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OPERATING SYSTEM USING LINUX **Course Code : 315353**

Programme Name/s : Electronics & Computer Engg.
Programme Code : TE
Semester : Fifth
Course Title : OPERATING SYSTEM USING LINUX
Course Code : 315353

I. RATIONALE

The operating system manages memory, processes, hardware, and software of the computer, and also it is possible for the user to interact with the computer without acquainting the computer languages. This course helps students to enhance skills for using Operating System functions, Linux OS principles, Tools, Commands, and Shell Programming.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry/employer excepted outcome through various teaching learning experiences:
Maintain Linux-Based Operating Systems to deliver high performance, security, flexibility, and cost-effectiveness.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Install linux Operating System and System tools to perform various functions of Operating System.
- CO2 - Apply concept of Process Management and Inter-Process Communication(IPC).
- CO3 - Apply scheduling algorithms to calculate turnaround time and average waiting time.
- CO4 - Use concept of different Memory Management Techniques.
- CO5 - Use File Management Techniques.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315353	OPERATING SYSTEM USING LINUX	OSL	DSC	5	-	2	2	9	3	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

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V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain functions of Linux OS. TLO 1.2 List types of Operating System. TLO 1.3 Execute Linux commands on command line for the given task. TLO 1.4 Enumerate system calls and describe functions of each.	**Unit - I Overview of Operating System** 1.1 Operating System: Concept, Components of Operating System, Operating System Structure (Simple Structure, Monolithic Structure, Layered Structure, Micro-Kernel Structure, Virtual Machines), Functions of Operating Systems, Services of OS 1.2 Different Types of Operating Systems: Serial Processing, Batch OS, Multiprogramming OS, Real-Time OS, Time-Sharing OS, Multiprocessor Systems, Distributed OS, Mobile OS-Android, Mac OS 1.3 Command Line Interface and Graphical User Interface: LINUX, WINDOWS, Comparison of LINUX and WINDOWS 1.4 System Call: Concept, Types of System call (for Process Management, File Management, Directory Management, Miscellaneous System Calls)	Lecture Using Chalk-Board Presentations Demonstration
2	TLO 2.1 Describe Process and Process State with suitable diagram. TLO 2.2 Describe functions of the given component of process stack in Process Control Block. TLO 2.3 Explain working of Inter-Process Communication(IPC) with suitable diagram. TLO 2.4 Explain characteristics of the given multithreading model.	**Unit - II Process Management** 2.1 Process: Process States, Process Control Block(PCB) 2.2 Process Scheduling- Scheduling Queues, Schedulers, Context Switch 2.3 Inter-Process Communication(IPC): Introduction, Shared Memory System and Message Passing System 2.4 Threads - Benefits, Users and Kernel Threads, Multithreading Models – One to One, Many to One, Many to Many	Lecture Using Chalk-Board Presentations Demonstration
3	TLO 3.1 Discuss need for given job scheduling criteria. TLO 3.2 Calculate turnaround time and average waiting time of the given scheduling algorithm. TLO 3.3 Explain necessary conditions leading to Deadlock.	**Unit - III CPU Scheduling and Algorithms** 3.1 Scheduling Types, Scheduling Objectives, CPU and I/O burst cycles, Pre-emptive, Non Pre-emptive Scheduling, Scheduling Criteria 3.2 Types of Scheduling Algorithms - First Come First Serve(FCFS), Shortest Job First(SJF), Shortest Remaining Time(SRTN), Round Robin(RR), Priority Scheduling, Multilevel Queue Scheduling 3.3 Deadlock - System Models, Necessary conditions leading to Deadlocks, Deadlock Handling, Preventions, Avoidance, Recovery from deadlock banker’s algorithm	Lecture Using Chalk-Board Presentations Demonstration
4	TLO 4.1 Describe working of Memory Management in Linux OS. TLO 4.2 Describe characteristics of Memory Management Techniques. TLO 4.3 Write algorithm for the given page replacement technique to calculate page fault for the given page reference string.	**Unit - IV Memory Management** 4.1 Basic Memory Management: Partitioning, Fixed and Variable, Free Space Management Techniques Bitmap, Linked List, Swapping 4.2 Virtual Memory: Introduction to Paging, Segmentation, Fragmentation and Page fault 4.3 Page Replacement Algorithms: FIFO, LRU, Optimal	Lecture Using Chalk-Board Presentations Demonstration

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Explain structure of the given file system with example. TLO 5.2 Describe step by step procedure for the given file access method. TLO 5.3 Describe step by step file allocation method with diagram. TLO 5.4 Describe the process for managing files/directories and assign access permissions to the specified files/directories. TLO 5.5 Explain features of the given Raid level structure of hard disk.	**Unit - V File Management** 5.1 File: Concepts of file, types of files, File Attributes, File Operations, File System Structure, Linux File System 5.2 Access Methods: Sequential, Direct, Swapping 5.3 File Allocation Methods - Contiguous, Linked, Indexed, File protection 5.4 Directory Structure: Single level, Two levels, Tree-structured Directory 5.5 Disk Organization and Disk Structure: Physical structure, Logical structure, Raid structure of disk, Raid level 0 to 6	Lecture Using Chalk-Board Presentations Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install Linux (or alike) Operating System. LLO 1.2 Execute General Purpose Commands: date, time, cal, clear, banner/figlet, tty, script, man, who, whoami, passwd, pwd, echo, bc.	1	* 1) Installation of Linux (or alike) Operating Systems 2) Execution of general purpose commands in Linux	2	CO1
LLO 2.1 Execute Process related Commands: ps, wait, sleep, exit, kill, pr.	2	* Execution of process related commands	2	CO2
LLO 3.1 Execute file and directory manipulation commands: Is, rm, mv, cp, cat (file saving and redirection operator), touch, join, split.	3	* Execution of file and directory manipulation commands(part -1)	2	CO2
LLO 4.1 Execute file and directory manipulation commands: mkdir, rmdir, cd, cmp, comm, diff, tar, zip, Use of wild card character (i.e. ?, *, []), chmod.	4	Execution of file and directory manipulation commands(part -2)	2	CO2
LLO 5.1 Execute text processing head, tail, sort, wc, grep, tac, nl, tr, cut, paste, spell, more.	5	Execution of filter commands in Linux	2	CO2
LLO 6.1 Develop a ‘C’ program to calculate turn around time and waiting time of any one given scheduling algorithm: FCFS, SJF, Priority, Round-Robin Algorithm.	6	* Write a ‘C’ program to calculate turn around time and waiting time of given scheduling algorithm	2	CO3
LLO 7.1 Execute memory manipulation commands: top, htop, free, df, du, vmstat.	7	* Execution of memory manipulation commands	2	CO4
LLO 8.1 Explore vi editor and execute all editor commands.	8	Use vi editor to create and edit files	2	CO5
LLO 9.1 Develop a Shell Script using Numeric Comparison, String Comparison, File Comparison for the given task.	9	Execution of Shell Script using comparison statement	2	CO5
LLO 10.1 Develop Shell Script using control statements and loops for a given task.	10	* Execution of Shell Script using control structure and loops	2	CO5

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- The microproject has to be Industry Application based, internet-based, workshop-based, laboratory-based or field based as suggested by Teacher.

1) Develop menu driven program to show the result of Linux Commands.
2) Develop Small Game based on Shell Script.
3) Develop Shell Script to circulate message among users.
4) Develop a Shell Script to perform file operations like create, delete directory, create, delete, copy, rename files.
5) Develop a Shell Script to Automate backups of important files and directories.

Assignment

- Complete an Assignment on any relevant topic given by the Teacher:

1) Prepare report depicting features of different types of Operating System, Batch OS, Multi-programmed OS, Time Shared, Multiprocessor OS, Real Time Systems, Mobile OS with Example.
2) Write a comparative statement to calculate page fault for given page reference string by using different Page Replacement Algorithms.
3) Prepare a report to calculate total waiting time and turn around time of n processes with different CPU scheduling algorithm.
4) Prepare a report about Linux operating systems and its flavors from starting to till date its features, uses etc.
5) Prepare a report on different types of operating system architecture. Example: Simple structure, Monolithic structure, Layered Structure, Microkernel
6) Prepare a report on Editors available in Linux i.e. Nano, Sed, gawk.

Other

- Join and Complete the course on Operating System/Linux OS/Shell Scripting on Infosys Springboard/MOOC Courses

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system with all necessary components like; motherboard, random access memory (RAM), read-only memory (ROM), internal hard disk drives, Mouse, Keyboard, and Open Source Operating System. (Linux or Alike)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Overview of Operating System	CO1	12	4	4	8	16
2	II	Process Management	CO2	10	2	4	8	14
3	III	CPU Scheduling and Algorithms	CO3	12	2	4	10	16
4	IV	Memory Management	CO4	10	2	4	8	14
5	V	File Management	CO5	6	2	4	4	10
Grand Total				**50**	**12**	**20**	**38**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit test of 30 marks and average of two-unit test will be considered for out of 30 marks. For formative assessment of laboratory learning 25 marks. Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester assessment of 70 marks. End semester summative assessment of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	1	1	2	1			
CO2	2	1	2	2	1	3	1			
CO3	1	1	-	2	1	1	1			
CO4	2	2	1	3	2	1	2			
CO5	2	3	3	3	1	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number

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Sr.No	Author	Title	Publisher with ISBN Number
1	Silberschatz, Galvin	Operating System Concepts	John Wiley and Sons, Ninth Edition, 2015, ISBN: 978-1119800361, Edition-10th
2	Godbole, Achyut S.	Operating System	Tata McGraw Hill Education, 2015, ISBN: 978-0070702035
3	Stallings ,William	Operating Systems: Internals and Design Principles	Pearson, ISBN: 978-0133805918
4	Dhamdhere, Dhanjay M	Operating System	McGraw Hill, 2015 ISBN: 978-0072957693
5	Dr. Rajendra Kawale	Operating System	Devraj Publications, Mumbai ISBN: 978-8193355114
6	Das, Sumitabha	Unix Concept and Programming	McGraw Hill education, 2015, ISBN: 9780070534759
7	Richard Blum	Linux command line and shell scripting	Wiley India ISBN Number 978-1118983843
8	Jon Emmons, Terry Ckark	Easy Linux Commands	SPD, ISBN 13:978-81-8404-329-7

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.geeksforgeeks.org/operating-systems/	Operating System
2	https://www.tutorialspoint.com/operating_system/index.htm	Operating System
3	https://www.mygreatlearning.com/academy/learn-for-free/courses/operating-system	Operating System
4	https://www.javatpoint.com/linux-file-contents	Linux Commands
5	https://www.shellscript.sh/	Shell Script

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 24/02/2025 **Semester - 5, K Scheme**