Government of Karnataka
DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Programme	Computer Science and Engineering	Semester	IV
Course Code	20CS42P	Type of Course	Programme Core
Course Name	Operating System and Administration	Contact Hours	8 hours/week 104 hours/semester
Teaching Scheme	L:T:P :: 3:1:4	Credits	6
CIE Marks	60	SEE Marks	40

1.Rationale

The Operating System knowledge and skill is an integral part in the study of computer science. It provides the platform for all other application to run on the machine, thus knowledge of operating system and administration becomes indispensable for understanding computing environment. It is essential to have knowledge of operating system's services and utilities to develop, deploy and maintain the software and hardware. The students will also be skilled in operating system virtualization, to create and manage virtual computing environment.

2. Course Outcomes: At the end of the course, the student will be able to:

CO-01	Explain functions and services of an operating system.
CO-02	Create a virtual environment and configure it to meet a specific application requirement.
CO-03	Identify and use Linux commands to create and manage simple file processing operations, organize directory structures, and develop shell script to automate given simple task.
CO-04	Demonstrate the role and responsibilities of a Linux system administrator and analyse problems using suitable diagnostic tools and resolve issues.

3. Course Content

Week	CO	PO	Lecture (Knowledge Criteria)	Tutorial (Activity Criteria)	Practice (Performance Criteria)
			3 hours/week	1 hour/week	4 hours/week (2 hours/batch twice in a week)
1	1	1,7	Overview of Operating System, Need for OS, Structure, OS Types, Examples of OS (desktop and mobile) Dual mode operation, Kernel and microkernel, Functions of OS User interfaces; Corporate Vs Personal needs; Types of OS installation	Refer Table 1	1. Types of OS installation 2. Boot methods 3 . File System and formatting 4. Post installation tasks
2	1, 2	1, 7	Virtualization technology, working, types		1. Install and configure

			Potentials and challenges of Virtualization, Virtual Machines, Containers. Linux Boot process. Linux command line - Interpreter, shell, CLI over GUI, Types of users- super and normal, Linux user manual.		virtual machine- Virtual box/VMware, VMware player station. 2. Download and install a terminal emulator and connect Linux VM via TE(optional). Significance of man command.
3	1,3	1, 7	File system - Pathnames, File system structure and its description, navigating the file system. File types, attributes, Access Control List (ACL), Adding text to file. Pipes, File Comparison, Filters / Text Processing Commands.		File and Directory commands: 1. Create and delete directories and files, File movement, copy commands, Pipes (named & unnamed) 2. Commands for viewing File, File comparison, File manipulation, Altering file permission, File compression and decompression. 3. Text processing commands.
4	1,	1,2,3,7	**Process Management –** Process, daemon, process states, PCB; Process scheduling Queue Operations on Processes - Process creation, Process termination, Interprocess communication. Scheduling - Long term, short term,and medium term; Context switch; Different types of CPU schedulers (Basic concept), Process priority; debugging (system hang)	Refer Table 1	1. Linux commands related to process creation and management- system calls fork() and exec(); bg, fg, nohup, pkill, nice, top, ps; 2. cron and at commands to schedule tasks.
5	1,3	1,2,3 4, 7	**Process synchronization-** critical section problem, Semaphores; Deadlock- System model, methods for handling deadlocks, deadlock prevention, avoidance, detection, recovery from deadlocks. Threads - Multithreading models,Threads, and processes. Types of threads - Kernel level and User level		1. Demonstration through videos. 2. Commands to exhibit thread concepts.
6	1	1,2,3 4, 7	**Memory management** - Process address space, static vs dynamic linking and loading.	Refer Table 1	1. Demonstration through videos. 2. Commands to view memory consumption

			Swapping, Memory allocation, Fragmentation, Paging, Segmentation; Virtual memory, Demand paging, Page replacement algorithm (concept only)		
7	1	2, 3 4, 7	**Shell Programming**: Basics of shell programming, types of shell in Linux, Basic Shell scripts- Shebang or Hashbang, Input & Output, decision making and iterative scripts.		1. Write shell scripts to illustrate decision making and different types of iterations; Ex- to perform string operations; to perform file operations;
8	1	2, 3 4, 7	**Automation of system tasks**: Writing scripts to automate common tasks.	Refer Table 1	1. Illustrate automation of basic tasks like monitoring memory consumption, check remote servers' connectivity, etc., at different frequencies.
9	1	2, 3,4	**Network Management** Network components- IP address, subnet mask, gateway. Network Interface management; Communication. Data transfer facilitation. Diagnosis and troubleshooting; Resource analysis.	Refer Table 1	1. Enable internet on Linux VM. 2. Test and manage network using following commands ifconfig, iwconfig, ethtool, arpwatch, bmon ,telnet, ssh, sendmail, mailstats, w cURL, wget, ftp, rcp, scp, rsync, sftp. netstat, ping, traceroute, iftop, nload, ss. tcpdump, dstat.
10	2,4		**User authentication** User and Group account management. Working on interface.	Refer Table 1	1. Work on user accounts useradd, passwd, userdel, usermod, groupadd, groupmod, gpasswd, groupdel; system-config.
		2,4,7	Linux Directory Service - Account Authentication, what is LDAP and Active Directory? LDAP structure, working.		2. OpenLDAP Installation 3. LDAP server and client configuration.
11		2, 3 4, 7	System monitoring, Log monitoring System maintenance, System information.		1. System monitoring commands top, df, dmesg, iostat 1, free, cat /proc/cpuinfo, cat/proc/meminfo;
	4		System architecture, Linux Boot process and System run levels, System updates and repositories.		2. Work on log directory - /var/log; 3. System maintenance commands- shutdown, reboot,

				Refer Table 1	halt, init. 4. System update & repositories- yum & rpm.
12	2,4	2, 3, 4, 7	Server setup: DNS- Introduction, Configuration, creating DNS zone, using DNS tools; FTP- Installation process, configuration and securing; setting up an Apache Web Server*(http)*	Refer Table 1	**Install and configure:** 1. DNS server with a domain name of your choice. 2. FTP server on LINUX and transfer files to demonstrate it's working. 3. Apache web server and create virtual hosts.
13	2,4	2, 3 4, 7	**Storage management:** Disk partition, formatting, mounting; Logical Volume Management (LVM)- Use of LVM, creating Volume groups, logical volume and disk mirroring, Extend Disk using LVM, Adding Swap Space Introduction to RAID – Hardware & Software, RAID levels.	Refer Table 1	1. Basic commands for storage partitions. 2. Install and configure LVM. 3. Add Disk and CreateStandard & LVM Partition. 4. Add virtual disk and create a new LVM partition(pvcreate, vgcreate, lvcreate) 5. Extend disk using LVM
Total in hours			39	13	52

*PO = Program outcome as listed and defined in year 1 curriculum

Table 1: Suggestive activities for tutorials (the list is only shared as an example and not inclusive of all possible activities for that course. Student and faculty are encouraged to choose activities that are relevant to the topic and the availability of such resources at their institution)

1	1. Compare features of different OS(windows, Linux, RTOS- Vxworks/android) 2 Study the evolution of OS to recognize the importance of current OS trends. 3. Explain the different flavors of LINUX.
2	1. Explain OS level virtualization and state its benefits. 2. Compare VMs and Containers 3. Identify the difference between hypervisors and Linux containers. 4. Comprehend the benefits of virtualization.
3	1. Compare ex2/ex3 filesystem attributes. 2. Discuss the file- mount and unmount system calls.
4	**1.** Compare Linux fork () and Windows createprocess () functions.
5	1. Study probable conditions for deadlock occurrence and how to overcome it. 2. Identify relationship between threads and processes. 3. Comprehend the differences between types of threads
6	1. Compare the features of swapping and paging.
7	**1.** Compare different Linux shells.
8	1. Write a cron job that runs all essential apps. on an hourly/ daily/weekly/monthly basis. (for ex. Executing Antivirus)
9	1. Compare static and DHCP IP addresses and check whether these can be switched over. 2. Study different options offered by Linux for package management.
10	1. Identify few alternatives to openLDAP and make a comparison.
11	1. Explore other network commands required for a sysadmin and interpret their functions and usage.

12	1. Study the difference between application server and web server.
	2. Identify the role of virtual host.
	3. Explain different types of Apache virtual hosts and how they are set up.
13	1. Compare the features between RAID and SSD.

4. CIE and SEE Assessment Methodologies

Sl. No	Assessment	Test Week	Duration In minutes	Max marks	Conversion
1.	CIE-1 Written Test	5	80	30	Average of three tests 30
2.	CIE-2 Written Test	9	80	30	
3	CIE-3 Written Test	13	80	30	
4.	CIE-4 Skill Test-Practice	6	180	100	Average of two skill tests reduced to 20
5	CIE-5 Skill Test-Practice	12	180	100	
6	CIE-6 Portfolio continuous evaluation of Activity through Rubrics	1-13		10	10
				Total CIE Marks	60
	Semester End Examination (Practice)		180	100	40
				Total Marks	100

5. Format for CIE written Test

Course Name	Operating System and Administration	Test	I/II/III	Sem	III/IV
Course Code	20CS42P	Duration	80 Min	Marks	30

Note: Answer any one full question from each section. Each full question carries 10 marks.

Section		Assessment Questions	Cognitive Levels	Course Outcome	Marks
I	1				
	2				
II	3				
	4				
III	5				
	6				

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, Cognitive level and course outcomes.

6. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		2	4	6	8	10	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	8
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	6
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2
				Average Marks= (8+6+2+2)/4=4.5			5

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

7. Reference:

Sl. No.	Description
1	Operating System internal and Design Principles, William Stallings
2	Operating System, Garry Nut
3	https://www.redhat.com/en/topics/virtualization
4	Virtual Machine - an overview | ScienceDirect Topics
5	DNS: https://www.youtube.com/watch?v=TiWs9n4fhys&list=RDCMUCQSpnDG3YsFNf5-qHocF-WQ&index
6	Linux system admin requirements: https://www.temok.com/blog/linux-system-administration/
7	Linux commands for modern sysadmins- N/W related - https://www.ubuntupit.com/useful-linux-network-commands-for-modern-sysadmins/
8	DNS Technology: https://www.digitalocean.com/community/tutorials/an-introduction-to-dns-terminology-components-and-concepts
9	Commands for Disk Management: https://www.programmersought.com/article/55913754022/

8. CIE SKILL Test or SEE Scheme of Evaluation

SL. No.	Particulars/Dimension	Marks
1	Create virtual environment and configure it to meet given application requirement.	20
2	Write and execute a shell script to automate a given task using appropriate Linux commands.	30
3	Demonstrate Linux administration skills in configuring and maintaining a server.	20
4	Explain the working above written shell script and procedure to configure the server, In the event of student failing to explain the working of shell script and procedure to configure the server, examiner shall use viva-voce to check the knowledge of student on operating system services and responsibilities of operating system administrator.	20
5	Portfolio evaluation of practice sessions.	10
	Total Marks	**100**

9. Equipment/software list with Specification for a batch of 20 students

Sl. No.	Particulars	Specification	Quantity
1	Computers		20
2	VirtualBox, Ubuntu or any other Linux OS image.		