



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

## COMPUTER SCIENCE AND ENGINEERING

### COURSE DESCRIPTOR

<b>Course Title</b>	<b>LINUX PROGRAMMING LABORATORY</b>				
<b>Course Code</b>	ACS109				
<b>Programme</b>	B. Tech				
<b>Semester</b>	VI	CSE			
<b>Course Type</b>	Core				
<b>Regulation</b>	IARE - R16				
<b>Course Structure</b>	<b>Theory</b>			<b>Practical</b>	
	<b>Lectures</b>	<b>Tutorials</b>	<b>Credits</b>	<b>Laboratory</b>	<b>Credits</b>
	-	-	-	3	2
<b>Chief Coordinator</b>	Ms. N.M Deepika, Assistant Professor				
<b>Course Faculty</b>	Ms. K Radhika, Assistant Professor Mr. P Anjaiah, Assistant Professor Ms. G Sulakshna, Assistant Professor				

#### I. COURSE OVERVIEW:

The main objective of this course is to present the fundamental idea about the Linux operating system and network programming concepts. It explores on the Linux file system, system calls, Implementation of shell scripts in BASH Shell environment. Designing and developing client/server applications in Linux using major methods of Inter Process Communication (IPC) and concurrent programming by handling different signals.

#### II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	ACS007	III	Operating systems	4
UG	AHS010	II	Probability & statistics	4

#### III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Linux Programming	70 Marks	30 Marks	100

#### IV. DELIVERY / INSTRUCTIONALMETHODOLOGIES:

✗	Chalk & Talk	✗	Quiz	✗	Assignments	✗	MOOCs
✓	LCD / PPT	✗	Seminars	✗	Mini Project	✓	Videos
✓	Open Ended Experiments						

#### V. EVALUATIONMETHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

**Semester End Examination (SEE):** The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

#### Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	Laboratory		Total Marks
	Day to dayperformance	Final internal lab assessment	
CIA Marks	20	10	30

#### Continuous Internal Examination(CIE):

One CIE exams shall be conducted at the end of the 16<sup>th</sup> week of the semester. The CIE exam is conducted for 10 marks of 3 hoursduration.

Preparation	Performance	Calculations and Graph	Results and Error Analysis	Viva	Total
2	2	2	2	2	10

## VI. HOW PROGRAM OUTCOMES AREASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Calculations of the observations
PO 2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Characteristic curves
PO 3	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Video
PO 4	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Term observations
PO 5	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	1	Video

**3 = High; 2 = Medium; 1 = Low**

## VII. HOW PROGRAM SPECIFIC OUTCOMES AREASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	<b>Professional Skills:</b> The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.	2	Characteristic curves
PSO 2	<b>Problem-Solving Skills:</b> The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success	-	-
PSO 3	<b>Successful Career and Entrepreneurship:</b> The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.	1	Presentation on real-world problems

**3 = High; 2 = Medium; 1 = Low**

## VIII. COURSE OBJECTIVES:

The course should enable the students to:	
I	Analyze the Linux utilities and Linux environment.
II	Learn the fundamentals of shells scripting/programming.
III	Understand the basic Linux administration.
IV	Implement inter process communication and management concepts.

## IX. COURSE OUTCOMES(COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Identify and use Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security	CLO 1	Learn the importance of Linux architecture along with features.
		CLO 2	Identify and use linux utilities to create and manage simple file processing operations
		CLO 3	Apply the security features on file access permissions by restricting the ownership using advance linux commands.
CO 2	Work confidently in Linux environment.	CLO 4	Implement the SED, GREP and AWK commands for pattern matching and mathematical functions.
		CLO 5	Understand the shell responsibilities of different types of shells.
CO 3	Work with shell script to automate different tasks as Linux	CLO 6	Develop shell scripts to perform more complex tasks in shell programming environment.
		CLO 7	Illustrate file processing operations such as standard I/O and formatted I/O.
		CLO 8	Understand process structure, scheduling and management through system calls.
		CLO 9	Generalize signal functions to handle interrupts by using system calls.
CO 4	Illustrate file processing operations such as standard I/O and formatted I/O.	CLO 10	Illustrate memory management of file handling through file/region lock
		CLO 11	Design and implement inter process communication (IPC) in client server environment by using pipe, message queues, named Pipes.
CO 5	Design various client server applications using TCP or UDP protocols	CLO 12	Illustrate client server authenticated communication in IPC through semaphores and shared memory.
		CLO 13	Demonstrate various client server applications on network using TCP or UDP protocols. Design custom-based network applications using the sockets interface in heterogeneous platforms.

## X. COURSE LEARNING OUTCOMES(CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACS109.01	CLO 1	Learn the importance of Linux architecture along with features.	PO 1	3
ACS109.02	CLO 2	Identify and use linux utilities to create and manage simple file processing operations	PO 1, PO 4	2
ACS109.03	CLO 3	Apply the security features on file access permissions by restricting the ownership using advance linux commands..	PO 1, PO 2	2

ACS109.04	CLO 4	Implement the SED, GREP and AWK commands for pattern matching and mathematical functions.	PO 1, PO 2	2
ACS109.05	CLO 5	Understand the shell responsibilities of different types of shells.	PO 2, PO 3	2
ACS109.06	CLO 6	Develop shell scripts to perform more complex tasks in shell programming environment.	PO 1, PO 5	2
ACS109.07	CLO 7	Illustrate file processing operations such as standard I/O and formatted I/O.	PO 2, PO 5	1
ACS109.08	CLO 8	Understand process structure, scheduling and management through system calls.	PO 2	2
ACS109.09	CLO 9	Generalize signal functions to handle interrupts by using system calls.	PO 1, PO 3	2
ACS109.10	CLO 10	Illustrate memory management of file handling through file/region lock	PO 1	3
ACS109.11	CLO 11	Design and implement inter process communication (IPC) in client server environment by using pipe, message queues, named Pipes.	PO 1, PO 2	2
ACS109.12	CLO 12	Illustrate client server authenticated communication in IPC through semaphores and shared memory.	PO 3, PO 5	1
ACS109.13	CLO 13	Demonstrate various client server applications on network using TCP or UDP protocols. Design custom-based network applications using the sockets interface in heterogeneous platforms.	PO 1, PO 3	2

**3 = High; 2 = Medium; 1 = Low**

**XI. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												3		1
CLO 2	3			2									1		1
CLO 3	3	3													
CLO 4	3	2											2		

CLO 5		2	3															1
CLO 6	3				1													
CLO 7		2			1												2	
CLO 8		2																
CLO 9	3		3														2	
CLO 10	3																2	
CLO 11	3	2															2	
CLO 12			2		1												2	
CLO 13	3		2														2	

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## XII. ASSESSMENT METHODOLOGIES –DIRECT

CIE Exams	PO 1, PO2 PO 3, PO4, PSO1,PSO3	SEE Exams	PO 1, PO2 PO 3, PO4, PSO1,PSO3	Assignments	-	Seminars	-
Laboratory Practices	PO 1, PO2 PO 3, PO4, PSO1,PSO3	Student Viva	PO 1, PO2 PO 3, PO4, PSO1,PSO3	Mini Project	-	Certification	-

## XIII. ASSESSMENT METHODOLOGIES -INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

## XIV. SYLLABUS

LIST OF EXPERIMENTS	
<b>Week-1</b>	<b>GENERAL PURPOSE UTILITIES COMMANDS</b>
Learning installation and upgradation of the Linux operating system. Basic Linux commands: User and session management commands: useradd, groupadd, userdel, groupdel, passwd; General purpose utilities: echo, printf, bc, who, whoami, tty, uname, clear, ls.	
<b>Week-2</b>	<b>FILE SYSTEM, TEXT PROCESSING COMMANDS AND VI EDITOR</b>
Linux commands: cat-create a file, append a file and open a file. file, wc, cp, rm, mv, more, head,tail, gzip, gunzip. vi editor- commands, navigation commands and creating a vi editor file.	
<b>Week-3</b>	<b>SED, GREP,EGREP,FGREP</b>
<ol style="list-style-type: none"> <li>1. Finding a file containing a particular textstring</li> <li>2. Regular expressions in grepcommand.</li> <li>3. Search multiple words / string pattern using grep command on bashshell</li> <li>4. Illustratebywritingscriptthatwillprint,message–HelloWorld,inBoldandBlinkeffect,andin different colors like red, brown etcusing echocommands.</li> <li>5. Write a program that will output the desiredpatterns</li> </ol>	
1	

	<p>2 2 3 3 3 4 4 4 4 5 5 5 5 5</p>
<b>Week-4</b>	<b>BASIC SHELL SCRIPTING</b>
	<ol style="list-style-type: none"> <li>1. Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.</li> <li>2. Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.</li> <li>3. Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.</li> </ol>
<b>Week-5</b>	<b>SHELL SCRIPTING</b>
	<ol style="list-style-type: none"> <li>1. Write a program to generate Fibonacci series</li> <li>2. Write a program to check whether given string is palindrome or not</li> </ol> <p>Write a shell script to find factorial of a given integer.</p>
<b>Week-6</b>	<b>INPUT OUTPUT REDIRECTIONS AND COMMAND SUBSTITUTIONS</b>
	<ol style="list-style-type: none"> <li>1. Write a shell script that receives any number of file names as arguments, checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.</li> <li>2. Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files.</li> </ol> <p>Write a shell script to list all of the directory files in a directory.</p>
<b>Week-7</b>	<b>AWK SCRIPT</b>
	<ol style="list-style-type: none"> <li>1. Write an awk script to count the number of lines in a file that do not contain vowels.</li> <li>2. Write an awk script to find the number of characters, words and lines in a file.</li> <li>3. Write an awk script to calculate average marks of each student.</li> <li>4. Write an awk script to replace a string in a file.</li> </ol>
<b>Week-8</b>	<b>PATTERN SCANNING AND PROCESSING SCRIPTS</b>
	<ol style="list-style-type: none"> <li>1. Write a C program that makes a copy of a file using standard I/O and system calls.</li> <li>2. Illustrate to redirect the standard input (stdin) and the standard output (stdout) of a process, so that scanf().</li> <li>3. Write an reads from the pipe and printf () writes into the pipe.</li> </ol>
<b>Week-9</b>	<b>PATTERN SCANNING AND PROCESSING SCRIPTS</b>
	<ol style="list-style-type: none"> <li>1. Write a program that takes one or more file/directory names as command line input and reports the following information on the file. A. File type. B. Number of links. C. Time of last access. D. Read, write and execute permissions.</li> <li>2. Write a C program to emulate the Unix ls -l command.</li> </ol> <p>Write a C program to list for every file in a directory, its inode number and filename.</p>
<b>Week-10</b>	<b>PROCESS ATTRIBUTES AND USAGE OF FORK()</b>
	<ol style="list-style-type: none"> <li>1. Write a C program to create a child process and allow the parent to display -parent and the child to display -child on the screen.</li> <li>2. Write a C program to create a zombie process.</li> <li>3. Write a C program that illustrates how an orphan is created.</li> </ol>
<b>Week-11</b>	<b>USAGE OF PIPES AND NAMED PIPES</b>
	<ol style="list-style-type: none"> <li>1. Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex:- ls -l   sort</li> <li>2. Write C programs that illustrate communication between two unrelated processes using named pipe.</li> </ol>

	3. Write a C program to create a message queue with read and write permissions to write 3 messages to it
<b>Week-12</b>	<b>SYNCHRONIZATION AND LOCKING TECHNIQUES</b>
	<ol style="list-style-type: none"> <li>1. Write a C program to allow cooperating processes to lock a resource for exclusive use, using a) semaphores b) flock or lockf system calls.</li> <li>2. Write a C program that illustrates suspending and resuming processes using signals.</li> <li>3. Write a C program that implements a producer-consumer system with two processes. (using Semaphores).</li> </ol>
<b>Week-13</b>	<b>SYNCHRONIZATION AND LOCKING TECHNIQUES</b>
	<ol style="list-style-type: none"> <li>1. Write client and server programs (using c) for interaction between server and client processes using Unix domain sockets.</li> <li>2. Write client and server programs (using c) for interaction between server and client processes using Internet domain sockets.</li> <li>3. Write a C program that illustrates two processes communicating using shared memory.</li> </ol>

#### XV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Week No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Learning installation and upgradation of the Linux operating system.	CLO 1, CLO 2	T1:1.4 R1:1.2
2	Basic Linux commands: User and session management commands: useradd, groupadd, userdel.	CLO 1, CLO 2	T1:1.5 R1:2.4
3	General purpose utilities: echo, printf, bc, who, whoami, tty, uname, clear, ls.	CLO 1, CLO 2, CLO 3, CLO 4	T1:2.5 R1:2.5
4	shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.	CLO 1, CLO 2, CLO 3, CLO 4	T1:2.5 R1:2.6
5	Linux commands: cat-create a file, append a file and open a file.	CLO 3, CLO 4, CLO 5	T1:2.7
6	Finding a file containing a particular text string Regular expressions in grep command.	CLO 3, CLO 4, CLO 5, CLO 6	T1:6.3 R1:5.3
7	Search multiple words / string pattern using grep command on bash shell Illustrate by writing script that will print, message —Hello World, in Bold and Blink effect, and in different colors like red, brown etc using echo commands. Write a program that will output the desired	CLO 3, CLO 4, CLO 5, CLO 6, CLO 7	T1:7.5 R1:6.3
8	Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the lines between the given line numbers.	CLO 1, CLO 2, CLO 8	T1:8.5 R1:6.8
9	Write a shell script that accepts a list of file names as its arguments, counts and reports the occurrence of each word that is present in the first argument file on other argument files	CLO 1, CLO 3, CLO 6, CLO 9	T1:12.2 R1:13.1
10	Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.	CLO 8, CLO 9, CLO 10	T1:12.3 R1:13.2
11	Write a program to generate Fibonacci series	CLO 8, CLO 9, CLO 11	T1:12.10 R1:13.7
12	Write a program to check whether given string is palindrome or not Write a shell script to find factorial of a given integer.	CLO 8, CLO 9, CLO 12	T1:11.2 R1:10.2



**XVI. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:**

<b>S NO</b>	<b>Description</b>	<b>Proposed actions</b>	<b>Relevance with POs</b>	<b>Relevance with PSOs</b>
1	To improve standards and analyze the concepts.	GuestLecture	PO 1, PO 4	PSO 1
2	Conditional probability, Sampling distribution, correlation, regression analysis and testing of hypothesis	GuestLecture / NPTEL	PO 4, PO3	PSO 1
3	Encourage students to solve real time applications.	NPTEL	PO 2	PSO 1

**Prepared by:**

Ms. N.M Deepika, Assistant Professor

**HOD,CSE**