GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-III

Course Title: Operating System Administration
(Course Code: 1333205)

Diploma programme in which this course is offered	Semester in which offered
Information and Communication technology	3rd Semester

1. RATIONALE

An operating system is the core software of any computer system. This is the basic software or platform on which other software work. Every student of Information and communication Technology must therefore understand basic structure of an operating system. After learning this subject student will be able to discriminate between various types of operating systems, its processor, processes, and memory and file management. The subject emphasis on Linux utilities and scripting as Linux is Open Source and widely used in the field of IoT with professional hardware like raspberry pi and other devices.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Manage various operations of Operating Systems administration.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Install & Differentiate various operating systems
b) Utilize Operating system tools to perform various functions.
c) Apply process commands & scheduling algorithms for performing process management operations
d) Illustrate different memory management techniques
e) Demonstrate use of shell scripts for performing various file management tasks.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
0	2	2	3	0	0	25*	25	50

(*): For this practical only course, 25 marks under the practical CA have two components i.e. the assessment of micro-project, which will be done out of 10 marks and the remaining 15 marks are for the assessment of practical. This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *-Practical;* ***C*** *– Credit,* ***CA*** *- Continuous Assessment;* ***ESE*** *-End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

Following practical outcomes (PrOs) are the sub-components of the Course Outcomes (Cos). Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'. Use Linux OS as and when required to perform exercises.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Install Linux operating system and compare with Window OS.	I	02*
2	Execute general purpose commands like date, time, cal, clear, banner, tty, script, man etc.	I	02*
3	Work with multiple linux terminals and basic commands like who, who am i, login, passwd, su, pwd	II	02*
4	A)Use Linux os services like Editor, GUI, File handling B)Run Linux os commands to start, stop and restart specific service.	II	02
5	Compare time complexity of following process scheduling algorithms a) First come first serve b) Round Robin	III	02

	c) SJF and SRTN		
6	Test & Execute process commands like ps, wait, sleep, exit, kill.	III	02*
7	Illustrate First In First Out page replacement technique to understand memory management.	IV	02*
8	Test and execute File and directory manipulation commands-Is, rm, mv, cp, join, split, cat, head, tail, touch	V	02*
9	Test and execute File and directory manipulation commands- diff, comm..,chmod,mkdir,rmdir,cd,pwd,dir,cmp.	V	02*
10	Test and execute text processing commands: Tr, wc,cut, paste,spell, sort, grep, more.	V	02*
11	Use vi editor and Test all editor commands.	V	02*
12	Create a shell scripts for following: 1. print ”Hello”. 2. Add three numbers and find its average	V	02
13	Write a shell script to create a blank file with name “practice.txt” and write at least 10 lines. Display the content of file.	V	02
14	Create a Shell script to read name of file from command line and show the content of that file.	V	02
15	Understand and Apply Arithmetic Operators. Write a shell script to perform arithmetic operations: a. Write a shell script to read two numbers from users and perform addition, subtraction, multiplication, division and modulus operation of two numbers and display suitable user friendly message on standard output for each operation. b. Write a shell script to read five numbers from user and find average of five numbers. c. Write a shell script to read radius (R) in cm from user and find area (A) of circle and display suitable user friendly message on standard output.	V	04*

16	Understand and apply control statements Write a shell script to perform given operations: a) Write a shell script to find maximum number among three numbers. b) Write a shell script to find sum and average of N numbers. c) Create a shell script to reverse the digits of a given 5-digit number. (for e.g. , if the no. is 57429 then answer is 92475).	V	04*
17	Test and execute Linux Super User command to perform following task: a) Display the user id of the currently logged-in user of your system. b) Display host name of your system. c) Write a Linux command to display the history of logins into the system.	V	02*
			28 Hrs.

Note

*i.More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii.Care must be taken in assigning and assessing study report as it is a first year study report. Study report, data collection and analysis report must be assigned in a group. Teacher has to discuss about type of data (which and why) before group start their market survey.

The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
	Process related	**70%**
1	Correctness of solution/answer	30%
2	Interpret and Solve various algorithms	30%
3	Debugging ability	20%
4	Program execution/answer to sample questions	20%
Total		**100%**

6. MAJOR EQUIPMENTS/ INSTRUMENTS REQUIRED

These major equipments with broad specifications for the PrOs is a guide to procure them by the administrators to user in uniformity of practical's in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1.	Computer with latest hardware configuration, CD/DVD reader/writer/USB drive, Source of Linux OS for Installation.	All
2.	Linux or alike Operating System such as Ubuntu, CentOS or any other	All

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs and PrOs. More could be added to fulfill the development of this course competency.

a) Work as a leader/a team member.
b) Follow ethical practices.
c) Practice environment friendly methods and processes.
d) Follow safety precautions.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i.'Valuing Level' in 1st year
ii.'Organization Level' in 2nd year.
iii.'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit-I **Operating System Concepts**	1a. Explain different operating system 1b. Explain types of operating system	1.1Need of operating system 1.2Evolution of operating system 1.3Operating systems i. Batch ii. Multi programming iii. Time Sharing iv. Real Time v. Multitasking vi. Multithreading 1.4Operating System Services 1.5Case study i. Linux ii. Windows 7
Unit– II **Linux Basics**	2a. Overview of Linux 2b. Test and Execute basic Linux commands 2c. Test and Execute shell commands in a script	2.1 Linux Shell 2.2 Introduction to shell and commands pwd, cd, mkdir, rmdir, ls, cat, cp, rm, mv, wc, split, cmp, comm, diff, head, tail, grep, sort, apt-get install, apt-get remove 2.3 Editing files with “vi”, “vim”, “gedit”, “gcc”
Unit-III **Process Management**	3a.Describe process model 3b. Describe process state 3c. Compare processor scheduling algorithm. 3d. Compare different scheduler 3e. Describe race condition & mutual exclusion 3f. Identify Deadlocks 3g. Apply Deadlock recovery procedure	3.1 Process and Process management i. Process model overview ii. Programmers view of process iii. Process states 3.2 Process and Processor Scheduling i Scheduling Criteria ii First Come First Serve iii Round Robin iv SJF v SRTN 3.3 Schedulers i Inter Process communication & synchronization ii Race condition iii Mutual Exclusion

		iv Monitors 3.4 Dead lock i Prevention ii Avoidance iii Detection and recovery
Unit-IV **Memory Management**	4a. Describe memory management 4b. Differentiate Contiguous and Non-contiguous memory 4c. Differentiate physical and virtual primary memory	4.1 Memory management 4.2 Contiguous allocation i Partitioned memory allocation ii Fixed & variable partitioning iii Swapping iv Relocation v Protection and Sharing 4.3 Non contiguous allocation i Page allocation ii Segmentation iii Virtual Memory
Unit-V **File Management**	5a. Apply file management concepts in Operating System 5b. Explain Directory structure of Operating System 5c. Describe Disk organization 5d. Implement file system security.	5.1 File management i. User view of file system ii. Attributes and operations iii. File system design iv. Disk space 5.2 Directory structure 5.3 Disk Organization i. Physical structure ii. Logical structure iii. Addressing 5.4 Security and Protection mechanism

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Operating System Concepts	**Not applicable**				
II	Linux Basics					
III	Process Management					
IV	Memory Management					
V	File Management					

Total	

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Undertake micro-projects in teams.

b) Prepare charts to explain use/process of the identified topic.

c) https://boonsuen.com/process-scheduling-solver, this website gives output for various process scheduling algorithms, students are expected to solve examples and crosscheck with output.

d) An hour of problem solving for various process and disk scheduling algorithms may be organized and students are encouraged to participate

e) Students are encouraged to register themselves in various MOOCs such as: Swayam, edx, Coursera, Udemy etc to further enhance their learning.

f) List different versions of Linux and windows operating system

g) Encourage students to form a coding club at institute level and can help the slow learners

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a)Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.

b)Guide student(s) in undertaking micro-projects.

c)***'L' in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.

d)About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.

e)With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.

f)Guide students to find different ICs used in real time application based on diodes ,transistors and thyristors.

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Guide student(s) in undertaking micro-projects.

b) Diagnosing Essential Missed Learning concepts that will help for students to improve their performance.

c) Guide Students to do Personalized learning so that students can understand the course material at his or her pace.

d) Encourage students to do Group learning by sharing so that learning can be enhanced.

e) About 20% of the topics/sub-topics which are relatively simpler or descriptive in nature is to be given to the students for self-learning, but to be assessed using different assessment methods.

f) Guide students on addressing the issues on environment and sustainability using the knowledge of this course

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro project should be about **14**-**16** ***(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) A Comparative Analysis of Operating System: case study of Windows Operating and Linux based OS. Comparing factors like booting process, user interface, handling system resources, device management, file management, security.
b) Give power point presentation on features of Windows 10 like Task manager, Device manager, Update & Security, Network & Internet, Time & Language.
c) Case study on different Process scheduling algorithms. Describe working of each algorithm.
d) Case Study on different Memory Allocation Techniques. Describe each technique.
e) Case study on any one cloud operating system.
f) Case study on any one real time operating system.
g) Case study on any one mobile operating system.
h) Case study on any one server operating system.
i) Case study on any one distributed operating system.
j) Case study on any one network operating system.
k) Case study on any operating system used in smart/embedded gadgets.

13. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Operating System Concepts, 9th Edition	Abraham Silberschatz, Peter B Galvin, Gerg Gagne	WILEY, 2016, ISBN- 978-8126554270
2	Modern Operating System 3rd Ed	Andrew Tanenbaum, Herbert Bos	2015,Pearson, ISBN – 9780133591620
3	Linux –Application and Administration	Ashok Kumar Harnal	2009,TMH, ISBN-13: 978-0070680104

14. SOFTWARE/LEARNING WEBSITES

a) https://boonsuen.com/process-scheduling-solver
b) http://cpuburst.com/ganttcharts.html
c) https://codepen.io/faso/pen/zqWGQW
d) https://www.tutorialspoint.com
e) www.w3schools com
f) https://nptel.ac.in/courses/106106144
g) https://nptel.ac.in/courses/117106113

15. PO-COMPETENCY-CO MAPPING

Semester III	Operating System Administration (Course Code: 1333205)						
	Pos						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency	• **Manage various operations of Operating Systems administration.**						
Course Outcomes Co1) Install & Differentiate various operating systems	2	-	-	-	-	-	1
Co2) Utilize Operating system tools to perform various functions	2	2	2	2	-	-	2
Co3) Apply process commands & scheduling algorithms for performing process management operations	2	2	2	-	-	1	1
Co4) Illustrate different memory management techniques	2	2	2	-	-	1	1
Co5) Demonstrate use of shell scripts for various file management techniques	2	2	2	3	-	-	1

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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