Program Structure for Third Year Information Technology
Semester V & VI
UNIVERSITY OF MUMBAI
(With Effect from 2021-2022)

Semester V

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract.	Theory	Pract.	Total
ITC501	Internet Programming	3	--	3	--	3
ITC502	Computer Network Security	3	--	3		3
ITC503	Entrepreneurship and E-business	3	--	3	--	3
ITC504	Software Engineering	3	--	3	--	3
ITDO501X	**Department Optional Course – 1**	**3**	**--**	**3**	**--**	**3**
ITL501	IP Lab	--	2	--	1	1
ITL502	Security Lab	--	2	--	1	1
ITL503	DevOPs Lab	--	2	--	1	1
ITL504	Advance DevOPs Lab	--	2	--	1	1
ITL505	Professional Communication & Ethics-II (PCE-II)	--	2*+2	--	2	2
ITM501	Mini Project – 2 A Web Based Business Model	--	4$	--	2	2
Total		**15**	**16**	**15**	**08**	**23**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Prac /oral	Total
		Internal Assessment			End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg					
ITC501	Internet Programming	20	20	20	80	3	--	--	100
ITC502	Computer Network Security	20	20	20	80	3	--	--	100
ITC503	Entrepreneurship and E-business	20	20	20	80	3	--	--	100
ITC504	Software Engineering	20	20	20	80	3	--	--	100
ITDO501X	**Department Optional Course – 1**	**20**	**20**	**20**	**80**	**3**	**--**	**--**	**100**
ITL501	IP Lab	--	--	--	--	--	25	25	50
ITL502	Security Lab	--	--	--	--	--	25	25	50
ITL503	DevOPs Lab	--	--	--	--	--	25	25	50

Code	Name								
ITL504	Advance DevOPs Lab	--	--	--	--	--	25	25	50
ITL505	Professional Communication & Ethics-II (PCE-II)	--	--	--	--	--	50	--	50
ITM501	Mini Project – 2 A Web Based Business Model	--	--	--	--	--	25	25	50
Total		**--**	**--**	**100**	**400**	**--**	**175**	**125**	**800**

* Theory class to be conducted for full class

$ indicates work load of Learner (Not Faculty), for Mini-Project. Students can form groups with minimum 2(Two) and not more than 4(Four). Faculty Load: 1hour per week per four groups.

ITDO501X	Department Optional Course – 1
ITDO5011	Microcontroller Embedded Programming
ITDO5012	Advance Data Management Technologies
ITDO5013	Computer Graphics & Multimedia System
ITDO5014	Advanced Data structure and Analysis

Semester VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	**Pract. Tut.**	**Theory**	**Pract.**	**Total**
ITC601	Data Mining & Business Intelligence	3	--	3	--	3
ITC602	Web X.0	3	--	3		3
ITC603	Wireless Technology	3	--	3	--	3
ITC604	AI and DS – 1	3	--	3	--	3
ITDO601 X	**Department Optional Course – 2**	**3**	**--**	**3**	**--**	**3**
ITL601	BI Lab	--	2	--	1	1
ITL602	Web Lab	--	2	--	1	1
ITL603	Sensor Lab	--	2	--	1	1
ITL604	MAD & PWA Lab	--	2	--	1	1
ITL605	DS using Python Skill based Lab	--	2	--	1	1
ITM601	Mini Project – 2 B Based on ML	--	4$	--	2	2
Total		**15**	**14**	**15**	**07**	**22**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Prac /oral	Total
		Internal Assessment			End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg					
ITC601	Data Mining & Business Intelligence	20	20	20	80	3	--	--	100
ITC602	Web X.0	20	20	20	80	3	--	--	100
ITC603	Wireless Technology	20	20	20	80	3	--	--	100
ITC604	AI and DS – 1	20	20	20	80	3	--	--	100
ITDO601 X	**Department Optional Course – 2**	**20**	**20**	**20**	**80**	**3**	**--**	**--**	**100**
ITL601	BI Lab	--	--	--	--	--	25	25	50
ITL602	Web Lab	--	--	--	--	--	25	25	50
ITL603	Sensor Lab	--	--	--	--	--	25	25	50
ITL604	MAD & PWA Lab	--	--	--	--	--	25	25	50
ITL605	DS using Python Lab (SBL)	--	--	--	--	--	25	25	50

ITM601	Mini Project – 2 B Based on ML	--	--	--	--	--	25	25	50
Total		**--**	**--**	**100**	**400**	**--**	**150**	**150**	**800**

$ indicates work load of Learner (Not Faculty), for Mini-Project. Students can form groups with minimum 2(Two) and not more than 4(Four). Faculty Load: 1hour per week per four groups.

ITDO601X	**Department Optional Course – 2**
ITDO6011	Software Architecture
ITDO6012	Image Processing
ITDO6013	Green IT
ITDO6014	Ethical Hacking and Forensic

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
ITC501	Internet Programming	03	--	03	--	03

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test2	Avg.					
ITC501	Internet Programming	20	20	20	80	03	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To orient students to Web Programming fundamental.
2	To expose students to JavaScript to develop interactive web page development
3	To orient students to Basics of REACT along with installation
4	To expose students to Advanced concepts in REACT
5	To orient students to Fundamentals of node.js
6	To expose students to node.js applications using express framework.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Select protocols or technologies required for various web applications.	L1,L2,L3,L4
2	Apply JavaScript to add functionality to web pages.	L1, L2, L3
3	Design front end application using basic React.	L1,L2,L3,L4,L5,L6
4	Design front end applications using functional components of React.	L1,L2,L3,L4,L5,L6
5	Design back-end applications using Node.js.	L1,L2,L3,L4,L5,L6
6	Construct web based Node.js applications using Express.	L1,L2,L3,L4,L5,L6

Prerequisite: Knowledge of basic programming, network fundamentals and operating systems.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Introduction and basics of HTML, CSS	**02**	-
I	Web programming fundamentals	Working of web browser, HTTP protocol, HTTPS, DNS, TLS, XML introduction, Json introduction, DOM, URL, URI, REST API. **Self-learning Topics:** : Nginx server	**03**	CO1
II	Java script:	Introduction to ES6, Difference between ES5 and ES6. Variables, Condition, Loops, Functions, Events, Arrow functions, Setting CSS Styles using JavaScript, DOM manipulation, Classes and Inheritance. Iterators and Generators, Promise, Client-server communication, Fetch **Self-learning Topics:** Asynchronous JavaScript, JSON	**06**	CO2
III	React fundamentals	Installation, Installing libraries, Folder and file structure, Components, Component lifecycle, State and Props, React Router and Single page applications, UI design, Forms, Events, Animations, Best practices. **Self-learning Topics**: React vs Angular vs Vue	**07**	CO3
IV	Advanced React:	Functional components- Refs, Use effects, Hooks, Flow architecture, Model-View-Controller framework, Flux, Bundling the application. Web pack. **Self-learning Topics:** React Native	**07**	CO4
V	Node.js:	Environment setup, First app, Asynchronous programming, Callback concept, Event loops, REPL, Event emitter, Networking module, Buffers, Streams, File system, Web module. **Self-learning Topics:** Node.js with Mongodb.	**07**	CO5
VI	Express:	Introduction, Express router, REST API, Generator, Authentication, sessions, Integrating with React. **Self-learning Topics:** Commercial deployment.	**07**	CO6

Text Books:

1. Rediscovering JavaScript, Master ES6, ES7, and ES8, By Venkat Subramaniam · 2018
2. Learning React Functional Web Development with React and Redux, Alex Banks and Eve Porcello, O'Reilly
3. Learning Redux, Daniel Bugl, Packt Publication
4. Learning Node.js Development, Andrew Mead, Packt Publishing
5. RESTful Web API Design with Node.js 10, Valentin Bojinov, Packt Publication

References:

1. Web Development with Node and Express, Ethan Brown, O'Reilly

Online Resources:

2. https://reactjs.org/tutorial/tutorial.html
3. https://react-redux.js.org/introduction/quick-start
4. https://webpack.js.org/
5. https://www.youtube.com/watch?v=-27HAh8c0YU

Assessment:
Internal Assessment (IA) for 20 marks:

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test

➢ **Question paper format**

- Question Paper will comprise of a total of **six questions each carrying 20 marksQ.1** will be **compulsory** and should **cover maximum contents of the syllabus**

- **Remaining questions** will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

- A total of **four questions** need to be answered

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
ITC502	Computer Network Security	03	--	03	--	03

Course Code	Course Name	Examination Scheme						
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test2	Avg.					
ITC502	Computer Network Security	20	20	20	80	03	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	The basic concepts of computer and Network Security
2	Various cryptographic algorithms including secret key management and different authentication techniques.
3	Different types of malicious Software and its effect on the security.
4	Various secure communication standards including IPsec, SSL/TLS and email.
5	The Network management Security and Network Access Control techniques in Computer Security.
6	Different attacks on networks and infer the use of firewalls and security protocols.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Explain the fundamentals concepts of computer security and network security.	L1, L2
2	Identify the basic cryptographic techniques using classical and block encryption methods.	L1
3	Study and describe the system security malicious software.	L1, L2
4	Describe the Network layer security, Transport layer security and application layer security.	L1, L2
5	Explain the need of network management security and illustrate the need for NAC.	L1, L2
6	Identify the function of an IDS and firewall for the system security.	L1,L2, L3

Prerequisite: Basic concepts of Computer Networks & Network Design, Operating System

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Basic concepts of Computer Networks & Network Design, Operating System	**02**	--
I	Introduction to Network Security & cryptography	Computer security and Network Security(Definition), CIA, Services, Mechanisms and attacks, The OSI security architecture, Network security model. Classical Encryption techniques (mono-alphabetic and poly-alphabetic substitution techniques: Vigenere cipher, playfair cipher, transposition techniques: keyed and keyless transposition ciphers). Introduction to steganography. **Self-learning Topics:** Study some more classical encryption techniques and solve more problems on all techniques. Homomorphic encryption in cloud computing	**07**	CO1
II	Cryptography: Key management, distribution and user authentication	Block cipher modes of operation,Data Encryption Standard, Advanced Encryption Standard (AES). RC5 algorithm. Public key cryptography: RSA algorithm. Hashing Techniques: SHA256, SHA-512, HMAC and CMAC, Digital Signature Schemes – RSA, DSS. Remote user Authentication Protocols, Kerberos, Digital Certificate: X.509, PKI **Self-learning Topics:** Study working of elliptical curve digital signature and its benefits over RSA digital signature.	**09**	CO2
III	Malicious Software	SPAM, Trojan horse, Viruses, Worms, System Corruption, Attack Agents, Information Theft, Trapdoor, Keyloggers, Phishing, Backdoors, Rootkits, Denial of Service Attacks, Zombie **Self-learning Topics:** Study the recent malicious software's and their effects.	**04**	CO3
IV	IP Security, Transport level security and Email Security	IP level Security: Introduction to IPSec, IPSec Architecture, Protection Mechanism (AH and ESP), Transport level security: VPN. Need Web Security considerations, Secure Sockets Layer (SSL)Architecture, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH) Protocol Stack. Email Security: Secure Email S/MIME Screen reader support enabled. **Self-learning Topics:** Study Gmail security and privacy from Gmail help	**07**	CO4
V	Network Management Security and Network Access Control	Network Management Security:SNMPv3, NAC:Principle elements of NAC,Principle NAC enforcement methods, How to implement NAC Solutions, Use cases for network access control **Self-learning Topics:** Explore any open source network management security tool	**06**	CO5

VI	System Security	IDS, Firewall Design Principles, Characteristics of Firewalls, Types of Firewalls	04	CO6
		Self-learning Topics: Study firewall rules table		

Textbooks:

1 William Stallings, Cryptography and Network Security, Principles and Practice, 6th Edition, Pearson Education, March 2013.
2 Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill.
3 Mark Stamp's Information Security Principles and Practice, Wiley
4 Bernard Menezes, "Cryptography & Network Security", Cengage Learning.

References:

1 Applied Cryptography, Protocols, Algorithms and Source Code in C, Bruce Schneier, Wiley.
2 Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill.
3 www.rsa.com

Online References:

Sr. No.	Website Name
1.	https://swayam.gov.in/
2.	https://nptel.ac.in/
3.	https://www.coursera.org/

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- A total of **four questions** need to be answered

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
ITC503	Entrepreneurship and E-business	03	--	03	--	03

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test2	Avg.					
ITC503	Entrepreneurship and E-business	20	20	20	80	03	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	Distinguish Entrepreneur and Entrepreneurship starting and feasibility study.
2	Realize the skills required to be an entrepreneur
3	Acquaint the students with challenges of starting new ventures
4	Identify the right sources of fund for starting a new business
5	Be familiarized with concept of E-business Models.
6	Understand various E-business Strategies.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand the concept of entrepreneurship and its close relationship with enterprise and owner-management.	L1,L2
2	Understand the nature of business development in the context of existing organizations and of new business start-ups.	L1,L2
3	Comprehended important factors for starting a new venture and business development.	L1,L2,L3
4	Know issues and decisions involved in financing and resourcing a business start-up	L1,L2,L3,L4
5	Describe various E-business Models	L1,L2,L3,L4
6	Discuss various E-business Strategies.	L1,L2,L3,L4

Prerequisite: None

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	**None**	--	--
I	Introduction	Concept, meaning and definition of Entrepreneur and Entrepreneurship. Evolution of Entrepreneurship, Role of Entrepreneurship in economic Development; Managerial vs entrepreneurial approach; Classification and types of Entrepreneurs. Characteristics and qualities of successful Entrepreneurs; Women Entrepreneurs; Corporate & Social entrepreneurship. **Self-learning Topics:** Factors impacting emergence of entrepreneurship.	**04**	CO1
II	Entrepreneurship Development and Leadership	Entrepreneurial Motivation: motivating factors, Types of startups; Characteristics of entrepreneurial leadership, Components of Entrepreneurial Leadership; Factors influencing entrepreneurial development and motivation, Entrepreneurial Opportunities and challenges, Entrepreneurship process. Types of Enterprises and Ownership Structure: small scale, medium scale and large-scale enterprises: Meaning and definition (evolution), role of small enterprises in economic development; proprietorship, Policies governing SMEs, partnership, Ltd. companies and co-operatives: their formation, capital structure and source of finance. **Self-learning Topics:** study the white paper https://www.ncert.nic.in/ncerts/l/lebs213.pdf	**06**	CO2
III	New Venture Planning	Methods to Initiate Ventures; Acquisition-Advantages of acquiring an ongoing venture and examination of key issues; Developing a Marketing plan-customer analysis, sales analysis and competition analysis, Business Plan-benefits of drivers, perspectives in business plan preparation, elements of a business plan; Business plan failures. **Self-learning Topics:** Refer following URL to study various case studies https://www.entrepreneurindia.co/case-studies	**07**	CO3
IV	Financing & Managing Venture	Financing Stages; Sources of Finance; Venture Capital; Criteria for evaluating new-venture proposals & Capital-process. Management of venture: objectives and functions of management, scientific management, general and strategic management; introduction to human resource management: planning, job analysis, training, recruitment and selection **Self-learning Topics:** visit website	**06**	CO4

		https://www.startupindia.gov.in		
V	Overview of E – business	Concept of E-business, Business Success through adoption of technology, information management for business Initiatives, Performance improvement through e-business. Introduction to various collaborative partnerships, E-commerce: Sectors of e-commerce, B to C, B to B and C to C ecommerce, E-commerce success factors, clicks and Bricks in ecommerce, collaborative commerce. E-Marketplace, M-commerce, E-Government; Various E-business Models, Challenges of the E-Business Models, Globalization of E-business. **Self-learning Topics:** Social media applications for E-Business, Social media analytics.	**08**	CO5
VI	Strategic Initiatives for Technology	**Customer Relationship Management:** The evolution of CRM, functional areas of CRM, contemporary trends - SRM, PRM AND ERM, Future Trends of CRM **Enterprise Resource Planning**: Core and Extended ERP; components of ERP system; Benefits and Risks of ERP implementation **Supply Chain Management**: Meaning, definition, importance, and characteristics of SCM, Elements of SCM, Push & Pull supply chain model, Use of e-business to restructure supply chain, Supply chain management implementation **Procurement**: Meaning and advantages of e –procurement, Types& Drivers of e- procurement, Components of e-procurement systems, Implementation of e-procurement **Self-learning Topics:** SEM and SEO E-CRM	**08**	CO6

Textbooks:

  1   Entrepreneurship; Robert Hisrich, Michael Peters; Tata McGraw Hill Publication
  2   Entrepreneurship: New venture creation by David Holt, Prentice Hall of India Pvt. Ltd.
  3   E- Business & E– Commerce Management: Strategy, Implementation, Practice – Dave Chaffey, Pearson Education
  4   E-commerce – A Managerial Perspective- P. T. Joseph, Prentice Hall India Publications. Content

References:
  1   Entrepreneurship and Innovations in E-business An Integrative Perspective by Fang Zhao, Idea Group Publications.
  2   Business Driven Technology –Haag/Baltzan/Philips –Tata McGraw Hill Publication
  3   Digital Business and E-commerce Management by Dave Chaffey, David Edmundson-Bird, Tanya Hemphill, Pearson Education
  4   E-Business 2.0 Roadmap for Success by Dr. Ravi Kalakota, Marcia Robinson, Pearson Education
  5   Case Studies in International Entrepreneurship: Managing and Financing Ventures in the Global Economy. By Walter Kuemmerle, Walter Kuemmerle. McGraw-Hill/Irwin, 2004.

Note: - It is advisable that faculty should discuss case studies in the classroom

Assessment:

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- A total of **four questions** need to be answered

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
ITC504	Software Engineering	03	--	03	--	03

Course Code	Course Name	Examination Scheme							
		Theory					**Term Work**	**Pract/ Oral**	**Total**
		Internal Assessment			**End Sem Exam**	**Exam Duration (in Hrs)**			
		Test1	**Test 2**	**Avg.**					
ITC504	Software Engineering	20	20	20	80	03	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To provide the knowledge of software engineering discipline.
2	To understand Requirements and analyze it
3	To do planning and apply scheduling
4	To apply analysis, and develop software solutions
5	To demonstrate and evaluate real time projects with respect to software engineering principles
6	Apply testing and assure quality in software solution.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand and use basic knowledge in software engineering.	L1, L2
2	Identify requirements, analyze and prepare models.	L1, L2, L3
3	Plan, schedule and track the progress of the projects.	L1, L2, L3
4	Design & develop the software solutions for the growth of society	L1, L2, L3
5	To demonstrate and evaluate real time projects with respect to software engineering principles	L1, L2, L3, L4
6	Apply testing and assure quality in software solution	L1, L2, L3, L4

Prerequisite: Basic programming of knowledge.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	None	--	--
I	Introduction to Software Engineering	Nature of Software, Software Engineering, Software Process, Capability Maturity Model (CMM) Generic Process Model, Prescriptive Process Models: The Waterfall Model, V-model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Agile process, Agility Principles, Extreme Programming (XP), Scrum, Kanban model **Self-learning Topics:** Personal and Team Process Models	06	CO1,CO2
II	Requirement Analysis	Software Requirements: Functional & non-functional – user-system requirement engineering process – feasibility studies – elicitation – validation & management – software prototyping – S/W documentation – Analysis and modelling Requirement Elicitation, Software requirement specification (SRS), **Self-learning Topics:** prioritizing requirements (Kano diagram) - real life application case study.	07	CO1,CO2
III	Software Estimation and Scheduling	Management Spectrum, 3Ps (people, product and process) Process and Project metrics Software Project Estimation: LOC, FP, Empirical Estimation Models - COCOMO II Model, Specialized Estimation Techniques, Object based estimation, use-case based estimation Project scheduling: Defining a Task Set for the Software Project, Timeline charts, Tracking the Schedule, Earned Value Analysis **Self-learning Topics:** Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.	06	CO3
IV	Design Engineering	Design Process & quality, Design Concepts, The design Model, Pattern-based Software Design. 4.2 Architectural Design :Design Decisions, Views, Patterns, Application Architectures, Modeling Component level Design: component, Designing class based components, conducting component-level design, User Interface Design: The golden rules, Interface Design	07	CO3, CO4

		steps & Analysis, Design Evaluation **Self-learning Topics:** Refinement, Aspects, Refactoring		
V	Software Risk, Configuration Management	Risk Identification, Risk Assessment, Risk Projection, RMMM Software Configuration management, SCM repositories, SCM process Software Quality Assurance Task and Plan, Metrics, Software Reliability, Formal Technical Review (FTR), Walkthrough **Self-learning Topics:**: Configuration management for WebApps	**07**	CO5
VI	Software Testing and Maintenance	Testing: Software Quality, Testing: Strategic Approach, Strategic Issues- Testing: Strategies for Conventional Software, Object oriented software, Web Apps- Validating Testing- System Testing- Art of Debugging. Maintenance : Software Maintenance-Software Supportability- Reengineering- Business Process Reengineering- Software Reengineering- Reverse Engineering- Restructuring- Forward Engineering **Self-learning Topics:** Test Strategies for WebApps	**06**	CO6

Text Books:

1 Roger S. Pressman, Software Engineering: A practitioner's approach, McGraw Hill
2 Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India
3 PankajJalote, An integrated approach to Software Engineering, Springer/Narosa.
4 Ian Sommerville, Software Engineering, Addison-Wesley.

References:

1 https://nptel.ac.in/courses/106/101/106101061/
2 https://www.youtube.com/watch?v=wEr6mwquPLY
3 http://www.nptelvideos.com/video.php?id=911&c=9
4 https://onlinecourses.nptel.ac.in/noc19_cs70/unit?unit=25&lesson=66
5 https://onlinecourses.nptel.ac.in/noc19_cs70/unit?unit=25&lesson=67
6 https://onlinecourses.nptel.ac.in/noc19_cs70/unit?unit=25&lesson=65
7 https://onlinecourses.nptel.ac.in/noc19_cs70/unit?unit=25&lesson=64
8 https://onlinecourses.nptel.ac.in/noc19_cs70/unit?unit=25&lesson=63

Preferable: Case studies can be discussed on every unit as per requirement for better understanding, examples are given below.

Unit 1	An information system (mental health-care system), wilderness weather system.
Unit 2	Mental health care patient management system (MHC-PMS).
Unit 3	Software Tools for Estimation.

Unit 4	Risk management in Food delivery software.
Unit 5	Study design of Biometric Authentication software.
Unit 6	Selenium Testing with any online application.

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Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
ITL501	IP Lab	--	02	--	01	01

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test 2	Avg.					
ITL501	IP Lab	--	--	--	--	--	25	25	50

Lab Objectives:

Sr. No.	Lab Objectives
The Lab aims:	
1	To orient students to HTML for making webpages
2	To expose students to CSS for formatting web pages
3	To expose students to developing responsive layout
4	To expose students to JavaScript to make web pages interactive
5	To orient students to React for developing front end applications
6	To orient students to Node.js for developing backend applications

Lab Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Identify and apply the appropriate HTML tags to develop a webpage.	L1, L2,L3,L4
2	Identify and apply the appropriate CSS tags to format data on webpage	L1, L2,L3,L4
3	Construct responsive websites using Bootstrap	L1, L2,L3,L4,L5,L6
4	Use JavaScript to develop interactive web pages.	L1, L2,L3,L4,L5,L6
5	Construct front end applications using React	L1, L2,L3,L4,L5,L6
6	Construct back end applications using Node.js/Express	L1, L2,L3,L4,L5,L6

Prerequisite: Knowledge of Java programming and object-oriented programming.

Hardware & Software Requirements:

Hardware Requirement:	Software requirement:
PC i3 processor and above	Google Chrome Browser (latest), Java 8 or above, NodeJS, React. Internet Connection

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	LO Mapping
I	HTML5	Elements, Attributes, Head, Body, Hyperlink, Formatting, Images, Tables, List, Frames, Forms, Multimedia	**02**	LO1
II	CSS3	Syntax, Inclusion, Color, Background, Fonts, Tables, lists,CSS3 selectors, Pseudo classes, Pseudo elements	**02**	LO2
III	Bootstrap	Grid system, Forms, Button, Navbar, Breadcrumb, Jumbotron	**02**	LO3
IV	JavaScript	Variables, Operators, Conditions, Loops, Functions, Events, Classes and Objects, Error handling, Validations, Arrays, String, Date	**05**	LO4
V	React	Installation and Configuration. JSX, Components, Props, State, Forms, Events, Routers, Refs, Keys.	**08**	LO5
VI	Node.js	Installation and Configuration, Callbacks, Event loops, Creating express app.	**07**	LO6

Textbooks:

1. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed., DT Editorial Services
2. Learning React Functional Web Development with React and Redux, Alex Banks and Eve Porcello, O'Reilly
3. Learning Node.js Development, Andrew Mead, Packt Publishing

References:
1. https://www.tutorialspoint.com/
2. https://reactjs.org/tutorial/tutorial.html
3. https://nodejs.dev/learn
4. https://www.youtube.com/watch?v=-27HAh8c0YU

Term Work: Term Work shall consist of at least 12 to 15 practicals based on the above list. Also Term work Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical & Oral Exam: An Practical & Oral exam will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
ITL502	Security Lab	--	02	--	01	01

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test 2	Avg.					
ITL502	Security Lab	--	--	--	--	--	25	25	50

Lab Objectives:

Sr. No.	Lab Objectives
The Lab experiments aims:	
1	To apply the knowledge of symmetric cryptography to implement classical ciphers.
2	To analyze and implement public key encryption algorithms, hashing and digital signature algorithms.
3	To explore the different network reconnaissance tools to gather information about networks.
4	To explore the tools like sniffers, port scanners and other related tools for analyzing.
5	To Scan the network for vulnerabilities and simulate attacks.
6	To set up intrusion detection systems using open-source technologies and to explore email security.

Lab Outcomes:

Sr. No.	Lab Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Illustrate symmetric cryptography by implementing classical ciphers.	L1,L2
2	Demonstrate Key management, distribution and user authentication.	L1,L2
3	Explore the different network reconnaissance tools to gather information about networks	L1,L2, L3
4	Use tools like sniffers, port scanners and other related tools for analyzing packets in a network.	L1,L2,L3
5	Use open-source tools to scan the network for vulnerabilities and simulate attacks.	L1,L2,L3
6	Demonstrate the network security system using open source tools.	L1,L2

Prerequisite: Basic concepts of Computer Networks & Network Design, Operating System

Hardware & Software Requirements:

Hardware Requirement:	Software requirement:
PC With following Configuration 1. Intel Core i3/i5/i7 Processor 2. 4 GB RAM 3. 500 GB Harddisk	1. Windows or Linux Desktop OS 2. wireshark 3. ARPWATCH 4. Kismet, NetStumbler 5. NESSU

DETAILED SYLLABUS:

Sr. No.	Detailed Content	Hours	LO Mapping
I	Classical Encryption techniques (mono-alphabetic and poly-alphabetic substitution techniques: Vigenere cipher, playfair cipher)	**04**	LO1
II	1)Block cipher modes of operation using a)Data Encryption Standard b)Advanced Encryption Standard (AES). 2)Public key cryptography: RSA algorithm. 3)Hashing Techniques: HMAC using SHA 4)Digital Signature Schemes – RSA, DSS.	**06**	LO2
III	1) Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars. 2) Study of packet sniffer tools Wireshark, :- a. Observer performance in promiscuous as well as non-promiscuous mode. b. Show the packets can be traced based on different filters.	**04**	LO3
IV	1) Download and install nmap. 2) Use it with different options to scan open ports, perform OS fingerprinting, ping scan, tcp port scan, udp port scan, etc.	**04**	LO4
V	a) Keylogger attack using a keylogger tool. b) Simulate DOS attack using Hping or other tools c) Use the NESSUS/ISO Kali Linux tool to scan the network for vulnerabilities.	**04**	LO5
VI	1) Set up IPSec under Linux. 2) Set up Snort and study the logs. 3) Explore the GPG tool to implement email security	**04**	LO6

Text Books

1   Build your own Security Lab, Michael Gregg, Wiley India.
2   CCNA Security, Study Guide, TIm Boyles, Sybex.
3   Hands-On Information Security Lab Manual, 4th edition, Andrew Green, Michael Whitman,

Herbert Mattord.

4   The Network Security Test Lab: A Step-by-Step Guide Kindle Edition, Michael Gregg.

References:

1   Network Security Bible, Eric Cole, Wiley India.
2   Network Defense and Countermeasures, William (Chuck) Easttom.
3   Principles of Information Security + Hands-on Information Security Lab Manual, 4th Ed. , Michael E. Whitman , Herbert J. Mattord.
4   IITB virtual Lab: http://cse29-iiith.vlabs.ac.in/
5   https://www.dcode.fr/en

Sr.No	Experiment Title
1.	Breaking the Mono-alphabetic Substitution Cipher using Frequency analysis method.
2.	Design and Implement a product cipher using Substitution ciphers.
3.	Cryptanalysis or decoding Playfair, vigenere cipher.
4.	Encrypt long messages using various modes of operation using AES or DES.
5.	Cryptographic Hash Functions and Applications (HMAC): to understand the need, design and applications of collision resistant hash functions.
6.	Implementation and analysis of RSA cryptosystem and Digital signature scheme using RSA.
7.	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
8.	Study of packet sniffer tools wireshark: - a. Observer performance in promiscuous as well as non-promiscuous mode. b. Show the packets can be traced based on different filters.
9.	Download, install nmap and use it with different options to scan open ports, perform OS fingerprinting, ping scan, tcp port scan, udp port scan, etc.
10.	Study of malicious software using different tools: a) Keylogger attack using a keylogger tool. b) Simulate DOS attack using Hping or other tools c) Use the NESSUS/ISO Kali Linux tool to scan the network for vulnerabilities.
11.	Study of Network security by a) Set up IPSec under Linux. b) Set up Snort and study the logs. c) Explore the GPG tool to implement email security

Term Work: Term Work shall consist of at least 12 to 15 practicals based on the above list. Also Term work Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical & Oral Exam: An Practical & Oral exam will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
ITL503	DevOPs Lab	--	02	--	01	01

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test 2	Avg.					
ITL503	DevOPs Lab	--	--	--	--	--	25	25	50

Lab Objectives:

Sr. No.	Lab Objectives
	The Lab experiments aims:
1	To understand DevOps practices which aims to simplify Software Development Life Cycle
2	To be aware of different Version Control tools like GIT, CVS or Mercurial
3	To Integrate and deploy tools like Jenkins and Maven, which is used to build, test and deploy applications in DevOps environment
4	To be familiarized with selenium tool, which is used for continuous testing of applications deployed.
5	To use Docker to Build, ship and manage applications using containerization
6	To understand the concept of Infrastructure as a code and install and configure Ansible tool.

Lab Outcomes:

Sr. No.	Lab Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
	On successful completion, of course, learner/student will be able to:	
1	To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your business requirements	L1,L2
2	To obtain complete knowledge of the "version control system" to effectively track changes augmented with Git and GitHub	L1,L2
3	To understand the importance of Jenkins to Build and deploy Software Applications on server environment	L1,L2
4	Understand the importance of Selenium and Jenkins to test Software Applications	L1,L2

5	To understand concept of containerization and Analyze the Containerization of OS images and deployment of applications over Docker		L1,L2,L3
6	To Synthesize software configuration and provisioning using Ansible.		L1,L2,L3

Prerequisite: Operating System, Linux Administration, Java /Web Application Programming, and Software Engineering.

Hardware & Software Requirements:

Hardware Requirements	Software Requirements	Other Requirements
PC With following Configuration 1. Intel i3 core or above 2. 4 GB RAM or above 3. 500 GB HDD 4. Network interface card	1. Linux / Windows Operating system 2. VIRTUAL BOX/ VMWARE	1. Internet Connection for installing additional packages 2. GitHub account 3. Docker hub account

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	Knowledge of Linux Operating system, installation and configuration of services and command line basics, Basics of Computer Networks and Software Development Life cycle.	**00**	LO1
I	Introduction to Devops	Understanding of the process to be followed during the development of an application, from the inception of an idea to its final deployment. Learn about the concept of DevOps and the practices and principles followed to implement it in any company's software development life cycle. Learn about the phases of Software Lifecycle. Get familiar with the concept of Minimum Viable Product (MVP) & Cross-functional Teams. Understand why DevOps evolved as a prominent culture in most of the modern-day startups to achieve agility in the software development process **Self-Learning Topics: Scrum, Kanban, Agile**	**04**	LO1
II	Version Control	In this module you will learn: • GIT Installation, Version Control, Working with remote repository • GIT Cheat sheet • Create and fork repositories in GitHub • Apply branching, merging and rebasing concepts. • Implement different Git workflow strategies in real-time scenarios • Understand Git operations in IDE **Self-Learning Topics: AWS Codecommit, Mercurial, Subversion, Bitbucket, CVS**	**04**	LO1 & LO2
III	Continuous Integration using Jenkins	In this module, you will know how to perform Continuous Integration using Jenkins by building and automating test cases using Maven / Gradle / Ant. • Introduction to Jenkins (With Architecture) • Introduction to Maven / Gradle / Ant.	**04**	LO1 & LO3

		• Jenkins Management Adding a slave node to Jenkins • Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to deploy an application over the tomcat server **Self-Learning Topics: Travis CI, Bamboo, GitLab, AWS CodePipeline**		
IV	Continuous Testing with Selenium	In this module, you will learn about selenium and how to automate your test cases for testing web elements. You will also get introduced to X-Path, TestNG and integrate Selenium with Jenkins and Maven. • Introduction to Selenium • Installing Selenium • Creating Test Cases in Selenium WebDriver • Run Selenium Tests in Jenkins Using Maven **Self-Learning Topics: Junit, Cucumber**	**04**	LO1 , LO3 & LO4
V	Continuous Deployment: Containerizatio n with Docker	In this module, you will be introduced to the core concepts and technology behind Docker. Learn in detail about container and various operations performed on it. • Introduction to Docker Architecture and Container Life Cycle • Understanding images and containers • Create and Implement docker images using Dockerfile. • Container Lifecycle and working with containers. • To Build, deploy and manage web or software application on Docker Engine. • Publishing image on Docker Hub. **Self-Learning Topics: Docker Compose, Docker Swarm.**	**05**	LO1 & LO5
VI	Continuous Deployment: Configuration Management with Puppet	In this module, you will learn to Build and operate a scalable automation system. • Puppet Architecture • Puppet Master Slave Communication • Puppet Blocks • Installation and Configuring Puppet Master and Agent on Linux machines • Use exported resources and forge modules to set up Puppet modules • Create efficient manifests to streamline your deployments **Self-Learning Topics: Ansible, Saltstack**	**05**	LO1 & LO6

Text books

1. DevOps Bootcamp, Sybgen Learning
2. Karl Matthias & Sean P. Kane, Docker: Up and Running, O'Reilly Publication.
3. Len Bass,Ingo Weber,Liming Zhu,"DevOps, A Software Architects Perspective", AddisonWesley-Pearson Publication.
4. John Ferguson Smart," Jenkins, The Definitive Guide", O'Reilly Publication.
5. Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet, by Ryan Russell-

Yates Packt Publishing (September 29, 2018)

References:

1. Sanjeev Sharma and Bernie Coyne," DevOps for Dummies", Wiley Publication
2. Httermann, Michael, "DevOps for Developers", Apress Publication.
3. Joakim Verona, "Practical DevOps", Pack publication
4. Puppet 5 Essentials - Third Edition: A fast-paced guide to automating your infrastructure by Martin Alfke Packt Publishing; 3rd Revised edition (September 13, 2017)

List of Experiments:

Sr.No	Experiment Title
1.	To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities.
2.	To understand Version Control System / Source Code Management, install git and create a GitHub account.
3.	To Perform various GIT operations on local and Remote repositories using GIT Cheat-Sheet
4.	To understand Continuous Integration, install and configure Jenkins with Maven/Ant/Gradle to setup a build Job.
5.	To Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.
6.	To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
7.	To Setup and Run Selenium Tests in Jenkins Using Maven.
8.	To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
9.	To learn Dockerfile instructions, build an image for a sample web application using Dockerfile.
10.	To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
11.	To learn Software Configuration Management and provisioning using Puppet Blocks(Manifest, Modules, Classes, Function)
12	To provision a LAMP/MEAN Stack using Puppet Manifest.

Term Work: Term Work shall consist of at least 12 to 15 practicals based on the above list. Also Term work Journal must include at least 2 assignments, one of which must include a Case study on DevOps Implementation in real world and the other one can be based on the self-learning topics mentioned in syllabus.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical & Oral Exam: An Practical & Oral exam will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
ITL504	Advance DevOps Lab	--	02	--	01	01

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test 2	Avg.					
ITL504	Advance DevOps Lab	--	--	--	--	--	25	25	50

Lab Objectives:

Sr. No.	Lab Objectives
The Lab experiments aims:	
1	To understand DevOps practices and cloud native environments to achieve continuous software delivery pipelines and automated operations that address the gap between IT resources and growing cloud complexity.
2	To Use Kubernetes services to structure N-tier applications.
3	To be familiarized with Infrastructure as code for provisioning, compliance, and management of any cloud infrastructure, and service.
4	To understand that security and speed in software development are not inversely-related objectives Internalizing the contribution of tools and automation in DevSecOps
5	To understand various troubleshooting techniques by monitoring your entire infrastructure and business processes
6	To understand how software and software-defined hardware are provisioned dynamically.

Lab Outcomes:

Sr. No.	Lab Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	To understand the fundamentals of Cloud Computing and be fully proficient with Cloud based DevOps solution deployment options to meet your business requirements	L1,L2
2	To deploy single and multiple container applications and manage application deployments with rollouts in Kubernetes	L1,L2,L3
3	To apply best practices for managing infrastructure as code environments and use terraform to define and deploy cloud	L1,L2,L3

	infrastructure.		
4	To identify and remediate application vulnerabilities earlier and help integrate security in the development process using SAST Techniques.	L1,L2,L3	
5	To use Continuous Monitoring Tools to resolve any system errors (low memory, unreachable server etc.) before they have any negative impact on the business productivity	L1,L2,L3	
6	To engineer a composition of nano services using AWS Lambda and Step Functions with the Serverless Framework	L1,L2,L3	

Prerequisite: Operating System, Linux Administration, Java /Web Application Programming, Software Engineering, Cloud Computing and DevOps Ecosystem.

Hardware & Software Requirements:

Hardware Requirements	Software Requirements	Other Requirements
PC With following Configuration 1. Intel i3 core or above 2. 4 GB RAM or above 3. 500 GB HDD 4. Network interface card	1. Linux / Windows Operating system 2. VIRTUAL BOX/ VMWARE	1. Internet Connection for installing additional packages 2. GitHub account 3. AWS free tier account

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	Knowledge of Linux Operating system, installation and configuration of services and command line basics, Basics of Computer Networks, Software Development Life cycle, Cloud Computing and DevOps Ecosystem.	**02**	--
I	Introduction to Devops on Cloud	Learn about various cloud services and service providers, also get the brief idea of how to implement DevOps over Cloud Platforms. • Introduction to high availability architecture and auto-scaling • Set up the DevOps infrastructure on the cloud • Work and set up IDE on Cloud9 • Deploy projects on AWS using Code Build, CodeDeploy, and CodePipeline **Self-Learning Topics:** AWS Codestar	**04**	LO1
II	Container Orchestration using Kubernetes	In this module, you will learn how Kubernetes automates many of the manual processes involved in deploying, managing, and scaling containerized applications. Install and configure Kubernetes Spin Up a Kubernetes Cluster Check the Nodes of Your Kubernetes Cluster	**04**	LO1, LO2

V		Installing kubectl to manage cluster and deploy Your First Kubernetes Application		
		Self-Learning Topics:		
		• Using Services and Ingresses to Expose Deployments		
		• Perform logging, monitoring, services, and volumes in Kubernetes.		
III	Infrastructure Automation with Terraform	In this module you will learn, Infrastructure as code for provisioning, compliance, and management of any cloud infrastructure, and service.	**04**	LO1, LO3
		• Introduction to Infrastructure as Code with Terraform		
		• Install, Build, change and Destroy Infrastructure using Terraform.		
		Self-Learning Topics:		
		Terraform		
		• Create Resource Dependencies		
		• Provision Infrastructure		
		• Define Input Variables, Query Data with output and store remote state		
IV	DevSecOps: Static Application Security Testing (SAST)	In this module, you will learn to identify and remediate application vulnerabilities earlier and help integrate security in the development process using tools like SonarQube / Gitlab /	**04**	LO1, LO4
		• Perform static analysis on application source code and binaries.		
		• Spot potential vulnerabilities before deployment		
		• Analysis of java / web-based project		
		• Jenkins SonarQube / Gitlab Integration		
		Self-Learning Topics: Snyk, OWASP ZAP, Analysis Core Plugin		
V	DevSecOps: Continuous Monitoring	In this module, you will learn to detect, report, respond to the attacks and issues which occur within the infrastructure.	**04**	LO1, LO5
		• Introduction to Continuous Monitoring		
		• Introduction to Nagios		
		• Installing Nagios		
		• Nagios Plugins (NRPE) and Objects Nagios Commands and Notification		
		• Monitoring of different servers using Nagios		

		Self-Learning Topics: Splunk, Snort, Tenable		
VI	NoOps: Serverless Computing	In this module, you will learn serverless computing platform like AWS Lambda, which allows you to build your code and deploy it without ever needing to configure or manage underlying servers. • AWS Lambda - Overview and Environment Setup • Building and Configuring the Lambda function (NODEJS/PYTHON/JAVA) • Creating & Deploying using AWS Console/CLI • Creating & Deploying using Serverless Framework **Self-Learning Topics:** AWS Lambda • Create a REST API with the Serverless Framework	**04**	LO1, LO6

Textbooks:
1. AWS Certified SysOps Administrator Official Study Guide: Associate Exam by Stephen Cole (Author), Gareth Digby (Author), Chris Fitch (Author), Steve Friedberg (Author), Shaun Qual
2. AWS Certified Solutions Architect Official Study Guide: Associate Exam by Joe Baron
3. Terraform: Up & Running - Writing Infrastructure as Code, Second Edition by Yevgeniy Brikman , O'Reilly
4. Kubernetes: Up and Running - Dive into the Future of Infrastructure, Second Editionby Brendan Burns,O'Reilly
5. Going Serverless with AWS Lambda: Leveraging the latest services from the AWS cloud by Ajay Pherwani , Shroff/X-Team;
6. Learning Nagios, Packt Publishing.

References:
1. Learning Aws - Second Edition: Design, build, and deploy responsive applications using AWS by Amit Shah Aurobindo Sarkar
2. Mastering Aws Lambda by Yohan Wadia Udita Gupta

List of Experiments:

Sr. No	Experiment Title
1	To understand the benefits of Cloud Infrastructure and Setup AWS Cloud9 IDE, Launch AWS Cloud9 IDE and Perform Collaboration Demonstration.
2	To Build Your Application using AWS CodeBuild and Deploy on S3 / SEBS using AWS CodePipeline, deploy Sample Application on EC2 instance using AWS CodeDeploy.
3	To understand the Kubernetes Cluster Architecture, install and Spin Up a Kubernetes Cluster on Linux Machines/Cloud Platforms.
4	To install Kubectl and execute Kubectl commands to manage the Kubernetes cluster and deploy Your First Kubernetes Application.

5	To understand terraform lifecycle, core concepts/terminologies and install it on a Linux Machine.
6	To Build, change, and destroy AWS / GCP /Microsoft Azure/ DigitalOcean infrastructure Using Terraform.
7	To understand Static Analysis SAST process and learn to integrate Jenkins SAST to SonarQube/GitLab.
8	Create a Jenkins CICD Pipeline with SonarQube / GitLab Integration to perform a static analysis of the code to detect bugs, code smells, and security vulnerabilities on a sample Web / Java / Python application.
9	To Understand Continuous monitoring and Installation and configuration of Nagios Core, Nagios Plugins and NRPE (Nagios Remote Plugin Executor) on Linux Machine.
10	To perform Port, Service monitoring, Windows/Linux server monitoring using Nagios.
11	To understand AWS Lambda, its workflow, various functions and create your first Lambda functions using Python / Java / Nodejs.
12	To create a Lambda function which will log "An Image has been added" once you add an object to a specific bucket in S3.

Term Work: Term Work shall consist of at least 12 to 15 practicals based on the above list. Also Term work Journal must include at least 2 assignments based on the self-learning topics mentioned in syllabus.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical & Oral Exam: An Practical & Oral exam will be held based on the above syllabus.

Course Code	Course Name	Teaching scheme			Credit assigned			
		Theory	**Pract.**	**Tut.**	**Theory**	**Pract.**	**Tut.**	**Total**
ITL505	Professional Communication & Ethics-II (PCE-II)	--	2*+ 2 Hours (Batch-wise)	--	--	02	--	02

*Theory class to be conducted for full class.

Course Code	Course Name	Examination Scheme									
		Theory					Term work	Pract	Oral	Internal Oral	Total
		Internal Assessment			End sem	Duration (hrs)					
		Test 1	Test 2	Avg.							
ITL505	Professional Communication & Ethics-II (PCE-II)	--	--	--	--	--	25	--	--	25	50

Course Code	Course Name	Credits
ITL505	Professional Communication & Ethics-II (PCE-II)	02
Course Rationale	This curriculum is designed to build up a professional and ethical approach, effective oral and written communication with enhanced soft skills. Through practical sessions, it augments student's interactive competence and confidence to respond appropriately and creatively to the implied challenges of the global Industrial and Corporate requirements. It further inculcates the social responsibility of engineers as technical citizens.	
Course Objectives	• To discern and develop an effective style of writing important technical/business documents. • To investigate possible resources and plan a successful job campaign. • To understand the dynamics of professional communication in the form of group discussions, meetings, etc. required for career enhancement. • To develop creative and impactful presentation skills. • To analyze personal traits, interests, values, aptitudes and skills. • To understand the importance of integrity and develop a personal code of ethics.	
Course Outcomes	**Learner will be able to…** • plan and prepare effective business/ technical documents which will in turn provide solid foundation for their future managerial roles. • strategize their personal and professional skills to build a professional image and meet the demands of the industry. • emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations. • deliver persuasive and professional presentations. • develop creative thinking and interpersonal skills required for effective professional communication. • apply codes of ethical conduct, personal integrity and norms of organizational behaviour.	

Module	Contents	Hours
1	**ADVANCED TECHNICAL WRITING :PROJECT/PROBLEM BASED LEARNING (PBL)** **1.1 Purpose and Classification of Reports:** **Classification on the basis of:** • Subject Matter (Technology, Accounting, Finance, Marketing, etc.) • Time Interval (Periodic, One-time, Special) • Function (Informational, Analytical, etc.) • Physical Factors (Memorandum, Letter, Short & Long) **1.2. Parts of a Long Formal Report:** • Prefatory Parts (Front Matter) • Report Proper (Main Body) • Appended Parts (Back Matter) **1.3. Language and Style of Reports** • Tense, Person & Voice of Reports • Numbering Style of Chapters, Sections, Figures, Tables and Equations • Referencing Styles in APA & MLA Format • Proofreading through Plagiarism Checkers **1.4. Definition, Purpose & Types of Proposals** • Solicited (in conformance with RFP) & Unsolicited Proposals • Types (Short and Long proposals) **1.5. Parts of a Proposal** • Elements • Scope and Limitations • Conclusion **1.6. Technical Paper Writing** • Parts of a Technical Paper (Abstract, Introduction, Research Methods, Findings and Analysis, Discussion, Limitations, Future Scope and References) • Language and Formatting • Referencing in IEEE Format	**06**
2	**EMPLOYMENT SKILLS** **2.1. Cover Letter & Resume** • Parts and Content of a Cover Letter • Difference between Bio-data, Resume & CV • Essential Parts of a Resume • Types of Resume (Chronological, Functional & Combination) **2.2 Statement of Purpose** • Importance of SOP • Tips for Writing an Effective SOP **2.3 Verbal Aptitude Test** • Modelled on CAT, GRE, GMAT exams **2.4. Group Discussions** • Purpose of a GD • Parameters of Evaluating a GD • Types of GDs (Normal, Case-based & Role Plays)	**06**

	• GD Etiquettes **2.5. Personal Interviews** • Planning and Preparation • Types of Questions • Types of Interviews (Structured, Stress, Behavioural, Problem Solving & Case-based) • Modes of Interviews: Face-to-face (One-to one and Panel) Telephonic, Virtual	
3	**BUSINESS MEETINGS** **1.1. Conducting Business Meetings** • Types of Meetings • Roles and Responsibilities of Chairperson, Secretary and Members • Meeting Etiquette **3.2. Documentation** • Notice • Agenda • Minutes	**02**
4	**TECHNICAL/ BUSINESS PRESENTATIONS** **1.1 Effective Presentation Strategies** • Defining Purpose • Analyzing Audience, Location and Event • Gathering, Selecting &Arranging Material • Structuring a Presentation • Making Effective Slides • Types of Presentations Aids • Closing a Presentation • Platform skills **1.2 Group Presentations** • Sharing Responsibility in a Team • Building the contents and visuals together • Transition Phases	**02**
5	**INTERPERSONAL SKILLS** **1.1. Interpersonal Skills** • Emotional Intelligence • Leadership & Motivation • Conflict Management & Negotiation • Time Management • Assertiveness • Decision Making **5.2 Start-up Skills** • Financial Literacy • Risk Assessment • Data Analysis (e.g. Consumer Behaviour, Market Trends, etc.)	**08**
6	**CORPORATE ETHICS** **6.1Intellectual Property Rights** • Copyrights • Trademarks • Patents • Industrial Designs	**02**

		• Geographical Indications
		• Integrated Circuits
		• Trade Secrets (Undisclosed Information)
		6.2 Case Studies
		• Cases related to Business/ Corporate Ethics

List of assignments:

(In the form of Short Notes, Questionnaire/ MCQ Test, Role Play, Case Study, Quiz, etc.)

1. Cover Letter and Resume
2. Short Proposal
3. Meeting Documentation
4. Writing a Technical Paper/ Analyzing a Published Technical Paper
5. Writing a SOP
6. IPR
7. Interpersonal Skills
8. Aptitude test (Verbal Ability)

Note:

1. The Main Body of the project/book report should contain minimum 25 pages (excluding Front and Back matter).
2. The group size for the final report presentation should not be less than 5 students or exceed 7 students.
3. There will be an end–semester presentation based on the book report.

Assessment:

Term Work:

Term work shall consist of minimum 8 experiments.
The distribution of marks for term work shall be as follows:
Assignment   : 10 Marks
Attendance   : 5 Marks
Presentation slides   : 5 Marks
Book Report (hard copy)   : 5 Marks
The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Internal oral:

Oral Examination will be based on a GD & the Project/Book Report presentation.

Group Discussion   : 10 marks
Project Presentation : 10 Marks
Group Dynamics   : 5 Marks

Books Recommended:
Textbooks and Reference books:

1. Arms, V. M. (2005). *Humanities for the engineering curriculum: With selected chapters from Olsen/Huckin: Technical writing and professional communication, second edition*. Boston, MA: McGraw-Hill.
2. Bovée, C. L., &Thill, J. V. (2021). *Business communication today*. Upper Saddle River, NJ: Pearson.
3. Butterfield, J. (2017). *Verbal communication: Soft skills for a digital workplace*. Boston, MA: Cengage Learning.
4. Masters, L. A., Wallace, H. R., & Harwood, L. (2011).*Personal development for life and work*. Mason: South-Western Cengage Learning.
5. Robbins, S. P., Judge, T. A., & Campbell, T. T. (2017). *Organizational behaviour*. Harlow, England:

Pearson.

6. Meenakshi Raman, Sangeeta Sharma (2004) Technical Communication, Principles and Practice. Oxford University Press

7. Archana Ram (2018) Place Mentor, Tests of Aptitude For Placement Readiness. Oxford University Press
Sanjay Kumar &PushpLata (2018). Communication Skills a workbook, New Delhi: Oxford University Press.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ITM501	Mini Project – 2 A Web Based Business Model	--	04	--	--	02	--	02

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Pract. /Oral	Total
		Internal assessment			End Sem. Exam			
		Test1	Test 2	Avg.				
ITM501	Mini Project – 2 A Web Based Business Model	--	--	--	--	25	25	50

Course Objectives
1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Course Outcome: Learner will be able to…
1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as member of a group or leader.
4. Draw the proper inferences from available results through theoretical/ experimental/simulations.
5. Analyse the impact of solutions in societal and environmental context for sustainable development.
6. Use standard norms of engineering practices
7. Excel in written and oral communication.
8. Demonstrate capabilities of self-learning in a group, which leads to life long learning.
9. Demonstrate project management principles during project work.

Guidelines for Mini Project
- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students hall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity;however, focus shall be on self-learning.

- Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format of University of Mumbai.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV. Similarly, Mini Project 2 in semesters V and VI.
- However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case by case basis.

Guidelines for Assessment of Mini Project:
Term Work
- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below;
  - Marks awarded by guide/supervisor based on log book   : 10
  - Marks awarded by review committee   : 10
  - Quality of Project report   : 05

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.
      One-year project:
- In first semester entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on presentation given by students group.
  - First shall be for finalisation of problem
  - Second shall be on finalisation of proposed solution of problem.
- In second semester expected work shall be procurement of component's/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester.
  - First review is based on readiness of building working prototype to be conducted.
  - Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester.

Half-year project:
- In this case in one semester students' group shall complete project in all aspects including,
  - Identification of need/problem
  - Proposed final solution
  - Procurement of components/systems
  - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
  - First shall be for finalisation of problem and proposed solution
  - Second shall be for implementation and testing of solution.

Assessment criteria of Mini Project.

Mini Project shall be assessed based on following criteria;

1. Quality of survey/ need identification
2. Clarity of Problem definition based on need.
3. Innovativeness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Innovativeness
8. Cost effectiveness and Societal impact
9. Full functioning of working model as per stated requirements
10. Effective use of skill sets
11. Effective use of standard engineering norms
12. Contribution of an individual's as member or leader
13. Clarity in written and oral communication

- In **one year, project**, first semester evaluation may be based on first six criteria's and remaining may be used for second semester evaluation of performance of students in mini project.
- In case of **half year project** all criteria's in generic may be considered for evaluation of performance of students in mini project.

Guidelines for Assessment of Mini Project Practical/Oral Examination:
- Report should be prepared as per the guidelines issued by the University of Mumbai.
- Mini Project shall be assessed through a presentation and demonstration of working model by the student project group to a panel of Internal and External Examiners preferably from industry or research organisations having experience of more than five years approved by head of Institution.
- Students shall be motivated to publish a paper based on the work in Conferences/students competitions.

Mini Project shall be assessed based on following points;

1. Quality of problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact
4. Full functioning of working model as per stated requirements
5. Effective use of skill sets
6. Effective use of standard engineering norms
7. Contribution of an individual's as member or leader
8. Clarity in written and oral communication