Program Name	: **Diploma in Information Technology**
Program Code	: **IF**
Semester	: **Fifth**
Course Title	: **Open Source Operating System & Scripting Language (Elective)**
Course Code	: **22522**

1.   RATIONALE

Operating System is the interface between the user and the computer system. Nowadays LINUX is one of the most widely used operating system. Knowledge of LINUX operating system is essential as it provides many features such as multitasking, multiuser, security etc. which are mainly used in both server and workstation systems. So, this course will enable the students to inculcate the basics of LINUX Operating System, writing Shell scripts as well as administer the network.

2.   COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:
- **Maintain Linux Operating System.**

3.   COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:
- a) Install Linux Operating System.
- b) Use Basic Linux commands and utilities.
- c) Develop Shell program for solving different problems.
- d) Maintain Linux Operating System.
- e) Maintain Linux Network Services.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Paper Hrs.	Theory						Practical					
L	T	P			ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25#	10	25	10	50	20

(*): Under the theory PA; Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

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

5.   COURSE MAP(with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.
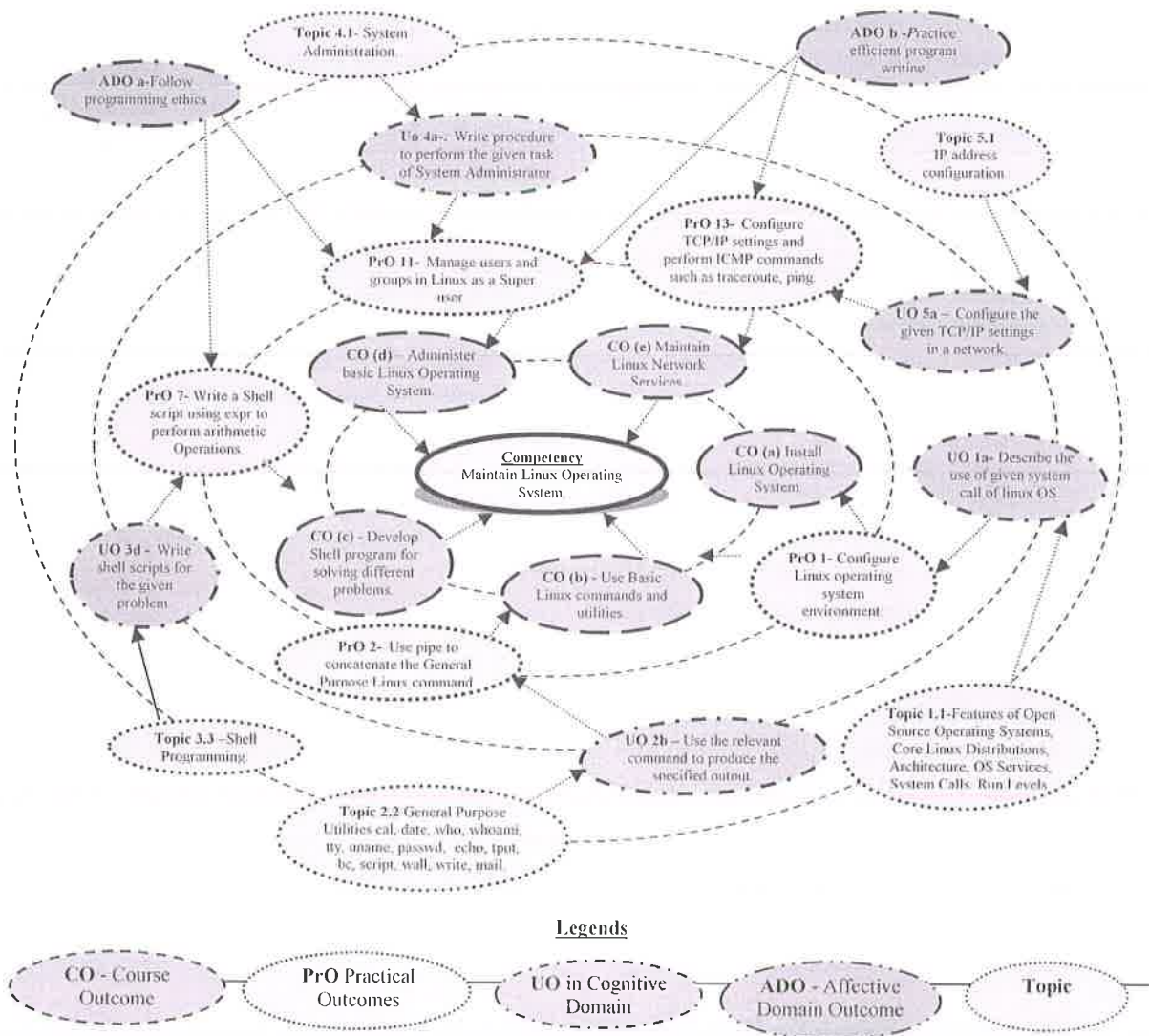

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1.	Configure Linux operating system environment.	I	02*
2.	Use pipe to concatenate the General Purpose Linux command.	II	02*
3.	Manage file permissions using chmod.	II	02*
4.	Use pattern Searching using *grep* family commands.	II	02*
5.	Use text Editor in different Modes.	III	02*
6.	Write a Shell script using following Control Structures : a) *if then else* structure and nested *if then* Structure. b) *Case* Statement.	III	

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
7.	Write a Shell script using expr to perform arithmetic Operations.	III	02
8.	Write a Shell script using following loop structure: a) For loop. b) While loop. c) Until.	III	02*
9.	Write a Shell script using test command to check a) Two variables using -eq, -ge, -gt, -le, -lt, - ne. b) Existence of file, file as a directory, file size greater than zero.	III	02
10.	Write a login Shell script to perform a) Verify that your Shell , Looking at Current Values b) Editing Current Values, Test New Prompts.	III	02
11.	Manage users and groups in Linux as a Super user,.	IV	02*
12.	Work with init level during startup and shut down of Linux OS.	IV	02*
13.	Configure TCP/IP settings and perform ICMP commands such as traceroute, ping.	V	02*
14.	Configure DHCP Server and DHCP Client.	V	02*
15.	Configure an IP table firewall in Linux for security.	V	02*
16.	Configure NFS server in Linux Operating System.	V	02*
	Total		32

Note

i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Application Level' of Bloom's Taxonomy' as generally required by the industry.

ii. The 'Process' and 'Product' related skills associated with each PrO are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Configuration of Linux operating system	25
2	Correctness of Executing various commands	25
3	Writing and executing shell script to get desired output	20
4	Debugging the program	15
5	Submit journal report in time	15
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:
   a. Follow safety practices.
   b. Practice good housekeeping.
   c. Demonstrate working as a leader/a team member.
   d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of

practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:
- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system (Any computer system with basic configuration)	All
2	Linux operating system.	

8.   UNDERPINNING THEORY COMPONENTS
The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Features of Linux Operating System	1a. Describe the use of given system call of linux OS. 1b. Determine the file type on the basis of first character of **ls** command output for the given computer system. 1c. Describe the given phase of state transition for the process states. 1d. Outline salient features of the given Linux shell.	1.1 Features of Open Source Operating Systems, Core Linux Distributions, Architecture, OS Services, System Calls, Run Levels. 1.2 File System : Hierarchical File System, File System features, Data Structures. 1.3 Process : Process concepts, context of process, Context Switch, Process State, State Transition diagram, Data Structure for processes. 1.4 Shell : Login into the system, Concept of Shell, Various Linux Shell and their Features.
Unit-II Linux Commands and Utilities	2a. Classify the given command as internal or external. 2b. Use the relevant command to produce the specified output. 2c. Use relevant file and directory command(s) to perform the specified operation. 2d. Apply the specified permissions to file and directory.	2.1 Locating Commands, Internal & External Commands, Arguments, Options & Filenames, Online help 2.2 General Purpose Utilities cal, date, who, whoami, tty, uname, passwd, echo, tput, bc, script, wall, write, mail. 2.3 Navigating the File System Concepts: Files, Directories, Paths, Home Directory, Parent-Child Relationship, Handling Command.- pwd, cd, mkdir, rmdir,ls Ordinary Files handling commands: cat, cp,rm,mv,file wc, cmp,comm,diff 2.4 File Attributes : File Permissions, listing file

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		permissions, chmod Command 2.5 grep Family: Regular expressions, grep, egrep, fgrep, tr.
Unit– III Shell Programming	3a. Use vi editor in the specified mode to carry out the given operation. 3b. Apply relevant wild card for the given pattern matching. 3c. Create conditional statement using logical and relational operators to implement the given criteria. 3d. Write shell scripts for the given problem.	3.1 vi Editor: Modes of vi, commands in various modes - creating, editing, saving and quitting 3.2 Shell, sh Command, Pattern Matching-the Wild Cards, Escaping-the Backslash(\), Quoting, Redirection, Pipes, Tees, Command Substitution, Shell Variables 3.3 Shell Programming: Shell Scripts, read Statement, Command Line Arguments-Positional Parameters, Exit Status of Command, Logical Operators && and ||, exit Statement, if and case Statements, expr Statement, while, until and for Statements, Sample Validation & Data Entry. 3.4 Simple Scripts, Scripts Using Simple Commands
Unit– IV Basic Linux System Administration	4a. Write procedure to perform the given task of System Administrator. 4b. Explain purpose of using the given run level. 4c. Write procedure to perform the given operation for managing the users/groups. 4d. Use relevant command as per the given disk management operation.	4.1 System Administration: Role of Administrator, root- Administrator's Login, su: Acquiring superuser Status, Administrator's Privileges-passwd Commands, Task Scheduling using cron, Maintaining Security. 4.2 Operations: Startup and shutdown, System runlevels 4.3 User management : User configuration and password file, Managing Users and Groups, 4.4 Managing Disk Space : df, du, find command-Locating files dd, Command-Copying Disks, disk management-RAID. 4.5 Backups: Need of backup, cpio & tar commands.
Unit –V Basic Network Management.	5a. Configure the given TCP/IP settings in a network. 5b. Configure the given setting in DHCP Server/Client. 5c. Write method to configure setting in firewall to apply the given network security feature. 5d. Use specified utility/software for Network Intrusion	5.1 IP address configuration: TCP/IP Network address, TCP/IP Configuration files, Network Interfaces and Routes : ifconfig, route, ping, netstat, tcpdump commands 5.2 DHCP Server Configuration Configuring DHCP Client and Server, Dynamic Address, Fixed Addresses. 5.3 NIS, NFS, SAMBA introduction. 5.4 Firewall and Internet Security: Limiting Network Services, Designing Firewall. 5.5 Network Intrusion Detection: Host based Intrusion Detection Software using *tripwire or any relevant utility.*

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	Detection.	

Note: *To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.*

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	Features of Linux Operating System	08	04	06	02	12
II	Linux Commands and Utilities	12	02	04	10	16
III	Shell Programming	12	02	04	12	18
IV	Basic Linux System Administration	10	02	04	08	14
V	Basic Network Management	06	02	04	04	10
	Total	**48**	**12**	**22**	**36**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note: *This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may 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 conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

   a. Prepare journals based on practical performed in laboratory.
   b. Prepare power point presentation for understanding different Linux Operating System distribution.

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. **'L' in item No. 4** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
   c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the COs through classroom presentations (see implementation guideline for details).
   d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
   e. Use different Audio Visual media for Concept understanding.
   f. Guide student(s) in undertaking micro-projects.

g. Demonstrate students thoroughly before they start doing the practice.

h. Observe continuously and monitor the performance of students in Lab.

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-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, 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 total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a) Configure following Common Services (Client AND Server)
- DHCP, DNS, LDAP, Email (SMTP, POP, IMAP)

b) Build a NAS

c) Configure NFS, Samba

d) Configure Proxy Server, Web server
- Squid, Apache

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Unix Concept and Programming	Das, Sumitabha	McGraw Hill education, New Delhi, 2015, ISBN: 978-0070635463
2.	Linux Command Line and Shell Scripting Bible, 3rd Edition	Blum, Richard, Bresnahan, Christine	Wiley Publication, New Delhi, 2015,ISBN:- 978-1-118-98384-3
3.	Red Hat: The Complete Reference Enterprise Linux and Fedora Edition	Piterson, Richard	McGraw Hill education, New Delhi , ISBN:-0-7-058709-4
4.	Red Hat Linux Networking and System Administration	Colling, Terri & Wall, Kurt	Red Hat ISBN: 0-7645-3632-X

14. SOFTWARE/LEARNING WEBSITES

a) https://www.linode.com/docs/tools-reference/linux-system-administration-basics.

b) http://training.linuxfoundation.org/free-linux-training.

c) https://www.javatpoint.com/linux-tutorial

d) http://www.tutorialspoint.com/listtutorials/linux/1

e) https://www.digitalocean.com/community/tutorials/how-to-customize-your-bash-prompt-on-a-linux-vps