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

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

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 **Self-learning Topics:** Study firewall rules table	**04**	CO6

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/

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
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.

ISBN: 0072977841.

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

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
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.

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
ITDO5014	Advanced Data structure and Analysis	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.					
ITDO5014	Advanced Data structure and Analysis	20	20	20	80	3	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To learn mathematical background for analysis of algorithm
2	To learn various advanced data structures.
3	To understand the different design approaches of algorithm.
4	To learn dynamic programming methods.
5	To understand the concept of pattern matching
6	To learn advanced algorithms.

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 different methods for analysis of algorithms.	L1,L2
2	Choose an appropriate advanced data structure to solve a specific problem.	L1,L2
3	Apply an appropriate algorithmic design approach for a given problem.	L1,L2,L3
4	Apply the dynamic programming technique to solve a given problem.	L1,L2,L3
5	Select an appropriate pattern matching algorithm for a given application.	L1,L2,L3
6	Understand the concepts of Optimization, Approximation and Parallel computing algorithms.	L1,L2

Prerequisite: Data structures and Analysis, Knowledge of Any Programming Language

DETAILED SYLLABUS:

Sr. No	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Basic of Data structures and analysis and programming language.	**02**	-
I	Introduction	Fundamentals of the analysis of algorithms: Time and Space complexity, Asymptotic analysis and notation, average and worst-case analysis, Recurrences: The substitution method, Recursive tree method, Masters method. **Self-learning Topics:** Analysis of Time and space complexity of iterative and recursive algorithms	**04**	CO1
II	Advanced Data Structures	B/B+ tree, Red-Black Trees, Heap operations, Implementation of priority queue using heap, Topological Sort. **Self-learning Topics:** Implementation of Red-Black Tree and Heaps.	**05**	CO2
III	Divide and Conquer AND Greedy algorithms	Introduction to Divide and conquer, Analysis of Binary Search, Merge sort and Quick sort, Finding minimum and maximum algorithm. Introduction to Greedy Algorithms: Knapsack Problem, Job sequencing using deadlines, Optimal storage on tape, Optimal Merge Pattern, Analysis of all these algorithms and problem solving. **Self-learning Topics:** Implementation of minimum and maximum algorithm, Knapsack problem, Job sequencing using deadlines.	**08**	CO3
IV	Dynamic algorithms	Introduction to Dynamic Algorithms, all pair shortest path, 0/1 knapsack, travelling salesman problem, Matrix Chain Multiplication, Optimal binary search tree, Analysis of All algorithms and problem solving. **Self-learning Topics:** Implementation of All pair shortest path, 0/1 Knapsack and OBST.	**06**	CO4
V	String Matching	Introduction, the naïve string matching algorithm, Rabin Karp algorithm, Boyer Moore algorithm, Knuth-Morris-Pratt algorithm, Longest Common Subsequence (LCS), Analysis of All algorithms and problem solving. **Self-learning Topics:** Implementation of Robin Karp algorithm, KMP algorithm and LCS.	**07**	CO5

VI	Advanced Algorithms and NP problems	**Optimization Algorithms:** Genetic algorithm(GA), **Approximation Algorithms:** Vertex-cover problem, **Parallel Computing Algorithms:** Fast Fourier Transform, **Introduction to NP-Hard and NP-Complete Problems** **Self-learning Topics:** Implementation of Genetic algorithm and Vertex-cover problem	**07**	CO6

Textbooks:

1 Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein, PHI.
2 Algorithms: Design and Analysis, Harsh Bhasin, OXFORD.
3 Fundamentals of Computer Algorithms, Horowitz, Sahani, Rajsekaran, Universities Press.
4 C and Data structures, Deshpande, Kakde, Dreamtech Press.

References:

1 Data Structures and Algorithms in C++, Goodritch, Tamassia, Mount, WILEY.
2 Data Structures using C, Reema Thareja , OXFORD.
3 Data Structures and Algorithm Analysis in C, Mark A. Weiss, Pearson.
4 Optimization Algorithms and Applications, By Rajesh Kumar Arora by Chapman and Hall

Online Resources

Sr.No	Website Links
1	https://nptel.ac.in/courses/106/106/106106131/
2	https://swayam.gov.in/nd1_noc19_cs47/preview
3	https://www.coursera.org/specializations/algorithms
4	https://www.mooc-list.com/tags/algorithms

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 marks Q.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.