
Course:							

SNo	**Assignment Description**	**Marks**	**CO**	**Level**
1	What is an access matrix? Explain the different methods of implementing access matrix.	5	CO5	L3
2	Explain bad-block recovery in disk.	6	CO5	L3
3	Explain the different steps involved in disk formatting	7	CO5	L3
4	Suppose that a disk has 50 cylinders named 0 to 49. The read/write head is currently serving at cylinder 15. The queue of pending requests are in order: 4, 40,11, 35, 7,14.For each of the scheduling algorithms: SCAN, C-LOOK and C-SCAN. i) Show the graphical representation for above scheduling algorithms.(ii) Find the average head movement for above scheduling algorithms	6	CO5	L3
5	Differentiate between protection and security.	4	CO5	L3
6	Explain the various storage mechanisms available to store files with neat diagram.	5	CO5	L3
7	Write a short notes on: I) Swap space management ii) Revocation of access rights	7	CO5	L3
8	With supporting diagrams, explain linked and indexed method of allocating disk space.	7	CO5	L3
9	Explain the following disk scheduling algorithm in brief: I) SSTF ii) SCAN iii) LOOK	6	CO5	L3
10	Explain in brief the selection of disk scheduling algorithm.	5	CO5	L3
11	Explain the Design principle of Linux.	7	CO5	L3
12	Explain the process management in Linux platform.	6	CO5	L3
13	Explain File Systems in Linux.	5	CO5	L3
14	What do you mean by Cloning? How is it achieved in Linux system.	7	CO5	L3
15	Write a short notes on: I) Portability issues in LINUX		CO5	L3

	ii) Network structure in LINUX.			

F. EXAM PREPARATION

1. University Model Question Paper

Course:		Sensors and Transducers					Month / Year		May /2018	
Crs Code:		15EE662	Sem:	6	Marks:	80	Time:		180 minutes	
Module		Answer all FIVE full questions. All questions carry equal marks.						**Marks**	**CO**	**Level**
1	a	Define Operating System. With a neat diagram explain the dual mode of operating system.						06	CO1	L2
	b	Explain the services of Operating System that are helpful for usetr and the system.						06	CO1	L2
	c	Define the following terms: I) virtual machines ii) CPU scheduler iii) System call iv) Context switch						04	CO1	L2
		OR								
	a	What is a process? Draw and explain the process state diagram						05	CO2	L4
	b	What is interprocess communication? Explain direct and indirect communication with respect to message passing system.						06	CO2	L4
	c	Explain the layered approach to structuring of an OS along with a relevant diagram						09	CO2	L4
2	a	Explain Multithreading models, Also list the benefits of Multithreaded Programming.						06	C03	L2
	b	Explain Multiprocessor Scheduling						04	C03	L2
	c	Consider the following set of processes with arrival time: Process / Burst Time (m sec) / Arrival time (m sec) / priority P1 / 10 / 0 / 4 P2 / 5 / 3 / 2 P3 / 6 / 3 / 6 P4 / 4 / 5 / 3 Consider larger number as highest priority. Calculate the average waiting time and turn around time and draw Gantt chart for preemptive scheduling and premptive SJF scheduling.						06	CO3	L2
		OR								
	a	What are the requirements to critical section problem? Explain Peterson's solution to critical section problem.						06	CO4	L3
	b	Explain Dining-philosophers problem with semaphores.						05	CO4	L3
	c	Explain the syntax and schematic view of monitors						05	CO4	L3
3	a	What are the necessary conditions for deadlock? Explain different methods to recover from deadlock.						08	CO5	L4
	b	Consider the following snapshot of a system: Allocation / MAX / Availabl						08	CO5	L4

		e			
		A B C A B C A B C			
		Po 0 0 2 0 0 4 1 0 2			
		P1 1 0 0 2 0 1			
		P2 1 3 5 1 3 7			
		P3 6 3 2 8 4 2			
		P4 1 4 3 1 5 7			
		Answer the following questions using Banker's algorithm: Is the system in a "safe state" ? If a request from process P2 arrives for (002) can the request be granted immediately?			
		OR			
	a	What is paging? Explain paging hardware with translation look-aside buffer.	06	CO6	L2
	b	Explain the structure of page table with respect to hierarchical paging.	06	CO6	L2
	c	Given the 5 memory partitions of 100K, 500K, 200K, 300K and 600K apply first fit and best fit and worst fit algorithm to place 212K, 417K, 112K and 426K size. Which algorithm makes efficient use of memory?	04	CO6	L2
4	a	What is page fault ? With a supporting diagram explain the steps involved in handling page fault.	06	CO7	L3
	b	Consider the following page reference stream 7,0,1,2,0,3,0,4,2,3,0. Calculate the number of page faults when number of frames is equal to 3, using FIFO, LRU and Optimal page replacement algorithms.	06	CO7	L3
	c	Explain copy-on-write process in virtual memory.	04	CO7	L3
		OR			
	a	What are the different allocation methods in disk? Explain in detail any two methods.	06	CO8	L2
	b	What is a file? Also list different file operations.	03	CO8	L2
	c	List the different Directory Structure. Explain acyclic-graph directory and tree structured directory.	07	CO8	L2
5	a	List the different disk scheduling techniques,Explain any two scheduling,considering the following disk queue requests: 98,183,37,122,14,124,65,67.	06	CO9	L3
	b	What is an access matrix? Explain the different methods of implementing access matrix.	06	CO9	L3
	c	Explain bad-block recovery in disk.	04	CO9	L3
		OR			
	a	Explain the Design principle of Linux.	06	CO10	L3
	b	Explain the process management in Linux platform.	06	CO10	L3
	c	Explain the interprocess communication mechanism in Linux.	04	CO10	L3

2. SEE Important Questions

Course:						Month / Year	
Crs Code:	1	Sem:		Marks:		Time:	
	Note	Answer all FIVE full questions. All questions carry equal marks.				-	-

<table>
<tr><th>Module</th><th>Qno.</th><th>Important Question</th><th>Marks</th><th>CO</th><th>Year</th></tr>
<tr><td>1</td><td>1</td><td>Define Operating System. With a neat diagram explain the dual mode of operating system.</td><td>06</td><td>CO1</td><td>2018</td></tr>
<tr><td></td><td>2</td><td>Explain the services of Operating System that are helpful for usetr and the system.</td><td>06</td><td>CO1</td><td>2018</td></tr>
<tr><td></td><td>3</td><td>Define the following terms:
I) virtual machines
ii) CPU scheduler
iii) System call
iv) Context switch</td><td>04</td><td>CO1</td><td>2018</td></tr>
<tr><td></td><td>4</td><td>What is a process? Draw and explain the process state diagram</td><td>05</td><td>CO2</td><td>2018</td></tr>
<tr><td></td><td>5</td><td>What is interprocess communication? Explain direct and indirect communication with respect to message passing system.</td><td>06</td><td>CO2</td><td>2018</td></tr>
<tr><td></td><td>6</td><td>Explain the layered approach to structuring of an OS along with a relevant diagram</td><td>09</td><td>CO2</td><td>2018</td></tr>
<tr><td></td><td>7</td><td>What are essential properties of batch,real time and distributed OS</td><td>06</td><td>CO1</td><td>2014</td></tr>
<tr><td></td><td>8</td><td>What are the different ways in which P-threads terminate</td><td>05</td><td>CO1</td><td>2015</td></tr>
<tr><td></td><td>9</td><td>Differntiate between multiprogramming and multiprocessing.</td><td>05</td><td>CO1</td><td>2015</td></tr>
<tr><td></td><td>10</td><td>What are system calls? With example explain different categories of system calls</td><td>07</td><td>CO2</td><td>2012</td></tr>
<tr><td></td><td>11</td><td>What are virtual machines? Explain its advantages with a neat diagram</td><td>08</td><td>CO2</td><td>2014</td></tr>
<tr><td></td><td>12</td><td>What are the benefits offered by co-operating processes? Describe direct and indirect inter process communication.</td><td>07</td><td>CO2</td><td>2012</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>1</td><td>Explain Multithreading models, Also list the benefits of Multithreaded Programming.</td><td>06</td><td>C03</td><td>2018</td></tr>
<tr><td></td><td>2</td><td>Explain Multiprocessor Scheduling</td><td>04</td><td>C03</td><td>2018</td></tr>
<tr><td></td><td>3</td><td>Consider the following set of processes with arrival time:
<table>
<tr><th>Process</th><th>Burst Time (m sec)</th><th>Arrival time (m sec)</th><th>priority</th></tr>
<tr><td>P1</td><td>10</td><td>0</td><td>4</td></tr>
<tr><td>P2</td><td>5</td><td>3</td><td>2</td></tr>
<tr><td>P3</td><td>6</td><td>3</td><td>6</td></tr>
<tr><td>P4</td><td>4</td><td>5</td><td>3</td></tr>
</table>
Consider larger number as highest priority. Calculate the average waiting time and turn around time and draw Gantt chart for preemptive scheduling and premptive SJF scheduling.</td><td>06</td><td>CO3</td><td>2017</td></tr>
<tr><td></td><td>4</td><td>Explain Control synchronization and need for control synchronization with an example</td><td>08</td><td>CO3</td><td>2018</td></tr>
<tr><td></td><td>5</td><td>Define multithreading. Explain the benefits of multithreading.</td><td>7</td><td>CO3</td><td>2016</td></tr>
<tr><td></td><td>6</td><td>List and explain the different scheduling criteria. Explain priority scheduling with an example.</td><td>7</td><td>CO4</td><td>2015</td></tr>
<tr><td></td><td>7</td><td>Explain critical-section problem and solution to it..</td><td>6</td><td>CO4</td><td>2017</td></tr>
<tr><td></td><td>8</td><td>What are the requirements to critical section problem? Explain Peterson's solution to critical section problem.</td><td>06</td><td>CO4</td><td>2017</td></tr>
<tr><td></td><td>9</td><td>Explain Dining-philosophers problem with semaphores.</td><td>05</td><td>CO4</td><td>2016</td></tr>
<tr><td></td><td>10</td><td>Explain the syntax and schematic view of monitors</td><td>05</td><td>CO4</td><td>2016</td></tr>
<tr><td>3</td><td>1</td><td>What are the necessary conditions for deadlock? Explain different methods to recover from deadlock.</td><td>08</td><td>CO5</td><td>2018</td></tr>
<tr><td></td><td>2</td><td>Consider the following snapshot of a system:</td><td>07</td><td>CO5</td><td>2018</td></tr>
</table>

		<table><tr><td></td><td>Allocation</td><td>MAX</td><td>Available</td></tr><tr><td></td><td>A B C</td><td>A B C</td><td>A B C</td></tr><tr><td>Po</td><td>0 0 2</td><td>0 0 4</td><td>1 0 2</td></tr><tr><td>P1</td><td>1 0 0</td><td>2 0 1</td><td></td></tr><tr><td>P2</td><td>1 3 5</td><td>1 3 7</td><td></td></tr><tr><td>P3</td><td>6 3 2</td><td>8 4 2</td><td></td></tr><tr><td>P4</td><td>1 4 3</td><td>1 5 7</td><td></td></tr></table> Answer the following questions using Banker's algorithm: Is the system in a "safe state" ? If a request from process P2 arrives for (002) can the request be granted immediately?			
	3	What are the necessary conditions for deadlock? Explain different methods to recover from deadlock.	08	CO5	2017
	4	What is swapping? Does this increase the operating systems overhead? Justify your answers	08	CO5	2016
	5	What do you mean by fragmentation? Explain difference between internal and external fragmentation with neat diagrams.	08	CO5	2015
	6	Explain basic method and hardware required for segmentation.	07	CO6	2017
	7	Distinguish between: I) Logical versus physical address space ii) Paging versus segmentation. Iii) First fit and best fit algorithms.	07	CO6	2016
	8	Given the 5 memory partitions of 100K, 500K, 200K, 300K and 600K apply first fit and best fit and worst fit algorithm to place 212K, 417K, 112K and 426K size. Which algorithm makes efficient use of memory?	06	CO6	2015
4	1	Explain the different LRU-approximation page replacement algorithms.	06	CO7	2016
	2	What is page fault ? With a supporting diagram explain the steps involved in handling page fault.	06	CO7	2017
	3	Consider the following page reference stream 7,0,1,2,0,3,0,4,2,3,0. Calculate the number of page faults when number of frames is equal to 3, using FIFO, LRU and Optimal page replacement algorithms.	06	CO7	2016
	4	Explain copy-on-write process in virtual memory.	04	CO7	2018
	5	What are the different allocation methods in disk? Explain in detail any two methods.	06	CO8	2018
	6	What is a file? Also list different file operations.	05	CO8	2018
	7	List the different Directory Structure. Explain acyclic-graph directory and tree structured directory.	07	CO8	2017
	8	Consider the following page reference stream 7,0,1,2,0,3,0,4,2,3,0. Calculate the number of page faults when number of frames is equal to 3, using FIFO, LRU and Optimal page replacement algorithms.	08	CO8	2017
5	1	Write a short notes on: I) Swap space management ii) Revocation of access rights	08	CO9	2017
	2	With supporting diagrams, explain linked and indexed method of allocating disk space.	08	CO9	2016
	3	Explain the following disk scheduling algorithm in brief: I) SSTF ii) SCAN iii) LOOK	08	CO9	2015

	4	Explain in brief the selection of disk scheduling algorithm.	08	CO9	2018
	5	Explain the Design principle of Linux.	08	CO10	2017
	6	Explain the process management in Linux platform.	05	CO10	2015
	7	Explain the interprocess communication mechanism in Linux.	07	CO10	2016
	8	List the different disk scheduling techniques,Explain any two scheduling,considering the following disk queue requests: 98,183,37,122,14,124,65,67.	08	CO10	2018
	9	What is an access matrix? Explain the different methods of implementing access matrix.	08	CO10	2018
	10	Explain bad-block recovery in disk.	08	CO10	2018