Vivekanand Education Society's

Department of Information Technology

(Affiliated to University of Mumbai, Approved by AICTE & Recognized by Govt. of Maharashtra)

Department of Information Technology

Academic Year 2023-24

Semester III and IV

Program Structure for Second Year Information Technology

Scheme for Autonomous Program

(With Effect from 2023-2024)

Semester III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	TW/ Pract	Tut	Total
ITC301	Engineering Mathematics III	3	-	1	5	-	1	4
ITC302	Data Structures and Analysis	3	-	-	3	-	-	3
ITC303	Database Management System	3	-	-	3	-	-	3
ITC304	Principle of Communications	3	-	-	3	-	-	3
ITL305	Paradigm and computer programming fundamentals	3			3			3
ITL301	Data Structures Lab	-	2	-	-	1	-	1
IT302	SQL Lab	-	2	-		1	-	1
ITL303	Computer Programming paradigms Lab	-	2*	-	-	1	-	1
ITL304	Java lab(SBL)	-	4			2		2
ITM301	Mini Project -1 backend front end using JAVA	-	4			2		2
	Total	**15**	**14**	**1**	**15**	**7**	1	**23**

Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral & Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Mid-Test (MT)	Continuous Assessment (CA)	Total					
ITC301	Engineering Mathematics III	20	20	40	60	2	-	-	100
ITC302	Data Structures and Analysis	20	20	40	60	2	-	-	100
ITC303	Database Management System	20	20	40	60	2	-	-	100
ITC304	Principle of Communications	20	20	40	60	2	--	-	100
ITC305	Paradigm and computer programming fundamentals	20	20	40	60	2			100
ITL301	Data structures Lab	-	-	-	-	-	25	25	50
ITL302	SQL Lab	-	-	-	-	-	25	25	50
IT303	Computer programming paradigm Lab	-	-	-	-	-	25	25	50
ITL304	Java Programming Lab	-	-	-	-	-	25	25	50
ITM 301	Mini project I (JAVA)						25	25	50
Total		**100**	**100**	**200**	**300**	**-**	**125**	**125**	**750**

Course Code:	Course Title	Credit
IT301	**Engineering Mathematics III**	**4**
1)Prerequisite: Engineering Mathematics-I, Engineering Mathematics-II		
2)Course Objectives:		
1	To build a strong foundation in mathematics, provide students with mathematics fundamentals necessary to formulate, solve and analyses complex engineering problems.	
2	To prepare student to apply reasoning informed by the contextual knowledge to engineering practice, to work as part of teams on multi-disciplinary projects.	
3	To describe the ideas of Fourier and Laplace transforms and illustrate their application in the fields of PDE, Digital Signal Processing, Image Processing, Image Processing, Theory of wave equations, Differential equations, and many others.	
4	To prepare the students to use the information from Laplace transform to convert a continuous signal from the time domain to the frequency domain.	
5	To prepare the students for transforming a problem with inconvenient geometry into a one with appropriate geometry by the use of Complex mapping.	
3)Course Outcomes:		
1.	Laplace transform: . Students will be able to apply Laplace transform and its properties to find the transform of a given function and evaluate some integrals of real value function.	
2	Inverse Laplace transform : Students will be capable of solving ordinary differential equations using Laplace transform as well as problems based on determining the inverse Laplace transform of specified functions.	

3	Fourier Series : Students will be able to expand a periodic function as a Fourier series in terms of sine and cosine functions.
4	Complex Variable: Students will be proficient to construct an analytic function, obtain a family of orthogonal trajectories.
5	Complex Integration : Students will be able to evaluate integration of complex variable functions using the knowledge of Cauchy integral formula, residue of singular points.
6	Z-transform : Students will be able to find Z-transform of sequences using Properties and Inverse Z-transform using series expansion, partial fraction.

4) Syllabus

Module	**Content**	**Hrs**
Module 1	Laplace Transform: 1.1 Definition and Condition of Existence of Laplace transform. 1.2 Laplace transform of standard functions like e at , sin(at), cos(at), sinh(at), cosh(at) and t n , n ≥ 0. 1.3 Properties of Laplace transform: Linearity, First Shifting, Second Shifting, Change of Scale, Multiplication by t, Division by t, Laplace Transform of derivative, integral and convolution of two functions. 1.4 Evaluation of real improper integrals using Laplace transformation. 1.5 Laplace transform of some special functions: Heaviside's Unit Step function, Dirac Delta function.	7
Module 2	Inverse Laplace Transform: 2.1 Definition and Inverse Laplace transform of standard functions. 2.2 Inverse Laplace transform using Partial fractions, derivatives property. 2.3 Inverse Laplace transform using Convolution property. 2.4 Applications to solve initial and boundary value problems involving Ordinary differential equations.	7
Module 3	Fourier Series: 3.1 Drichlet's conditions, Definition of Fourier series and Parseval's Identity. 3.2 Fourier series of periodic function with period 2π and $2L$ 3.3 Fourier series of even and odd functions. 3.4 Half range Sine and Cosine Series.	7

Module 4	Complex Variables: 4.1 Function of complex variable f(z), Limit, Continuity and Differentiability of f(z), Analytic function. Necessary and sufficient conditions for f(z) to be Analytic. Cauchy-Riemann equations in Cartesian coordinate. 4.2 Milne-Thomson method: Determine analytic function f(z) when real part (u), imaginary part (v) or its combination is given. 4.3 Harmonic function, Harmonic conjugate and Orthogonal trajectories.	6
Module 5	Complex Integration: 5.1 Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions, Cauchy's Integral formula. 5.2 Taylor's and Laurent's series expansion. 5.3 Definition of Singularity, Zeroes, Poles of f(z), Residues, Cauchy's Residue Theorem.	7
Module 6	Z-Transform: 6.1 Definition and Region of Convergence, Transform of Standard Functions: {k n a k }, {a |k| }, { C. a k n k+n }, {c k sin(αk + β)}, {c k sinh αk}, {c k cosh αk}. 6.2 Properties of Z-Transform: Change of Scale, Shifting Property, 5 Multiplication, and Division by k, Convolution theorem. 6.3 Inverse Z-Transform: Partial Fraction Method, Convolution Method.	5
	Total	48

5) Textbooks:	
1	Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication
2	Linear Algebra and its Applications, D. C. Lay, Pearson
3	J.L Schiff , The Laplace Transform, Springer (1999)
6) Reference Books:	
1	J H Mathews and R W Howell, Complex Analysis for Mathematics and Engineering, Narosa
2	Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa Publication.
3	Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited
4	Complex Variables and Applications, Brown and Churchill, McGraw-Hill Education

7) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

*For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

Course Code: ITC302	Course Title: Data Structure and Analysis	Credit
ITC302	**Course Title: Data Structure and Analysis**	3

Prerequisite: Introduction of C programming language.

2) Course Objectives: The course aims:

1	The fundamental knowledge of data structures.
2	The programming knowledge which can be applied to sophisticated data structures
3	The fundamental knowledge of stacks, queues, linked lists etc.
4	The fundamental knowledge of Trees, Graphs etc.
5	The fundamental knowledge of different sorting, searching, hashing and recursion Techniques
6	The real time applications for stacks, queue, linked list, trees, graphs etc.

3) Course Outcomes: On successful completion, of course, learner/student will be able to:

1	Classify and Apply the concepts of stacks, queues and linked lists in real life problem solving.
2	Classify, apply and analyze the concepts trees in real life problem solving.
3	Illustrate and justify the concepts of graphs in real life problem solving.

4	List and examine the concepts of searching techniques in real life problem solving.
5	List and examine the concepts of sorting techniques in real life problem solving.
6	Examine and justify different operations of stacks, queues, linked list, trees and graphs to various applications

5) Library related work (5 marks)

6)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

4) Syllabus

Module		**Content**	**Hrs**
Module 0	**Prerequisite**	Defining, Declaring and Initialization of structure variables. Accessing members of a structure, Array of structures, Nested structures, Pointers to structures. Passing structure, structure members, structure arrays and pointer to structure as function parameters. Self-referential structures.. **Recursion**: Writing a recursive function, Flow of control in recursive functions, Winding and unwinding phase, **Time and space complexity of algorithm.**	**03**

Module 1	**Introduction to Stacks, Queues and Linked Lists**	Introduction to Data Structures: Linear and Non Linear Data Structures, Static and Dynamic Data Structures. Concept of Stack and Queue. Array Implementation of Stack and Queue, Circular Queue, Double Ended Queue, Priority Queue. Concept of Linked Lists. Singly linked lists, doubly linked lists and circular linked lists. Insertion, deletion, update and copying operations with Singly linked lists, doubly linked lists and circular linked lists. Reversing a singly linked list. **Self-learning Topics**: Linked List Implementation of Stack, Linked List implementation of Queue, Circular Queue, Double Ended Queue, Priority Queue.	**09**
Module 2	**Trees**	Introduction to Trees: Terminology, Types of Binary trees. Non recursive Preorder, in-order and post-order traversal. Creation of binary trees from the traversal of binary trees. Binary search tree: Traversal, searching, insertion and deletion in binary search tree. Threaded Binary Tree: Finding in-order successor and predecessor of a node in threaded tree. Insertion and deletion in threaded binary tree. AVL Tree: Searching and traversing in AVL trees. Tree Rotations: Right Rotation, Left Rotation. Insertion and Deletion in an AVL Tree. B-tree: Searching, Insertion, Deletion from leaf node and non-leaf node. B+ Tree, Digital Search Tree, Game Tree & Decision Tree **Self-learning Topics**: Implementation of AVL and B+ Tree	**06**

Module 3	**Graphs**	Introduction to Graphs: Undirected Graph, Directed Graph, graph terminology, Connectivity in Undirected and Directed Graphs. Spanning tree. Representation of graph: adjacency matrix, adjacency list, Transitive closure of a directed graph and path matrix. Traversals: Breadth First Search, Depth First Search. **Self-learning Topics**: Implementation of BFS, DFS	**07**
Module 4	**Searching Techniques**	Searching: Sequential Search, Binary Search. Hashing: Hash Functions: Truncation, Mid-square Method, Folding Method, Division Method. Collision Resolution: Open Addressing: Linear Probing, Quadratic Probing, Analysis of all searching techniques **Self-learning Topics: Double Hashing, Separate Chaining Bucket Hashing.**	**04**
Module 5	**Sorting Techniques**	Insertion sort, Selection sort, Merge sort, Quick sort and Radix sort. Analysis of all sorting techniques. **Self-learning Topics: Radix-Exchange Sort,shell sort**	**04**

Module 6	**Applications of Data Structures**	Applications of Linked Lists: Addition of 2 Polynomials and Multiplication of 2 polynomials. Applications of Stacks: Reversal of a String, Checking validity of an expression containing nested parentheses, Function calls, Polish Notation: Introduction to infix, prefix and postfix expressions and their evaluation and conversions. Application of Queues: Scheduling, Round Robin Scheduling Applications of Trees: Huffman Tree and Heap Sort. Applications of Graphs: Dijkstra's Algorithm, Minimum Spanning Tree: Prim's Algorithm, Kruskal's Algorithm.	**06**
		Total	**39**

5) Textbooks:	
1	K Srivastava, Deepali Srivastava; Data Structures through C in Depth; BPB Publications; 2011
2	eYedidya Langsam, Moshej Augenstein, Aaron M. Tenenbaum; Data Structure Using C & C++; rentice Hall of India; 1996.
3	Reema Thareja; Data Structures using C; Oxford
6) Reference Books:	
1	Ellis Horowitz, Sartaj Sahni; Fundamentals of Data Structures; Galgotia Publications; 2010 Jean Paul Tremblay, Paul G. Sorenson

2	Rakesh K. Shukla; Data Structures using C and C++; Wiley India; 2009.

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	***Certificate course for 4 weeks or more:-** **NPTEL/ Coursera/ Udemy/any MOOC**	10 mark
2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

***** Rubrics 1 compulsory, along with rubrics rubrics 2 or (rubrics 3 & 4) students can select.

***** For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9) Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2) Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5 marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10) Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11) End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five need to be solved.

Sample Template for Lab Work

Lab Code	Lab Name	Credit
ITL301	**Data Structure Lab**	**1**

1)Prerequisite: Introduction of C programming language.

2) Lab Objectives: The course aims:

1	To use data structures as the introductory foundation for computer automation to engineering Problems
2	To use the basic principles of programming as applied to complex data structures.
3	To learn the principles of stack, queue, linked lists and its various operations.
4	To learn fundamentals of binary search tree, implementation and use of advanced tree like AVL, B trees and graphs.
5	To learn about searching, hashing and sorting.
6	To learn the applications of linked lists, stacks, queues, trees and graphs.

3) Lab Outcomes: On successful completion, of course, learner/student will be able to:

1	Describe various types of Data Structures viz. stack, queue, linked list, trees, graphs; and the operations that can be performed on each. and calculate time and Space complexity of each operation
2	Describe various searching and sorting methods.

3	Select appropriate data structure to be used for the given problem
4	Explain and use the concept of recursion
5	Develop an algorithm and a C program for the given application.

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)	
Sr. No.	**Name of the Experiment**
1*	Implementation of Stack Data Structure using array.
2*	Conversion of Infix Expression to Postfix Expression Using Stack
3*	Implementation of Linear Queue Data Structure using array.
4	Implementation of Circular Queue Data Structure using array.
5*	Implementation of Singly Linked List.
6*	**Linked List implementation of Stack/queue in real life application.**
7*	Implementation of Circular Singly Linked List.
8*	Implementation of Circular Doubly Linked List.

9*	Implementation of Binary Search Tree .
10*	Implementation of AVL tree.
11*	Implementation of BFS and DFS on a directed graph using an adjacency matrix.
12*	**Implementation of Binary Search in real life application**
13*	Implementation of Menu driven Selection sort, Bubble sort, Insertion sort
14*	Implementation of Menu driven Merge Sort and Quick Sort

5) Useful Links:	
1	https://www.nptel.ac.in
2	https://opendatastructures.org/
3	https://www.coursera.org/
4	https://programiz.com/dsa/

6) Term Work:

1	Term Work shall consist of at least 12 Practical's 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)
7) Continuous assessment exam	
1	Experiment submission on time
2	Explanation/concepts
3	Algorithm implementation
4	Analysis
5	Performance/Documentation

Course Code: ITC303	**Course Title :Database Management System**	**Credit**
Currently same	**Database Management System**	3
1)Prerequisite: C Programming		
2)Course Objectives: The course aims:		
1	To learn the basics and understand the need of a database management system.	
2	To construct conceptual data model for real world applications	
3	To Build a Relational Model from ER/EER.	
4	To introduce the concept of SQL to store and retrieve data efficiently.	
5	To demonstrate notions of normalization for database design.	
6	To understand the concepts of transaction processing- concurrency control & recovery procedures.	
3)Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Identify the need of Database Management System.	
2	Design conceptual model for real life applications.	
3	Create Relational Model for real life applications	
4	Formulate query using SQL commands.	
5	Apply the concept of normalization to relational database design.	
6	Demonstrate the concept of transaction, concurrency and recovery.	

4) syllabus

Module		Content	Hrs
Module 1	**Database System Concepts and Architecture**	Introduction, Characteristics of Databases, File system v/s Database system, Data abstraction and Data Independence, DBMS system architecture,Database Administrator (DBA), Role of DBA **Self-learning Topics:** Identify the types of Databases.	05
Module 2	**The Entity-Relationship Model**	Conceptual Modeling of a database, The Entity-Relationship (ER) Model, Entity Type, Entity Sets,Attributes and Keys, Relationship Types, Relationship Sets, Weak entity Types Generalization, Specialization and Aggregation, Extended Entity-Relationship (EER) Model. **Self-learning Topics:** Design an ER model for any real time case study.	05
Module 3	**Relational Model & Relational Algebra**	Introduction to Relational Model,Relational Model Constraints and Relational Database Schemas, Concept of Keys: Primary Kay, Secondary key, Foreign Key, Mapping the ER and EER Model to the Relational Model, Introduction to Relational Algebra, Relational Algebra expressions for Unary Relational Operations, Set Theory operations, Binary Relational operation Relational Algebra Queries **Self-learning Topics:** Map the ER model designed in module II to relational schema.	**05**
Module 4	**Structured Query Language (SQL) & Indexing**	Overview of SQL, Data Definition Commands, Set operations, aggregate function, null values, Data Manipulation commands, Data Control commands, Complex Retrieval Queries using Group By, Recursive Queries, nested Queries ; Integrity constraints in SQL. Database Programming with JDBC, Security and authorization: Grant & Revoke in SQL Functions and Procedures in SQL and cursors. **Introduction to Query Processing and Optimization.** Self-learning Topics: Physical design of database for the relational model designed in module III and fire various queries.	08

Module 5	**Relational Database Design**	Design guidelines for relational Schema, Functional Dependencies, Database tables and normalization, The need for normalization, The normalization process, Improving the design, Definition of Normal Forms- 1NF, 2NF, 3NF & The Boyce-Codd Normal Form (BCNF),**4NF,5NF.** **Self-learning Topics:** Consider any real time application and normalization upto 4NF/5NF	07
Module 6	**Transactions Management and Concurrency and Recovery**	Transaction: Transaction concept, State Diagram, ACID Properties, Transaction Control Commands,Concurrent Executions, Serializability – Conflict and View, Concurrency Control: Lock-based-protocols, Deadlock handling ,Timestamp-based protocols, Recovery System: **Failure Classification, Storage structure, Recovery & atomicity,** Log based recovery,**Shadow paging** **Self-learning Topics:** Study the various deadlock situation which may occur for a database designed in module V.	09
		Total	**39**

5) Textbooks:	
1	Korth, Slberchatz, Sudarshan, Database System Concepts, 6th Edition, McGraw Hill
2	Elmasri and Navathe, Fundamentals of Database Systems, 6th Edition, Pearson education
3	Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH
6) Reference Books:	
1	Peter Rob and Carlos Coronel, ―Database Systems Design, Implementation and Management‖,Thomson Learning, 9th Edition.
2	SQL & PL / SQL for Oracle 11g Black Book, Dreamtech Press
3	G. K. Gupta : "Database Management Systems", McGraw – Hill

7) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Mini Project / Extra Experiments/ Virtual Lab	10 marks
3.	GATE Based Assignment test/Tutorials etc	10 marks
4.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five need to be solved.

Sample Template for Lab Work

Lab Code	**Lab Name**	**Credit**
ITL302	SQL Lab	**1**
1)Prerequisite: The Lab experiments aims:		
2)Lab Objectives:		
1	To identify and define problem statements for real life applications	
2	To construct conceptual data model for real life applications	
3	To Build Relational Model from ER/EER and demonstrate usage of relational algebra.	
4	To Apply SQL to store and retrieve data efficiently	
5	To implement database connectivity using JDBC	
6	To understand the concepts of transaction processing- concurrency control & recovery procedures.	
3)Lab Outcomes: On successful completion, of course, learner/student will be able to:		
1	Define problem statement and Construct the conceptual model for real life application.	
2	Create and populate a RDBMS using SQL.	
3	Formulate and write SQL queries for efficient information retrieval	

4	Apply view, triggers and procedures to demonstrate specific event handling.
5	Demonstrate database connectivity using JDBC.
6	Demonstrate the concept of concurrent transactions.

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)	
Sr. No.	**Name of the Experiment**
1	Identify real world problems and develop the problem statement. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model.
2	Mapping ER/EER to Relational schema model.
3	Create a database using DDL and apply integrity constraints.
4	Perform data manipulations operations on populated databases.
5	Perform Authorization using Grant and Revoke.
6	Implement Basic and complex SQL queries.
7	Implementation of Views and Triggers.
8	Demonstrate database connectivity using JDBC.
9	Execute TCL commands.
10	Implement functions and procedures in SQL
11	Implementation of Cursor.
12	Implementation and demonstration of Transaction and Concurrency control techniques using locks.

5)Useful Links:	
1	https://www.geeksforgeeks.org/dbms/
2	https://www.w3schools.com/sql/sql_having.asp

3	https://www.tutorialspoint.com/dbms/index.htm
4	https://onlinecourses.nptel.ac.in/noc21_cs58/preview

6) Term Work:	
1	Term Work shall consist of at least 10 Practical based on the above list, but not limited to. 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)
7) Continuous assessment exam:	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis
5.	Documentation/Performance:

Course Code: ITC305	Course Title : Principle of Communication	Credit
Currently same	Principle of Communication	**3**
1)Prerequisite: C Programming		
2)Course Objectives: The course aims:		
1	Study the basic principles and techniques used in analog and digital communications.	
2	Understand the concept of noise and Fourier transform for designing and analysing communication system.	
3	Acquire the knowledge of different modulation techniques such as AM , FM and study the block diagrams of transmitter and receiver.	
4	Study the Sampling theorem and Pulse Analog Modulation techniques.	
5	Learn the concepts of Digital modulation techniques such as PCM, DM, ADM and multiplexing techniques.	
6	Gain the core idea of Electromagnetic Radiation and propagation of waves.	
3)Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Describe analog and digital communication systems	
2	Differentiate types of noise, analyses the Fourier transform of time and frequency domain	
3	Design transmitter and receiver of AM, DSB, SSB and FM.	
4	Describe Sampling theorem and pulse modulation systems.	
5	Explain multiplexing and digital band pass modulation techniques.	
6	Describe electromagnetic radiation and propagation of waves.	

4) syllabus

Module	Topic	Content	Hrs
Module 1	Introduction	1.1 Basics of analog communication and digital communication systems (Block diagram). 1.2 Electromagnetic Spectrum and application, Types of Communication channels.	03
Module 2	Noise	~~2.1 Introduction to Fourier Transform, its properties (time and frequency shifting)~~ Types of Noise, Noise parameters –Signal to noise ratio, Noise factor, Noise figure. 2.2 Friss formula and Equivalent noise temperature.	05
Module 3	Amplitude and Angle modulation Techniques.	3.1 Need for modulation, Amplitude Modulation Techniques: DSBFC AM,DSBSC-AM, SSB SC AM- block diagram spectrum, waveforms, bandwidth, Power calculations. Generation of AM using Diode, generation of DSB using Balanced modulator, Generation of SSB using Phase Shift Method. 3.2 AM Transmitter (Block Diagram) AM Receivers – Block diagram of TRF receivers and Super heterodyne receiver and its characteristics- Sensitivity, Selectivity, Fidelity, Image frequency and its rejection and double spotting. 3.2 **Angle Modulation FM:** Principle of FM- waveforms, spectrum, bandwidth. Pre- emphasis and de-emphasis in FM, FM generation: Direct method –Varactor diode Modulator, Indirect method (Armstrong method) block diagram and waveforms. 3.4 FM demodulator: Foster Seeley discriminator, Ratio detector	14
Module 4	Pulse Analog Modulation and Digital Modulation	4.1 Sampling theorem for low pass and band pass signals ~~with proof~~, Anti- aliasing filter, PAM, PWM and PPM generation and Degeneration.	09

		4.2 Quantization process, Pulse code modulation, Delta modulation, Adaptive delta modulation. ~~Introduction to Line codes and ISI.~~	
Module 5	Multiplexing and Digital Band Pass Modulation Techniques	5.1 Principle of Time Division Multiplexing, Frequency Division Multiplexing , and its applications 5.2 ASK, FSK, PSK, ~~QPSK~~ Generation and detection.	04
Module 6	Radiation and Propagation of Waves	6.1 Electromagnetic radiation, fundamentals, types of propagation 6.2 Ground wave, sky wave, space wave tropospheric scatter propagation.	04
		Total	**39**

	5) Textbooks:
1	George Kennedy, Bernard Davis, SRM Prasanna, Electronic Communication Systems, Tata McGraw Hill, 5th Ed
2	Simon Haykin, Michael Moher, Introduction to Analog & Digital Communications, Wiley India Pvt. Ltd., 2nd Ed.
3	Wireless Communication and Networking, Vijay Garg
Reference Books	
1	Wayne Tomasi, Electronic Communications Systems, Pearson Publication, 5th Ed.
2	B P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University
3	Herbert Taub, Donald L Schilling, Goutam Saha, Principles of Communication Systems, Tata McGraw Hill, 3rdEd.

7) Internal Assessment(20marks):
Consisting of Two Compulsory Class Tests
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Mini Project / Extra Experiments/ Virtual Lab	10 marks
3.	GATE Based Assignment test/Tutorials etc	10 marks
4.	Multiple Choice Questions (Quiz)	5 marks

*For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)
2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)
3) Multiple Choice Questions (Quiz) (5marks)
4) Literature review of papers/journals (5 marks)
5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
2	Question paper will comprise of total six questions, each carrying 20 marks.
3	Q.1 will be compulsory and should cover maximum contents of the syllabus.
4	Remaining question will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
5	Total four questions need to be solved.

Course Code: ITL304	Course Title : Java Lab (SBL)	Credit
Currently same	Java Lab (SBL)	2
1)Prerequisite: Basics of Computer Programming		
2)Course Objectives: The course aims:		
1	To understand the concepts of object-oriented paradigm in the Java programming language.	
2	To understand the importance of Classes & objects along with constructors, Arrays ,Strings and vectors	
3	To learn the principles of inheritance, interface and packages and demonstrate the concept of reusability for faster development.	
4	To recognize usage of Exception Handling, Multithreading, Input Output streams in various applications.	
5	To learn designing, implementing, testing, and debugging graphical user interfaces in Java using Swings and AWT components that can react to different user events.	
6	To develop graphical user interfaces using JavaFX controls.	
3)Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Explain the fundamental concepts of Java Programing.	
2	Use the concepts of classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.	
3	Demonstrate how to extend java classes and achieve reusability using Inheritance, Interface and Packages.	
4	Construct robust and faster programmed solutions to problems using concept of Multithreading, exceptions and file handling	

5	Design and develop Graphical User Interface using Abstract Window Toolkit and Swings along with response to the events.
6	Develop Graphical User Interface by exploring JavaFX framework based on MVC architecture.

4) syllabus

Module		Content	Hrs
Module 1	**Java Fundamentals**	**Overview of procedure and object oriented Programming, Java Designing Goals and Features of Java Language**. **Java virtual machine** **Introduction to the principles of object-oriented programming:** Classes, Objects, Abstraction, Encapsulation, Inheritance, Polymorphism. Keywords, Data types, Variables, Operators, Expressions, Types of variables and methods. Control Statements: If Statement, If-else, Nested if, switch Statement, break, continue. **Iteration Statements:** for loop, while loop, and do-while loop **Java Collection** (Perform any 2 programs that covers Classes, Methods, Control structures and Looping statements) 1) Implement a java program to calculate gross salary & net salary taking the following data. Input: empno, empname, basic Process: DA=70% of basic HRA=30% of basic CCA=Rs240/- PF=10% of basic PT= Rs100/- 2) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Write a Java program to take as input the speed of each racer and print back the speed of qualifying racers.	**07**

		3) Write a Java program that prints all real solutions to the quadratic equation ax2+bx+c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2-4ac is negative, display a message stating that there are no real solutions? 4) Write a Menu driven program in java to implement simple banking application. Application should read the customer name, account number, initial balance, rate of interest, contact number and address field etc. Application should have following methods. 1. createAccount() 2. deposit() 3. withdraw() 4. computeInterest() 5. displayBalance() 5)Write a menu driven Java program which will read a number and should implement the following methods 1. factorial() 2. testArmstrong() 3. testPalindrome() 4. testPrime() 5. fibonacciSeries() 6) Create a Java based application to perform various ways of Method overloading.	
Module 2	**Classes, objects, Arrays and Strings**	**Classes & Objects:** Reference Variables, Passing parameters to Methods and Returning parameters from the methods, Static members, Non-Static members Nested and Inner Classes. Static Initialization Block(SIB), Instance Initialization Block(IIB) **Constructors:** Parameterized Constructors, chaining of constructor, finalize() Method, Method overloading, Constructors Overloading. Recursion, Command-Line Arguments. Wrapper classes, InputBufferReader, OutputBufferReader, String Buffer classes, String functions. **Arrays & Vectors:** One and Two Dimensional arrays, Irregular arrays, dynamic arrays, Array List and Array of Object. **Java Data Structures**	**07**

		(Perform any 3 programs that covers Classes & objects, Constructors, Command Line Arguments, Arrays/Vectors,String function and recursions). **Experiments:** 1) Write a program that would print the information (name, year of joining, salary, address) of three employees by creating a class named 'Employee'. The output should be as follows: Name Year of joining Address Robert 1994 64C- WallsStreat Sam 2000 68D- WallsStreat John 1999 26B- WallsStreat 2) Write a program to print the area of a rectangle by creating a class named 'Area' having two methods. First method named as 'setDim' takes length and breadth of rectangle as parameters and the second method named as 'getArea' returns the area of the rectangle. Length and breadth of rectangle are entered through keyboard. 3) Write a Java program to illustrate Constructor Chaining. 4) Create a class 'Student' with three data members which are name, age and address. The constructor of the class assigns default values name as "unknown", age as '0' and address as "not available". It has two members with the same name 'setInfo'. First method has two parameters for name and age and assigns the same whereas the second method takes has three parameters which are assigned to name, age and address respectively. Print the name, age and address of 10 students. Hint - Use array of objects. 5) Write a java programs to add n strings in a vector array. Input new string and check whether it is present in the vector. If it is present delete it otherwise add it to the vector. 6) Print the sum, difference and product of two complex numbers by creating a class named 'Complex' with separate methods for each operation whose real and imaginary parts are entered by user.	

		7)Write menu driven program to implement recursive Functions for following tasks. a) To find GCD and LCM b) To print n Fibonacci numbers c) To find reverse of number d) To solve 1 +2+3+4+..... +(n- l)+n 8) Print Reverse Array list in java by writing our own function.	
Module 3	**Inheritance, Packages and Interfaces.**	**Inheritance:** Inheritance Basics, Types of Inheritance in Java, member access, using Super- to call superclass Constructor, to access member of super class(variables and methods), creating multilevel hierarchy, Constructors in inheritance, method overriding, Abstract classes and methods, using final, Dynamic Method Dispatch **Packages:** Defining packages, creating packages and Importing and accessing packages Interfaces: Defining, implementing and extending interfaces, variables in interfaces, Default Method in Interface ,Static Method in interface, Abstract Classes vs Interfaces. (Perform any 3 programs covering Inheritance, Interfaces and Packages). **Experiments** 1) Create a Teacher class and derive Professor/ Associate_Professor/Assistant_Professor class from Teacher class. Define appropriate constructor for all the classes. Also define a method to display information of Teacher. Make necessary assumptions as required. 2) Create a class Book and define a display method to display book information. Inherit Reference_Book and Magazine classes from Book class and override display method of Book class in Reference_Book and Magazine classes. Make necessary assumptions required. 3) A university has two types of students — graduate students and research students. The University maintains the record of name, age and programme of every student. For graduate students, additional information like percentage of marks and stream, like science, commerce, etc. is recorded; whereas for research students, additionally, specialization and years of working experience, if any, is recorded.	**10**

		Each class has a constructor. The constructor of subclasses makes a call to constructor of the superclass. Assume that every constructor has the same number of parameters as the number of instance variables. In addition, every subclass has a method that may update the instance variable values of that subclass. All the classes have a function display_student_info( ), the subclasses must override this method of the base class. Every student is either a graduate student or a research student. Perform the following tasks for the description given above using Java : (i) Create the three classes with proper instance variables and methods, with suitable inheritance. (ii) Create at least one parameterised constructor for each class. (iii) Implement the display_student_info( ) method in each class.	
Module 4	**Exception Handling, Multithreading, Input Output streams**	**Exception Handling:** Exception-Handling Fundamentals, Exception Types, Exception class Hierarchy, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally , Java's Built-in Exceptions, Creating Your Own Exception Subclasses **Multithreaded Programming:** The Java Thread Model and Thread Life Cycle, Thread Priorities, Creating a Thread, Implementing Runnable, Extending Thread, Creating Multiple **Threads, Synchronization:** Using Synchronized Methods, The synchronized Statement I/O Streams: Streams, Byte Streams and Character, The Predefined Streams, Reading Console Input, Reading Characters, Reading Strings, Writing Console Output, Reading and Writing Files. **Multithreading advantages and issues.** (Perform any 3 programs that cover Exception Handling, Multithreading and I/O Streams). **Experiments:** 1) Write java program where user will enter login id and password as input. The password should be 8 digit containing one digit and one special symbol. If user enter valid password satisfying above criteria	**10**

		then show "Login Successful Message". If user enter invalid Password then create InvalidPasswordException stating Please enter valid password of length 8 containing one digit and one Special Symbol. 2) Java Program to Create Account with 1000 Rs Minimum Balance, Deposit Amount, Withdraw Amount and Also Throws LessBalanceException. It has a Class Called LessBalanceException Which returns the Statement that Says WithDraw Amount(_Rs) is Not Valid. It has a Class Which Creates 2 Accounts, Both Account Deposite Money and One Account Tries to WithDraw more Money Which Generates a LessBalanceException Take Appropriate Action for the Same. 3) Create two threads such that one thread will print even number and another will print odd number in an ordered fashion. 4) Assume that two brothers, Joe and John, share a common bank account. They both can, independently, read the balance, make a deposit, and withdraw some money. Implement java application demonstrate how the transaction in a bank can be carried out concurrently. 5) You have been given the list of the names of the files in a directory. You have to select Java files from them. A file is a Java file if it's name ends with ".java". For e.g. File- "Names.java" is a Java file, "FileNames.java.pdf" is not. **Input:** test.java, ABC.doc, Demo.pdf, add.java, factorial.java, sum.txt **Output**: tset.java, add.java, factorial.java	
Module 5	**GUI programming- I (AWT, Event Handling, Swing)**	**Designing Graphical User Interfaces in Java:** Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features **Event-Driven Programming in Java:** Event-Handling Process, Event-Handling Mechanism, Delegation Model of Event Handling, Event Classes, Event Sources, Event Listeners, Adapter Classes as Helper Classes in Event Handling.	**12**

		Introducing Swing: AWT vs Swings, Components and Containers, Swing Packages, A Simple Swing Application, Painting in Swing, Designing Swing GUI Application using Buttons, JLabels, Checkboxes, Radio Buttons, JScrollPane, JList, JComboBox, Trees, TablesScroll pane Menus and Toolbar. (Perform any 3 programs that contain AWT, Event handling and Swing to build GUI application). 1)Write a Java program to implement Swing components namely Buttons, ,JLabels, Checkboxes, Radio Buttons, JScrollPane, JList, JComboBox, Trees, Tables Scroll pane Menus and Toolbars to design interactive GUI. 2) Write a program to create a window with four text fields for the name, street, city and pincode with suitable labels. Also windows contains a button MyInfo. When the user types the name, his street, city and pincode and then clicks the button, the types details must appear in Arial Font with Size 32, Italics. 3) Write a Java program to create a simple calculator using java AWT elements. .Use a grid layout to arrange buttons for the digits and basic operation +, -, /, *. Add a text felid to display the results. 4) Write a Java Program to create a Student Profile form using AWT controls. 5) Write a Java Program to simulate traffic signal light using AWT and Swing Components. 6) Write a Java Program to create a color palette. Declare a grid of Buttons to set the color names. Change the background color by clicking on the color button. 7) Build a GUI program that allows the user to add objects to a collection and perform search and sort on that collection.(Hint. Use Swing components like JButton, JList, JFrame, JPanel and JOptionPane.)	
Module 6	**GUI Programming-II (JavaFX)** **Java Applets**	JavaFX Basic Concepts, JavaFX application skeleton, Compiling and running JavaFX program,Simple JavaFX control:Label,Using Buttons and events, Drawing directly on Canvas.	**04**

		(Perform any one program that contains the concept of JavaFX). 1)Write a Java program to design a Login Form using JavaFX Controls. 2)Write Java program to draw various shapes on Canvas using JavaFX. **Applet Programming:** local and remote applets, difference between applet and application, applet life cycle, developing executable applet code. 1)Develop code for simple Java applets.	
		Total	**50**

	5) Textbooks:
1	Herbert Schildt, "Java-The Complete Reference", Tenth Edition, Oracle Press, Tata McGraw Hill Education.
2	E. Balguruswamy, "Programming with Java A primer", Fifth edition, Tata McGraw Hill Publication
3	Anita Seth, B.L.Juneja, " Java One Step Ahead", oxford university press. Korth, Slberchatz, Sudarshan, Database System Concepts, 6th Edition, McGraw Hill
	6) Reference Books:
1	D.T. Editorial Services, "Java 8 Programming Black Book", Dreamtech Press.
2	Learn to Master Java by Star EDU Solutions
3	Yashvant Kanetkar, "Let Us Java" ,4th Edition ,BPB Publications.

7) Term work:
The Term work shall consist of at least 15 practical based on the above list. The term work Journal must include at least 2 Programming assignments. The Programming assignments should be based on real world applications which cover concepts from more than one modules of syllabus.

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

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

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

Course Code: ITM301	Course Title : Mini Project – 1 A for Front end /backend Application using JAVA	Credit
Currently same	**Mini Project – 1 A for Front end /backend Application using JAVA**	2

1)Prerequisite:

2)Course Objectives:

The course aims:

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.

3)Course Outcomes:

On successful completion, of course, learner/student 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.

4) 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 nfaculties.
- 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.

5) 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

6) 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.

7) 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.

8) 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

Program Structure for Second Year Information Technology

Scheme for Autonomous Program

(With Effect from 2023-2024)

Semester IV

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	TW/ Pract	Tut	Total
ITC401	Engineering Mathematics –IV	3	-	1	5	-	1	4
ITC402	Computer Network and Network Design	3	-	-	3	-	-	3
ITC403	Operating System	3	-	-	3	-	-	3
ITC404	Automata Theory	3	-	-	3	-	-	3
ITC405	Computer Organization and Architecture	3			3			3
ITL401	Network Lab	-	2	-	-	1	-	1
ITL402	Unix Lab	-	2	-		1	-	1
ITL403	Microprocessor Lab	-	2	-	-	1	-	1
ITL404	Python Lab (SBL)	-	4			2		2
ITM401	Mini Project – 1 B for Python Based automation projects	-	4			2		2
	Total	**15**	**14**	**1**	**15**	**7**	**1**	**23**

Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral & Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Mid-Test (MT)	Continuous Assessment (CA)	Total					
ITC401	Engineering Mathematics –IV	20	20	40	60	2	-	-	100
ITC402	Computer Network and Network Design	20	20	40	60	2	-	-	100
ITC403	Operating System	20	20	40	60	2	-	-	100
ITC404	Automata Theory	20	20	40	60	2	-	-	100
ITC405	Computer Organization and Architecture	20	20	40	60	2			100
ITL401	Network Lab	-	-	-	-	-	25	25	50
ITL402	Unix Lab	-	-	-	-	-	25	25	50
ITL403	Microprocessor Lab	-	-	-	-	-	25	25	50
ITL404	Python Lab (SBL)	-	-	-	-	-	25	25	50
ITM401	Mini Project – 1 B for Python Based automation projects						25	25	50
Total		**100**	**100**	**200**	**300**	**-**	**125**	**125**	**750**

@ 4 hours shown as theory to be taken class wise and 1 hour to be taken tutorial as class wise

$ 3 hours shown as theory to be taken class wise and 1 hour to be taken tutorial as batch wise

* 2 hours shown as practical's to be taken class wise lecture and another 2 hours to be taken as batch wise practices in the lab.

Course Code:	Course Title	Credit
IT 401	**Applied Mathematics IV**	**4**
1)Prerequisite: Engineering Mathematics-I, Engineering Mathematics-II, Engineering Mathematics-III		
2)Course Objectives:		
1	To build a strong foundation in mathematics, provide students with mathematics fundamentals necessary to formulate, solve and analyses complex engineering problems. To prepare student to apply reasoning informed by the contextual knowledge to engineering practice, to work as part of teams on multi-disciplinary projects.	
2	To prepare student to apply reasoning informed by the contextual knowledge to engineering practice, to work as part of teams on multi-disciplinary projects.	
3	To acknowledge the importance of sampling design and analysis methods for research and management in many other fields.	
4	To get familiar with the mathematical formulation of a real world problem, acquaint with the problem solving techniques theoretically, tackle several parameters into account while dealing with the problem and make aware the students about the applications of various forms of Linear Programming.	
5	To prepare students to apply linear algebra concepts to model, solve and analyse real-world situations.	
6	To prepare students to apply the concept of eigenvalues and Eigen vector which will further be useful in applications like Google page rank algorithms, principal component analysis (biometric systems), and natural frequency for a structure.	
7	To prepare the students to use a powerful statistical software platform SPSS (Statistical Package for the Social Sciences) for the analysis of statistical data in the future.	
3)Course Outcomes:		
1	Probability theory: Students will understand various probability measures, distribution functions, and their characteristics. They will be able to Compute probability using probability distribution of discrete and continuous Random variable.Additionally,the knowledge regarding Bayes theorem will help them take various real-life problems that arise in the medical fields and industries.	
2	Probability Distribution and Sampling Theory : Students will know fundamental concepts of testing of hypothesis, formulation of statistical hypothesis in real-life situations, developing best test procedures to test the hypothesis, and the principles underlying sampling as a means of making inferences about a population. They can also apply the idea of probability distribution to engineering problems .	

3	Statistical Techniques: Students will apply the concept of Correlation and Regression, fitting of curve to the given data sets.
4	Eigenvalues and Eigenvectors: Students will be able to execute matrix diagonalization and perform basic eigenvalue and eigenvector computations.
5	Linear Programming Problems: Students should be able to formulate a given simplified description of a suitable real-world problem as a linear programming model in general, standard and canonical forms.linear programming models can be solved by them using the simplex method , Big M method and Dual simplex method.
6	Non Linear Programming Problems: Students will be able to solve Non Linear Optimization problems using Lagrange's multiplier method and Karush Kuhn Tucker Method.

4) syllabus

Module	Content	Hrs
Module 1	**Probability:** 2.1 Definition and basics of probability, conditional probability. Total Probability theorem and Bayes' theorem. 2.2 Discrete and continuous random variable with probability distribution and probability density function. 2.3 Expectation, Variance, Moment generating function, Raw and central Moments, Covariance, Skewness and Kurtosis of distribution and their properties. 2.4 Probability Distribution: Binomial, Poisson and Normal distribution.	08
Module 2	**Probability Distribution and Sampling Theory:** 3.1 Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Test of significance of mean and difference between the means of two samples for Large samples. 3.2 Degree of freedom, Student's t-distribution, Test of significance of mean and difference between the means of two samples for Small samples. 3.3 Chi-Square Test: Test of goodness of fit. Contingency table and Test of independence of attributes.	07
Module 3	**Statistical Techniques:** 4.1 Karl Pearson's coefficient of correlation (r). 4.2 Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks). 4.3 Fitting of first and second degree curves. 4.4 Lines of regression.	5
Module 4	**Linear Algebra (Theory of Matrices):** 1.1 Characteristic Equation, Eigen values and Eigen vectors, and properties.	7

	1.2 Cayley-Hamilton Theorem ,verification and reduction of higher degree polynomials. 1.3 Similarity of matrices, diagonalizable and non-diagonalizable matrices	
Module 5	**Linear Programming Problems:** 5.1 Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method. 5.2 Artificial variables, Big-M method (Method of penalty) 5.3 Duality, Dual of LPP and Dual Simplex Method.	6
Module 6	**Nonlinear Programming Problems:** 6.1 NLPP with no constraint, one equality constraint . using the method of Lagrange's multipliers. 6.2 NLPP with two equality constraints. 6.3 NLPP with inequality constraint: Karush-Kuhn-Tucker (KKT) conditions.	6
	Total	**46**

5) Textbooks:	
1	Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa.
2	Gupta and Kapoor, Fundamental of Mathematical Statistics, S Chand
3	Operations Research, Hira and Gupta, S. Chand Publication.
6) Reference Books:	
1	Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons.
2	Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill Education.

7) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	10 marks

*For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.
9)Rubrics for slow learners:-
1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)
2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)
3) Multiple Choice Questions (Quiz) (5marks)
4) Literature review of papers/journals (5 marks)
5) Library related work (5 marks)
10)Rubrics for Indirect Assessment :-
1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

6)Term Work:	
1	(breakup for term work can be specified by the subject teacher)
7)Continuous assessment exam	
1	(breakup and conditions can be specified by subject teacher)

Course Code: ITC402	**Course Title: Computer Networks**	**Credit**
ITC402	**Course Title: Computer Networks**	3
2) Course Objectives: The course aims:		
1	Study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.	
2	Acquire knowledge of Application layer and Presentation layer paradigms and protocols.	
3	Study Session layer design issues, Transport layer services, and protocols.	
4	Gain core knowledge of Network layer routing protocols and IP addressing.	
5	Study data link layer concepts, design issues, and protocols.	
6	Read the fundamentals and basics of Physical layer, and will apply them in real time applications.	
3) Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Describe the functions of each layer in OSI and TCP/IP model.	

Course Code: ITC402	Course Title: Computer Networks	Credit
ITC402	**Course Title: Computer Networks**	3
2	Explain the functions of Application layer and Presentation layer paradigms and Protocols.	
3	Describe the Session layer design issues and Transport layer services.	
4	Classify the routing protocols and analyze how to assign the IP addresses for the given network.	
5	Describe the functions of data link layer and explain the protocols.	
6	Explain the types of transmission media with real time applications.	

4) Syllabus

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Von Neumann model, Modulation, Demodulation, encoding, Decoding.	02	--
I	Introduction	Network Criteria, Physical Structures, Network Types: LAN, WAN, Switching, OSI Reference model, TCP/IP suite, Comparison of OSI and TCP/IP, Network devices.	04	CO1

II	Application layer and Presentation layer	Introduction: Providing Services, Application layer Paradigms, Client- Server Paradigm: Application Programming Interface, Using Services of the Transport Layer, Standard Client Server applications: World Wide Web and HTTP, FTP, Electronic Mail, TELNET, Secure Shell (SSH), Domain Name System (DNS), Compression: Lossless Compression, Lossy Compression, Multimedia data: Text, Image, Video , Audio ,Multimedia in the Internet: Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, Optimal Compression Algorithms, Huffman Coding, Adaptive Huffman Compression, Dictionary Based Compression, Speech Compression, LZW, RLE, Image Compression – GIF,JPEG.	10	CO1 CO2
III	Session layer and Transport layer	Session layer design issues, Session Layer protocol - Remote Procedure Call (RPC), Transport layer services, Transport Layer Protocols: Simple Protocol, Stop-and-Wait Protocol, Go- Back-N Protocol (GBN), Selective- Repeat Protocol, Bidirectional Protocols: Piggybacking, Internet Transport-Layer Protocols, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Segment, A TCP Connection, State Transition Diagram, Windows in TCP, Flow Control, Error Control, TCP Congestion Control, TCP Timers, Options.	10	CO1 CO3
IV	Network Layer	Introduction: Network-Layer Services, Packet Switching, Network-Layer Performance, Network-Layer Performance, Network-Layer Congestion, Structure of A Router, Network Layer Protocols: IPv4 Datagram Format, IPv4 Addresses,	12	CO1 CO4

		Forwarding of IP Packets, ICMPv4, Unicast Routing: General Idea, Routing Algorithms, Unicast Routing Protocols, Multicast Routing : Introduction, Multicasting Basics, Intradomain Routing Protocols, Interdomain Routing Protocols, Next generation IP: Packet Format , IPv6 Addressing , Transition from IPv4 to IPv6, ICMPv6, Mobile IP: Addressing , Agents , Three Phases , Inefficiency in Mobile IP.		
V	Data Link Layer	Wired Networks; Introduction: Nodes and Links, Two Types of Links, Two Sublayers, Data Link Control: Framing, Flow and Error Control, Error Detection and Correction, Two DLC Protocols, Medium Access Protocols: Random Access, Controlled Access, Channelization, Link Layer Addressing, Wired LANS: Ethernet Protocol; IEEE Project 802, Standard Ethernet, Fast Ethernet (100 Mbps), Gigabit Ethernet, 10-Gigabit Ethernet, Virtual LANs, Other Wired Networks: Point-to-Point Networks, SONET, Switched Network: ATM, Connecting Devices: Repeaters or Hubs, Link-Layer Switches, Routers, Sliding Window Compression.	09	CO1 CO5

VI	Physical Layer	Data and Signals: Analog and Digital, Transmission Impairment, Data Rate Limits, Performance, Digital Transmission: Digital-to-Digital Conversion , Analog-to-Digital Conversion, Analog Transmission: Digital-to-Analog Conversion, Analog- to-Analog Conversion ,Bandwidth Utilization: Multiplexing, Spread Spectrum, Transmission Media: Guided Media, Unguided Media: Wireless, Real Time Interactive Protocols: Rationale for New Protocols, RTP, Session Initialization Protocol (SIP), H.323, SCTP.	05	CO1 CO6

5) Textbooks:	
1	Behrouz A. Forouzan, Forouzan Mosharrat , Computer Networks A Top down Approach, Mc Graw Hill ucation.
2	Andrew S Tanenbaum, Computer Networks -, 4th Edition, Pearson Education.
3	Ranjan Bose, Information Theory, Coding and Cryptography, Ranjan Bose, Tata McGrawHill , Second ition.
6) Reference Books:	
1	Behrouz A. Forouzan, Data communications and Networking, Fifth edition TMH 2013.
2	se, K. W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 3rd Edition, Pearson Eduction.

7) Internal Assessment (20 marks):
Consisting of Two Compulsory Class Tests
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

Sr.n	Rubrics	Marks
1.	***Certificate course for 4 weeks or more:-** **NPTEL/ Coursera/ Udemy/any MOOC**	10 marks
2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

***** Rubrics 1 compulsory, along with rubrics rubrics 2 or (rubrics 3 & 4) students can select.

***** For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

8) Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5 marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

9) Rubrics for Indirect Assessment :-

1. Mock Viva/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

Extra Assignments/lab/lecture

10)End Semester Theory Examination:	
1	Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
2	Question paper will comprise of total six questions, each carrying 20 marks.
3	Q.1 will be compulsory and should cover maximum contents of the syllabus.
4	Remaining question will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
5	Total four questions need to be solved.

Course Code: ITC403	Course Title :Operating System	Credit
Currently same	**Operating System**	3

1)Prerequisite: C Programming

2)Course Objectives:

The course aims:

1	To understand the major components of the Operating System & its functions.
2	To introduce the concept of a process and its management like transition, scheduling, etc.
3	To understand basic concepts related to Inter-process Communication (IPC) like mutual exclusion, deadlock, etc. and role of an Operating System in IPC.
4	To understand the concepts and implementation of memory management policies and virtual memory.
5	To understand functions of Operating Systems for storage management and device management.
6	To study the need and fundamentals of special-purpose operating system with the advent of new emerging technologies.

3)Course Outcomes:

On successful completion, of course, learner/student will be able to:

1	Understand the basic concepts related to Operating Systems.
2	Describe the process management policies and illustrate scheduling of processes by CPU.
3	Explain and apply synchronization primitives and evaluate deadlock conditions as handled by the Operating System.
4	Describe and analyze the memory allocation and management functions of Operating Systems.
5	Analyze and evaluate the services provided by the Operating System for storage management.

6	Compare the functions of various special-purpose Operating Systems.

4) syllabus

Module		Content	Hrs
Module 1	**Fundamentals of Operating System**	Introduction to Operating Systems; Operating System Structure-**Layered,Monolithic,Microkernel operating system**; Functions of Operating Systems; Operating System Services and Interface; System Calls and its Types; System Programs; Operating System Structure. Self-learning Topics: Study of any three different OS. System calls with examples for different OS.	05
Module 2	**Process Management**	Basic Concepts of Process; Operation on Process; Process State Model and Transition; Process Control Block; Context Switching; Introduction to Threads; Types of Threads, Thread Models; Basic Concepts of Scheduling; Types of Schedulers; Scheduling Criteria; Scheduling Algorithms and **performance evaluation of the scheduling.** **Self-learning Topics:** Performance comparison of Scheduling Algorithms, Selection of Scheduling Algorithms for different situations, Real-time Scheduling	06
Module 3	**ProcessCoordination**	Basic Concepts of Inter-process Communication and Synchronization; Race Condition; Critical Region and Problem; Peterson's Solution; Synchronization Hardware and Semaphores; **Monitors**,Classic Problems of Synchronization; Message Passing; Introduction to Deadlocks; System Model, Deadlock Characterization; Deadlock Detection and Recovery; Deadlock Prevention; Deadlock Avoidance. **Self-learning Topics:** Study a real time case study for Deadlock detection and recovery.	09
Module 4	**Memory Management**	Basic Concepts of Memory Management;**Logical and Physical address map**,Swapping; Memory Allocation :**Contiguous**	09

		memory allocation-Fixed and variable partition-Internal and External fragmentation and compaction; Paging; Structure of Page Table;Segmentation ; Basic Concepts of Virtual Memory; Demand Paging, Page Replacement Algorithms; Thrashing. **Self-learning Topics:** Memory Management for any one Operating System, Implementation of Page Replacement Algorithms.	
Module 5	**Storage Management**	Basic Concepts of File System; File Access Methods; Directory Structure; File-System Implementation; Allocation Methods; Free Space Management; Overview of Mass-Storage Structure; Disk Structure; Disk Scheduling; RAID Structure; Introduction to I/O Systems. **Self-learning Topics:** File System for Linux and Windows, Features of I/O facility for different OS.	06
Module 6	**Special-purpose Operating Systems**	Open-source and Proprietary Operating System; Fundamentals of Distributed Operating System; Network Operating System;Cloud and IoT Operating Systems; Real-Time Operating System;Mobile Operating System;Multimedia operating System;Comparison between functions of various Special-purpose Operating Systems. **Self-learning Topics**: Case Study on any one Special-purpose Operating Systems.	04
		Total	**39**

5) Textbooks:	
1	A. Silberschatz, P. Galvin, G. Gagne, Operating System Concepts, 10th ed., Wiley, 2018.
2	W. Stallings, Operating Systems: Internal and Design Principles, 9th ed., Pearson, 2018.
3	A. Tanenbaum, Modern Operating Systems, Pearson, 4th ed., 2015.
6) Reference Books:	
1	N. Chauhan, Principles of Operating Systems, 1st ed., Oxford University Press, 2014.
2	A. Tanenbaum and A. Woodhull, Operating System Design and Implementation, 3rd ed., Pearson.
3	R. Arpaci-Dusseau and A. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, CreateSpace Independent Publishing Platform, 1st ed., 2018.

7) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.n	Rubrics	Marks
1.	***Certificate course for 4 weeks or more:- NPTEL/Coursera/Udemy/any MOOC**	**10 marks**
2.	**Extra Experiments/ Virtual Lab/GATE Based Assignment test/Tutorials etc**	**10 marks**
3.	**IA Test**	**20 Marks**

*****For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five need to be solved.

Course Code: ITC405	Course Title: Automata Theory	Credit
ITC405	**Course Title: Automata Theory**	3
2) Course Objectives: The course aims:		
1	To learn fundamentals of Regular and Context Free Grammars and Languages.	
2	To understand the relation between Regular Language and Finite Automata and machines.	
3	To learn how to design Automata's and machines as Acceptors, Verifiers and Translators.	
4	To understand the relation between Contexts free Languages, PDA and TM.	
5	To learn how to design PDA as acceptor and TM as Calculators.	
6	To learn how to co-relate Automata's with Programs and Functions.	
3) Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Understand, design, construct, analyze and interpret Regular languages, Expression and Grammars.	
2	Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.	
3	Understand, design, analyze and interpret Context Free languages, Expression and Grammars.	
4	Design different types of Push down Automata as Simple Parser.	
5	Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.	
6	Compare, understand and analyze different languages, grammars, Automata and Machines and appreciate their power and convert Automata to Programs and Functions.	

4) Syllabus

Sr. No.	Module	Detailed Content	Hours	CO Mapping
I	Introductio n and Regular	Languages: Alphabets and Strings. Regular Languages: Regular Expressions, Regular Languages, Regular Grammars, RL and LL	06	CO1
II	Finite Automata and machines	Finite Automata: FA as language acceptor or verifier, NFA (with and without ε) , DFA, RE to NFA, NFA to DFA, Reduced DFA , NFA-DFA equivalence, FA to RE. Finite State Machines: m/c with output Moore and Mealy machines. M/c as translators. Melay and Moore m/c Conversion	09	CO2
III	Context Free Grammars	Context Free Languages: CFG, Leftmost and Rightmost derivations, Ambiguity, Simplification and Normalization (CNF) and Chomskey Hierarchy (Types 0 to 3)	08	CO3
IV	Push Down Automata	Push Down Automata: Deterministic (single stack)PDA, Equivalence between PDA and CFG.	05	CO4
V	Turing Machine	Turing Machine: Deterministic TM , Multi-track and Multi-tape TMs, concept of UTM and idea of system program. Issue and concept of Halting Problem	07	CO5
VI	Application s of Automata	1. Power and Limitations of Regular and Context Free Grammars and Machines 2. Designing Functions: FA: Acceptor and Verifier. FSM: Translator PDA: Simple Parser for WF parenthesis, palindromes etc. TM: Basic bit wise calculator(+ /- /AND/OR) and Translator **(Note Added)**	04	CO2 CO4 CO5 CO6

Text Books:	
1	J.C.Martin, “Introduction to languages and the Theory of Computation”, TMH.
2	Kavi Mahesh, “Theory of Computation A Problem Solving Approach”, Wiley India
References:	
1	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, “Introduction to Automata Theory, Languages and Computation”, Pearson Education.
2	Daniel I.A. Cohen, “Introduction to Computer Theory”, John Wiley & Sons.
3	Theory of Computation - By Vivek Kulkarni from Oxford University.

Suggested Tutorials:

Sr. No.	Module	Detailed Content
I	Introduction and Regular Languages	1 Tutorial on design of RE, RG, RLG and LLG for given Regular Language.
II	Finite Automata and machines	3 Tutorials for converting RE to NFA, NFA to DFA to Reduced DFA, FA to RE. 1 Tutorial on design of Moore and Mealy machines.
III	Context Free Grammars	1 Tutorial on design of CFG and Leftmost and Rightmost derivations. 1 Tutorial for converting CFG to CNF.
IV	Push Down Automata	1 Tutorial on design of Push Down Automata.
V	Turing Machine	1 Tutorial on design of single tape Turing Machine. 1 Tutorial on design of Multi-track and Multi-tape TMs.
VI	Applications of Automata	2 Tutorials for converting Automata to Functions: a. FA to Acceptor / Verifier. b. FSM to Translator. c. PDA to Simple Parser for WF parenthesis, palindromes etc. d. TM to Basic bit wise calculator(+ /- /AND/OR) / Translator

7) Internal Assessment (20 marks):

Consisting of Two Compulsory Class Tests

Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

Sr.r	Rubrics	Marks
1.	***Certificate course for 4 weeks or more:-** **NPTEL/ Coursera/ Udemy/any MOOC**	10 marks
2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

***** Rubrics 1 compulsory, along with rubrics rubrics 2 or (rubrics 3 & 4) students can select.

***** For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

8) Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5 marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

9) Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

Extra Assignments/lab/lecture

10)End Semester Theory Examination:	
1	Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
2	Question paper will comprise of total six questions, each carrying 20 marks.
3	Q.1 will be compulsory and should cover maximum contents of the syllabus.
4	Remaining question will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
5	Total four questions need to be solved.

Course Code: ITC405	Course Title :Computer Organization and Architecture	Credit
Currently same	**Computer Organization and Architecture**	03

1)Prerequisite: Basics of Electrical Engineering, Fundamentals of Computer

2)Course Objectives:

The course aims:

1	Learn the fundamentals of Digital Logic Design.
2	Conceptualize the basics of organizational and features of a digital computer.
3	Study microprocessor architecture and assembly language programming.
4	Study processor organization and parameters influencing performance of a processor.
5	Analyse various algorithms used for arithmetic operations.
6	Study the function of each element of memory hierarchy and various data transfer techniques used in digital computers.

3)Course Outcomes:

On successful completion, of course, learner/student will be able to:

1	Demonstrate the fundamentals of Digital Logic Design
2	Describe basic organization of computer, the architecture of 8086 microprocessor and implement assembly language programming for 8086 microprocessors.
3	Demonstrate control unit operations and conceptualize instruction level parallelism.
4	List and Identify integers and real numbers and perform computer arithmetic operations on integers.

5	Categorize memory organization and explain the function of each element of a memory hierarchy.
6	Examine different methods for computer I/O mechanism.

4) syllabus

Module		Content	Hrs
Module 1	**Fundamentals of Logic Design**	Number systems: Introduction to Number systems,Binary Number systems, Signed Binary Numbers,Binary, Octal, Decimal and Hexadecimal number and their conversions, 1's and 2's complement Combinational Circuits: NOT,AND,OR,NAND,NOR,EX-OR,EX-NOR Gates. Half & Full Adder and subtractor, Reduction of Boolean functions using K-map method (2,3,4 Variable), introduction to Multiplexers and Demultiplexers, Encoders & Decoders.Sequential Circuits: Introduction to Flip Flops: SR, JK,D, T, master slave flip flop, Truth Table. **Self-learning Topics:** Number System, Quine- McCluskey,Flip-Flop conversion, Counter Design.	07
Module 2	**Overview of Computer Architecture & Organization**	Introduction of Computer Organization and Architecture. Basic organization of computer and block level description of the functional units. Evolution of Computers, Von Neumann model. Performance measure of Computer Architecture, Architecture of 8086 Family, Instruction Set, Addressing Modes, Assembler Directives, Mixed-Language Programming, Stack, Procedure, Macro. Self-learning Topics: Interfacing of I/O devices with 8086(8255,ADC,DAC).	08

Module 3	**Processor Organization and Architecture**	CPU Architecture, Instruction formats, basic instruction cycle with Interrupt processing. Instruction interpretation and sequencing. Control Unit: Soft wired (Microprogrammed) and hardwired control unit design methods. Microinstruction sequencing and execution. Introduction to parallel processing concepts, Flynn's classifications, instruction pipelining, pipeline hazards. **Self-learning Topics:** Study the examples on instruction pipelining for practice.	07
Module 4	**Data Representation and Arithmetic Algorithms**	Booth's algorithm. Division of integers: Restoring and non-restoring division, signed division, basics of floating-point representation IEEE 754 floating point (Single & double precision) number representation. **Self-learning Topics:** Implement Booth's Algorithm and Division methods.	06
Module 5	**Memory Organization**	Introduction to Memory and Memory parameters.Classifications of primary and secondary memories. Types of RAM and ROM, Allocation policies, Memory hierarchy and characteristics. Cache memory: Concept,architecture (L1, L2, L3), mapping techniques. **Self-learning Topics:** Case study on Memory Organization, Numerical on finding EAT, Address mapping.	07
Module 6	**I/O Organization**	Input/output systems, I/O module-need & functions and Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA.	04

		Self-learning Topics: Comparison of all I/O methods.	
		Total	**39**

5) Textbooks:	
1	R. P. Jain,"Modern Digital Electronics", TMH
2	M. Morris Mano,"Digital Logic and Computer Design", PHI
3	Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, Fifth Edition, Tata McGraw-Hill.
4	William Stallings, Computer Organization and Architecture: Designing for Performance, Eighth Edition, Pearson
6) Reference Books:	
1	A. Anand Kumar, "Fundamentals of Digital Circuits",. PHI
2	Donald P Leach, Albert Paul Malvino, "Digital Principals & Applications", TMH.
3	B. Govindarajulu,, Computer Architecture and Organization: Design Principles and Applications, Computer Architecture and Organization: Design Principles and Applications, Tata McGraw-Hill
4	Dr. M. Usha, T. S. Srikanth, Computer System Architecture and Organization, First Edition, Wiley-India.
5	John P. Hayes, Computer Architecture and Organization, Third Edition., McGraw-Hill

7) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40 Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.n	Rubrics	Marks
1.	***Certificate course for 4 weeks or more:- NPTEL/Coursera/Udemy/any MOOC**	**10 mark**
2.	**Extra Experiments/ Virtual Lab /GATE Based Assignment test/Tutorials etc**	**10 marks**
3.	**IA Test**	**20 Marks**

*****For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five need to be solved.

Sample Template for Lab Work

Lab Code	**Lab Name**	**Credit**
ITL403	**Microprocessor Lab**	**1**

1)Prerequisite: The Lab experiments aims:	
2)Lab Objectives:	
1	Learn assembling and disassembling of PC
2	Design, simulate and implement different digital circuits
3	Get hands-on experience with Assembly Language Programming.
4	Study of 8086 microprocessors with interfacing of peripheral devices.
5	Realize techniques for faster execution of instructions and improve speed of operation and performance of microprocessors.
6	Write and debug programs in TASM/MASM/hardware kits
Lab Outcomes:On successful completion, of course, learner/student will be able to:	
1	Demonstrate various components and peripheral of computer system
2	Analyze and design combinational circuits
3	Build a program on a microprocessor using arithmetic & logical instruction set of 8086.
4	Develop the assembly level programming using 8086 loop instruction set
5	Write programs based on string and procedure for 8086 microprocessors.
6	Design interfacing of peripheral devices with 8086 microprocessors.

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)	
Sr. No.	**Name of the Experiment**
1	PC Assembly:Study of PC Motherboard Technology (South Bridge and North Bridge), Internal Components and Connections used in computer system.
2	Implementation of combinational circuits:1. Verify the truth table of various logic gates (basic and universal gates) 2. Realize Half adder and Full adder 3. Implementation of MUX and DeMUX 4.Implementation of Encoder and Decoder
3	Arithmetic and logical operations in 8086 Assembly language programming: 1. Program for 16 bit BCD addition 2. Program to evaluate given logical expressions. 3. Convert two digit Packed BCD to Unpacked BCD. 4. Multiply 8 bit and 16 bit numbers
4	Loop operations in 8086 Assembly language programming : 1. Program to move set of numbers from one memory block to another. 2. Program to count number of 1's and 0's in a given 8 bit number 3. Program to add 10 numbers using a loop.
5	3. Program to find even and odd numbers from a given list 4. Program to search for a given number
6	String & Procedure in 8086 Assembly language programming: 1. Check whether a given string is a palindrome or not. 2. Compute the factorial of a positive integer 'n' using procedure.
7	Check whether a given string is a palindrome or not.
8	2. Compute the factorial of a positive integer 'n' using procedure.
9	Generate the first 'n' Fibonacci numbers.
10	ALP to sort a given set of 16 bit unsigned integers into ascending order using bubble sort algorithm
11	ALP to find smallest no from the given array

12	Case study on Interfacing with 8086 microprocessor 1. Interfacing Seven Segment Display 2. Interfacing keyboard matrix

5)Text books:	
1	Scott Mueller, ”Upgrading and repairing PCs”, Pearson,
2	R. P. Jain, “Modern Digital Electronics”, Tata McGraw Hill.
3	John Uffenbeck, “8086/8088 family: Design Programming and Interfacing:”Pearson Education
4	M. Morris Mano, “Digital Logic and computer Design”, PHI
	K Bhurchandi, “Advanced Microprocessors & Peripherals”, Tata McGraw-Hill Education

6) Term Work:	
1	**Term Work shall consist of at least 10 Practical based on the above list, but not limited to. 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)**
7) Continuous assessment exam:	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis
5.	Documentation/Performance:

Lab Code	Lab Name	Credit
ITL303	UNIX Lab	**1**

1)Prerequisite: The Lab experiments aims:	
2)Lab Objectives:	
1	To understand architecture and installation of Unix Operating System
2	To learn Unix general purpose commands and programming in Unix editor environment
3	To understand file system management and user management commands in Unix.
4	To understand process management and memory management commands in Unix
5	To learn basic shell scripting.
6	To learn scripting using awk and perl languages.
3)Lab Outcomes: On successful completion, of course, learner/student will be able to:	
1	Understand the architecture and functioning of Unix
2	Identify the Unix general purpose commands
3	Apply Unix commands for system administrative tasks such as file system management and user management
4	Execute Unix commands for system administrative tasks such as process management and memory management
5	Implement basic shell scripts for different applications
6	Implement advanced scripts using awk & perl languages and grep, sed, etc. commandsfor performing various tasks

6) Term Work:	
1	Term Work shall consist of at least 10 Practical based on the above list, but not limited to. 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)

7) Continuous assessment exam:	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis
5.	Documentation/Performance:

Course Code: ITC404	Course Title :Python Lab (SBL)	Credit
Currently same	**Python Lab (SBL)**	02

1)Prerequisite: C, Java programming

2)Lab Objectives:

The course aims:

1	Basics of python including data types, operator, conditional statements, looping statements, input and output functions in Python.
2	List, tuple, set, dictionary, string, array and functions.
3	Object Oriented Programming concepts in python.
4	Concepts of modules, packages, multithreading and exception handling.
5	File handling, GUI & database programming.
6	Data visualization using Matplotlib, Data analysis using Pandas and Web programming using Flask.

3)Lab Outcomes:

On successful completion, of course, learner/student will be able to:

1	Understand the structure, syntax, and semantics of the Python language.
2	Interpret advanced data types and functions in python.
3	Illustrate the concepts of object-oriented programming as used in Python.
4	Create Python applications using modules, packages, multithreading and exception handling.
5	Gain proficiency in writing File Handling programs ,also create GUI applications and evaluate database operations in python.
6	Design and Develop cost-effective robust applications using the latest Python trends and technologies.

4) syllabus

Module		Content	Hrs	
I	**Basics of Python**	Introduction, Features, Python building blocks – Identifiers, Keywords, Indention, Variables and Comments, Basic data types (Numeric, Boolean, Compound) Operators: Arithmetic, comparison, relational, assignment, logical, bitwise, membership, identity operators, operator precedence Control flow statements: Conditional statements (if, if…else, nested if) Looping in Python (while loop, for loop, nested loops) Loop manipulation using continue, pass, break. Input/output Functions, Decorators, Iterators and Generators.	**08**	LO 1
II	**Advanced data types & Functions**	Lists: a) Defining lists, accessing values in list, deleting values in list, updating lists b) Basic list operations c) Built-in list functions Tuples: a) Accessing values in Tuples, deleting values in Tuples, and updating Tuples b) Basic Tuple operations c) Built-in Tuple functions Dictionaries: a) Accessing values in Dictionary, deleting values in Dictionary, and updating Dictionary b) Basic Dictionary operations c) Built-in Dictionary functions Sets: a) Accessing values in Set, deleting values in Set, updating Sets b) Basic Set operations, c) Built-in Set functions Strings: a) String initialization, Indexing, Slicing, Concatenation, Membership & Immutability b) Built-in String functions Arrays: a) Working with Single dimensional Arrays: Creating, importing, Indexing, Slicing, copying and processing array arrays. b) Working with Multi-dimensional Arrays using Numpy: Mathematical operations, Matrix operations, aggregate and other Built-in functions Functions: a) Built-in functions in python b) Defining function, calling function, returning values, passing parameters c) Nested and Recursive functions d) Anonymous Functions (Lambda, Map, Reduce, Filter)	**09**	LO 1 LO 2
III	**Object Oriented Progr**	Overview of Object-oriented programming, Creating Classes and Objects, Self-Variable, Constructors, Inner class, Static method, Namespaces. Inheritance: Types of Inheritance (Single, Multiple, Multi-level, Hierarchical), Super() method, Constructors in inheritance, operator overloading, Method overloading, Method overriding, Abstract class, Abstract method, Interfaces in Python.	**08**	LO 1 LO 3

	am mi ng			
IV	**Expl orin g conc ept of mod ules, packages, multit hread ing and e xcepti on handli ng**	Modules: Writing modules, importing objects from modules, Python built-in modules (e.g. Numeric and Mathematical module, Functional Programming module, Regular Expression module), Namespace and Scoping. Packages: creating user defined packages and importing packages. Multi-threading: process vs thread, use of threads, types of threads, creating threads in python, thread synchronization, deadlock of threads. Exception handling: Compile time errors, Runtime errors, exceptions, types of exception, try statement, except block, raise statement, Assert statement, User-Defined Exceptions.	**06**	LO 1 LO 4
V	**File handl ing, GUI & datab ase progra mming**	File Handling: Opening file in different modes, closing a file, writing to a file, accessing file contents using standard library functions, reading from a file – read (), readline (), readlines (), Renaming and Deleting a file, File Exceptions, Pickle in Python. Graphical user interface (GUI): different GUI tools in python (Tkinter, PyQt, Kivy etc.), Working with containers, Canvas, Frame, Widgets (Button, Label, Text, Scrollbar, Check button, Radio button, Entry, Spinbox, Message etc.) Connecting GUI with databases to perform CRUD operations. (on supported databases like SQLite, MySQL, Oracle, PostgreSQL etc.).	**09**	LO 1 LO 5
VI	**Data visua lizati on, a nalys is and web prog ram ming using python**	Visualization using Matplotlib: Matplotlib with Numpy, working with plots (line plot, bar graph, histogram, scatter plot, area plot, pie chart etc.), working with multiple figures. Data manipulation and analysis using Pandas: Introduction to Pandas, importing data into Python, series, data frames, indexing data frames, basic operations with data frame, filtering, combining and merging data frames, Removing Duplicates. SciPy: Linear algebra functions using Numpy and Scipy. Web programming: Introduction to Flask, Creating a Basic Flask Application, Build a Simple REST API using Flask	**10**	LO 1 LO 6

		Total	**50**	

5) Textbooks:	
1	Dr. R. Nageswara Rao," Core Python Programming" , Dreamtech Press, Wiley Publication
2	M. T. Savaliya , R. K. Maurya, "Programming through Python", StarEdu Solutions.
3	E Balagurusamy, "Introduction to computing and problem-solving using python", McGraw Hill Publication.
6) Reference Books:	
1	Zed A. Shaw, "Learn Python 3 the Hard Way", Zed Shaw's Hard Way Series.
2	Martin C. Brown," Python: The Complete Reference", McGraw-Hill Publication.
3	Paul Barry," Head First Python", 2nd Edition, O'Reilly Media, Inc.

7) Internal Assessment:

The Term work shall consist of at least 15 practical based on the above list. The term work Journal must include at least 2 Programming assignments. The Programming assignments should be based on real world applications which cover concepts from more than one modules of syllabus.

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

Sr.n	Rubrics	Marks
1.	***Certificate course for 4 weeks or more:- NPTEL/Coursera/Udemy/any MOOC**	**10 marks**
2.	**Extra Experiments/ Virtual Lab /GATE Based Assignment test/Tutorials etc**	**10 marks**
3.	**Continuous Assesment**	**20 Marks**

*****For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

Course Code: ITM401	Course Title : Mini Project – 1 B for Python based automation projects	Credit
Currently same	**Mini Project – 1 B for Python based automation projects**	
1)Prerequisite:		
2)Course Objectives: The course aims:		
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.	
3)Course Outcomes: On successful completion, of course, learner/student 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.

4) 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.

5)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

6) 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.

7) 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.

8) 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

Vivekanand Education Society's
Institute of Technology
(Affiliated to University of Mumbai, Approved by AICTE & Recognized by Govt. of Maharashtra)

Department of Information Technology

Academic Year 2023-24

Semester V, VI

Program Structure for Third Year Information Technology

Scheme for Autonomous Program

(With Effect from 2023-2024)

Semester V

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned			
		Theory	Practical	Theory	Practical	Tutorial	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
	Total	15	16	15	8		23

* Theory class ; $ indicates workload of Learner (Not Faculty), for Mini Project

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA					
ITC501	Internet Programming	20	20	60	2	-	-	100
ITC502	Computer Network Security	20	20	60	2	-	-	100
ITC503	Entrepreneurship and E-business	20	20	60	2	-	-	100
ITC504	Software Engineering	20	20	60	2	-	-	100
ITDO501 X	**Department Optional Course – 1**	20	20	60	2	-	-	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)	-	-	-	-	25	25	50
ITM501	Mini Project – 2 A Web Based Business Model	--	--	--	--	25	25	50
	Total	100	100	300	-	150	150	800

Department Optional Courses:

1. Microcontroller Embedded Programming	2. Computer Graphics & Multimedia System
3. Advance Data Management Technologies	4. Advanced Data structure and Analysis

Course Code:	Course Title:	Credit
ITC501	Internet Programming	3
Prerequisite: Knowledge of basic programming, network fundamentals and operating systems.		
2) Course Objectives: The course aims:		
1	To orient students to Web Programming fundamentals.	
2	To expose students to JavaScript to develop	
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.	
3) Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Select protocols or technologies required for various web applications.	
2	Apply JavaScript to add functionality to web pages.	
3	Design front end application using basic React.	
4	Design front end applications using functional components of React.	
5	Design back-end applications using Node.js.	
6	Construct web based Node.js applications using Express.	

4) Syllabus

Module		Content	Hrs
Module 1	Web programming fundamentals	**Web Application Architecture**,Working of web browser, HTTP protocol,HTTPS, DNS, TLS, XML, JSON, DOM, URL, URI, REST API.	03
Module 2	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	06
Module 3	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,	06
Module 4	Advanced React:	Functional components- Refs, Use effects, Hooks, Flow architecture, Model-View-Controller framework, Flux, Bundling the application. Web pack.	07
Module 5	NodeJS	**Features of NodeJS, Modules,** Environment setup, First app, Asynchronous programming, Callback concept, Architecture: Event loops, REPL, Event emitter, Networking module, Buffers, Streams, File system, Web module**. Connecting NodeJS to Database**	08
Module 6	Express	Introduction to Express ,Installing Express,Creating First Express application,The application, request, and response objects, Configuring Routes, REST API,Generator, **Understanding Middleware**, Cookies, Session, Authentication. Integrating with React.	07

		Total	37

5) Textbooks:	
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 React Functional Web Development with React and Redux, Alex Banks and Eve Porcello, O'Reilly
4	RESTful Web API Design with Node.js 10, Valentin Bojinov, Packt Publication
6) Reference Books:	
1	Web Development with Node and Express, Ethan Brown, O'Reilly

7) Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Project based Assignment	10 marks
3.	Participation in event/ workshop /talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

***** Rubrics 1 compulsory, along with rubrics rubrics 2 or (rubrics 3 & 4) students can select.

***** For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9) Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5 marks)

4) Literature review of papers/journals (5 marks)
5) Library related work (5 marks)

10) Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments / lab / lecture

11) End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five need to be solved.

Course Code: ITC502	Course Title :Computer Network Security	Credit
Currently same	(Subject name)	3

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

2)Course Objectives:

The course aims:

1	Explain the fundamentals concepts of computer security and network security.
2	Identify the basic cryptographic techniques using classical and block encryption methods.
3	Study and describe the system security malicious software.
4	Describe the Network layer security, Transport layer security and application layer security.
5	Explain the need of network management security and illustrate the need for NAC.
6	Identify the function of an IDS and firewall for the system security.

3)Course Outcomes:

On successful completion, of course, learner/student will be able to:

1	Explain the fundamentals concepts of computer security and network security.
2	Identify the basic cryptographic techniques using classical and block encryption methods.

3	Study and describe the system security malicious software.
4	Describe the Network layer security, Transport layer security and application layer security.
5	Explain the need of network management security and illustrate the need for NAC.
6	Identify the function of an IDS and firewall for the system security.

4) Syllabus

Module		**Content**	**Hrs**
Module 1	**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

Module 2	**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
Module 3	**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 and their effects.	04
Module 4	**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,	07

		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	
Module 5	**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
Module 6	**System Security**	IDS,Classification of Intrusion Detection Systems,Detection Method of IDS Deployment, Firewall Design Principles, Characteristics of Firewalls, Types of Firewalls,IDS vs Firewalls **Self-learning Topics:** Study firewall rules table	06
		Total	**39**

5) 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.
6) Reference Books:	
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

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Mini Project / Extra Experiments/ Virtual Lab	10 marks
3.	GATE Based Assignment test/Tutorials etc	10 marks
4.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five need to be solved.

Course Code:	Course Title	Credit
ITC503	Entrepreneurship and E-business	3
1)Prerequisite:		
2)Course Objectives:		
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	
3)Course Outcomes:		
1	Understand the concept of entrepreneurship and its close relationship with enterprise and owner-management.	
2	Understand the nature of business development in the context of existing organizations and of new business start-ups.	
3	Comprehended important factors for starting a new venture and business development	
4	Know issues and decisions involved in financing and resourcing a business start-up	
5	Describe various E-business Models	
6	Discuss various E-business Strategies	

Syllabus

Module	Content	Hrs
Module 1 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
Module 2 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
Module 3 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**
Module 4 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 ttps://www.startupindia.gov.in*	06
Module 5 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 ecommerce, B to C, B to B and C to C ecommerce, Ecommerce 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.	08

	Self-learning Topics: Social media applications for E-Business, Social media analytics.	
Module 6 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 eprocurement systems, Implementation of eprocurement *Self-learning Topics: SEM and SEO E-CRM*	08
	Total	**39**

	5) 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
4	E-commerce – A Managerial Perspective- P. T. Joseph, Prentice Hall India Publications. Content
	6) Reference Books:
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 EdmundsonBird, 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

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.n	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept /case studies (preparing a proposal for the new proposed business)**	**10 marks**
5.	**Mini Project / Extra Experiments/ Virtual Lab (Development of e-commerce web portal for the proposed business discussed under case study)**	**10 marks**
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5. marks

*****For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9) Rubrics for the slow learners:-

1) **Case study**, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2) Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5 marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code: ITC504	**Course Title :Software Engineering**	**Credit**
Currently same	(Subject name)	3
1)Prerequisite: Basic programming of knowledge.		
2)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	
3)Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Understand and use basic knowledge in software engineering	
2	Identify requirements, analyze and prepare models	
3	Plan, schedule and track the progress of the projects.	

4	Design & develop the software solutions for the growth of society
5	To demonstrate and evaluate real time projects with respect to software engineering principles
6	Apply testing and assure quality in software solution

4) syllabus

Module		**Content**	**Hrs**
Module 1	**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	07
Module 2	**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	09
Module 3	**Software Estimation**	Management Spectrum, 3Ps (people, product and process) Process and Project metrics	04

	and Scheduling	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.	
Module 4	**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 steps & Analysis, Design Evaluation Self-learning Topics: Refinement, Aspects, Refactoring	07
Module 5	**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	06
Module 6	**Software Testing and Maintenance**	Testing: Software Quality, Testing: Strategic Approach, Strategic Issues- Testing: Strategies for Conventional Software, Object oriented software, Web AppsValidating Testing- System Testing- Art of Debugging. Maintenance : Software Maintenance-	06

		Software Supportability- Reengineering- Business Process Reengineering- Software Reengineering- Reverse Engineering- Restructuring- Forward Engineering Self-learning Topics: Test Strategies for WebApps	
		Total	**39**

5) Textbooks:	
1	1 Roger S. Pressman, Software Engineering: A practitioner's approach, McGraw Hill
2	2 Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India
3	3 PankajJalote, An integrated approach to Software Engineering, Springer/Narosa.
4	4 Ian Sommerville, Software Engineering, Addison-Wesley. William Stallings, Cryptography and Network Security, Principles and Practice, 6th Edition, Pearson Education, March 2013.
6) References	
1	https://www.youtube.com/watch?v=wEr6mwquPLY

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Case studies + Assignment	10 marks

*****For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks

2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five need to be solved.

Course Code:	Course Title:	Credit
ITDO5012	Advance Data Management Technologies	3
Prerequisite: Basic concepts of a Relational database and SQL		
2) Course Objectives: The course aims:		
1	To impart knowledge related to query processing and query optimization phases of a database management system	
2	To learn advanced techniques for data management and to overview emerging data models like Temporal, Mobile, and Spatial databases.	
3	To introduce advanced database models like distributed databases.	
4	To create awareness of how enterprises can organize and analyze large amounts of data by creating a Data Warehouse.	
5	To understand the process of data extraction, transformation, and loading	
6	To understand the concept of Big data and NoSQL databases.	
3) Course Outcomes: On successful completion, of course, the learner/student will be able to:		
1	Measure query costs and design alternate efficient paths for query execution..	
2	Apply sophisticated access protocols to control access to the database	
3	Implement Distributed databases.	
4	Organize strategic data in an enterprise and build a data Warehouse.	
5	Analyse data using OLAP operations so as to take strategic decisions	

6	Design modern applications using NoSQL databases. databases..

4) Syllabus

Module		Content	Hrs
Module 0	Prerequisite	Reviewing basic concepts of a Relational database, SQL concepts	02
Module 1	Query Processing and Optimization	Overview: Introduction, Query processing in DBMS, Steps of Query Processing, Measures of Query Cost Selection Operation, Sorting, Join Operation, Evaluation of Expressions. Query Optimization Overview, Goals of Query Optimization, Approaches of Query Optimization, Transformations of Relational Expression, Estimating Statistics of Expression.	06
Module 2	Advanced Data Management Techniques	Advanced Database Access protocols: Discretionary Access Control Based on Granting and Revoking Privileges. Mandatory Access Control and RoleBased Access Control, Remote Database access protocol. Overview of Advanced Database Models like Mobile databases, Temporal databases, Spatial databases.	06
Module 3	Distributed Databases	Introduction: Distributed Data Processing, Distributed Database System: Architecture, Types, Design Issues. Data Fragmentation, Allocation in distributed databases.**Transaction execution in Distributed Database:2 phase commit and 3 phase commit protocol**	05
Module 4	Data Warehousing, Dimensional Modelling and OLAP	The Need for Data Warehousing; Data Warehouse Defined; Is data warehouse still relevant in the age of big data, Features of a Data Warehouse; Data Warehouse Architecture-Enterprise or centralized, federated and multi tired architectures; Data Warehouse and Data Marts; Data	09

		Warehousing Design Strategies, Data modeling Dimensional Model; The Star Schema; How Does a Query Execute? The Snowflake Schema; Fact Tables and Dimension Tables; Factless Fact Table;, Updates To Dimension Tables, Primary Keys, Surrogate Keys & Foreign Keys. What is business intelligence, use of BI, Tools used in BI, Need for Online Analytical Processing; OLAP Operations in a cube: Roll-up, Drill-down, Slice, Dice, Pivot; OLAP Architectures: MOLAP, ROLAP, DOLAP and HOLAP.	
Module 5	ETL Process	Challenges in ETL Functions; Data Extraction; Identification of Data Sources; Immediate Data Extraction, Deferred Data Extraction; Data Transformation: Tasks Involved in Data Transformation, Techniques of Data Loading. **Trends in DataWarehouse:knowlege management, CRM, SCM**	05
Module 6	Big data and NoSQL	Big data and NoSQL : Introduction, types and characteristics of big data, **Big Data Challenges, Examples of Big Data in Real Life, Big Data Applications.** What is NoSQL, CAP theorem, BASE property, NoSQL data architecture patterns: Key-value stores, Graph stores, Column family stores, Document stores. **MongoDB.**	07
		Total	37

5) Textbooks:	
1	Korth, Slberchatz, Sudarshan, ”Database System Concepts”, 6th Edition, McGraw – Hill
2	Elmasri and Navathe, “Fundamentals of Database Systems”, 6th Edition, PEARSON Education.
3	Theraja Reema, “Data Warehousing”, Oxford University Press.
4	Raghu Ramakrishnan and Johannes Gehrke, “Database Management Systems” 3rd Edition - McGraw Hill
6) Reference Books:	
1	Paulraj Ponniah, “Data Warehousing: Fundamentals for IT Professionals”, Wiley India.
2	Peter Rob and Carlos Coronel, “Database Systems Design, Implementation and Management”, Thomson Learning, 9th Edition.
3	Ralph Kimball, Margy Ross, “The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling”, 3rd Edition. Wiley India

7) Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/ workshop /talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

***** Rubrics 1 compulsory, along with rubrics 2 or (rubrics 3 & 4) students can select.

***** For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9) Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project-based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5 marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10) Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments / lab / lecture

11) End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All questions carry 20 marks
4	Any three questions out of five need to be solved.

Course Code: TDO5014	**Course Title: Advance Data Structure and Analysis**	**Credit**
Currently same	(Subject name)	3

1) Prerequisite: Basics of Data structures and analysis and programming language, **Time and space complexity of algorithm**

2) Course Objectives:

1	To learn mathematical background for analysis of algorithm
2	To learn various advanced data structures.
3	To understand the different design approaches of algorithms.
4	To learn dynamic programming methods.
5	To understand the concept of pattern matching
6	To learn advanced algorithms.

3) Course Outcomes:

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

4) syllabus

Module		Content	Hrs
0	Prerequisite	Basics of Data structures and analysis and programming language	2
1	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	4
2	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.	5
3	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.	8
4	Dynamic algorithms	Introduction to Dynamic Algorithms, all pair shortest path, 0/1 knapsack, traveling 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.	6

5	String Matching	Introduction, the naïve string matching algorithm, Rabin Karp algorithm, Boyer Moore algorithm, KnuthMorris-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.	7
6	Advanced Algorithms and NP problems	Optimization Algorithms: Genetic algorithm(GA) Approximation Algorithms: Vertex-cover problem and **TSP**, **Geometric Algorithm: Closest Pair** Introduction to NP-Hard and NP-Complete Problems Self-learning Topics: Implementation of Genetic algorithm and Vertex-cover problem, **Randomized algorithms**	7
		Total	**39**

5) 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	Data structures, Deshpande, Kakde, Dreamtech Press.
6) Reference Books:	
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

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Lab Code	Lab Name	Credit
ITL501	**IP Lab**	**1**

1)Prerequisite:	
2) Lab Objectives: The course aims:	
1	To orient students to HTML for making webpages
2	To orient students to HTML for making webpages
3	To expose students to developing responsive layout
4	To expose students to developing responsive layout
5	To expose students to developing responsive layout
6	To orient students to Node.js for developing backend applications
3) Lab Outcomes: On successful completion, of course, learner/student will be able to:	
1	Identify and apply the appropriate HTML tags to develop a webpage.
2	Identify and apply the appropriate CSS tags to format data on webpage
3	Identify and apply the appropriate CSS tags to format data on webpage
4	Use JavaScript to develop interactive web pages.
5	Construct front end applications using React
6	Construct back end applications using Node.js/Express

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)

Sr. No.	Name of the Experiment
1	Experiment to study basics of HTML5 and basic tags of HTML5.
2	Experiment to study Advanced tags of HTML5 .
3	Experiment to study basics of CSS.
4	Experiment to study advanced features supported by CSS3.
5	Experiment to study the basics of Java Script.
6	Experiment to study Advanced JavaScript concepts.
7	Experiment to study basics of Bootstrap.
8	Experiment to study the basics of React.
9	Experiment to study the Advanced React.
10	Experiment to study basics of Node JS.
11	Experiment to study basics of Express JS.

5) Useful Links:	
1	https://www.nptel.ac.in
2	https://www.tutorialspoint.com
3	https://nodejs.dev/learn
4	https://www.udemy.com/

6) Term Work:	
1	Term Work shall consist of at least 12 Practical's 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)
7) Continuous assessment exam	
1	Experiment submission on time
2	Explaination/concepts
3	Algorithm implementation
4	Analysis
5	Performance/Documentation

Lab Code	Lab Name	Credit
ITL502	Security Lab	**1**

1)Prerequisite: The Lab experiments aims:	
2)Lab Objectives:	
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.
3)Lab Outcomes: On successful completion, of course, learner/student will be able to:	
1	Illustrate symmetric cryptography by implementing classical ciphers.
2	Demonstrate Key management, distribution and user authentication.
3	Explore the different network reconnaissance tools to gather information about networks.
4	Use tools like sniffers, port scanners and other related tools for analyzing packets in a network.

5	Use open-source tools to scan the network for vulnerabilities and simulate attacks.
6	Demonstrate the network security system using open source tools.

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)	
Sr. No.	**Name of the Experiment**
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

5)Useful Links:	
1	IITB virtual Lab: http://cse29-iiith.vlabs.ac.in/
2	https://www.dcode.fr/en

6)Term Work:	
1	Term Work shall consist of at least 10 Practical 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)
7)Continuous assessment exam	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis:

5.	Documentation/Performance:

Lab Code	Lab Name	Credit
ITL503	**DevOps**	**1**

1)Prerequisite: The Lab experiments aims:	
2)Lab Objectives:	
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 & configure Ansible/Puppet tool.
3)Lab Outcomes: 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
2	To obtain complete knowledge of the “version control system” to effectively track changes augmented with Git and GitHub
3	To understand the importance of Jenkins to Build and deploy Software Applications on server environment

4	Understand the importance of Selenium and Jenkins to test Software Applications
5	To understand concept of containerization and Analyze the Containerization of OS images and deployment of applications over Docker
6	To Synthesize software configuration and provisioning using Ansible/Puppet.

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	**04**	LO1

		Self-Learning Topics: Scrum, Kanban, Agile		
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. • 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**	**04**	LO1 & LO3

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 , LO4
V	Continuous Deployment: Containerization 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/Ansible Architecture • Puppet/Ansible Master Slave Communication • Puppet/Ansible Blocks • Installation and Configuring Puppet/Ansible Master and Agent on Linux machines. **Self-Learning Topics: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", Addison Wesley 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)

Sr. No.	Name of the Experiment
1	Case study on real world: 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	Advanced git commands
5	To understand Continuous Integration, install and configure Jenkins with Maven/Ant/Gradle to setup a build Job.
6	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.
7	To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
8	To Setup and Run Selenium Tests in Jenkins Using Maven.
9	To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
10	To learn Dockerfile instructions, build an image for a sample web application using Dockerfile.
11	Docker Compose – multi container tool
12	To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet/Ansible.
13	To learn Software Configuration Management and provisioning using Puppet/Ansible Blocks(Manifest, Modules, Classes, Function)
14	To provision a LAMP/MEAN Stack using Puppet/Ansible Manifest.

5)Useful Links:

1. DevOps Bootcamp, Sybgen Learning
2. Len Bass, Ingo Weber, Liming Zhu, "DevOps, A Software Architects Perspective", Addison Wesley Pearson Publication.
3. https://devops.com/
4. http://git-scm.com/
5. https://github.com/
6. https://education.github.com/git-cheat-sheet-education.pdf
7. John Ferguson Smart," Jenkins, The Definitive Guide", O'Reilly Publication.
8. https://www.jenkins.io/
9. https://www.jenkins.io/doc/developer/publishing/continuous-integration/#ji-toolbar
10. https://www.jenkins.io/doc/book/security/
11. https://www.selenium.dev/
12. Karl Matthias & Sean P. Kane, Docker: Up and Running, O'Reilly Publication.
13. https://www.docker.com/
14. https://github.com/docker
15. https://docs.docker.com/compose/
16. https://docs.docker.com/samples/django/
17. https://docs.docker.com/engine/swarm/
18. "Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet", by Ryan Russell Yates Packt Publishing (September 29, 2018)
19. https://puppet.com/

6)Term Work:

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

7) Continuous assessment exam

1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis:
5.	Documentation/Performance:

Lab Code	Lab Name	Credit
ITL504	**Adv. DevOps**	**1**

1)Prerequisite: The Lab experiments aims:	
2)Lab Objectives:	
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.
3)Lab Outcomes: 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 requirement

2	To deploy single and multiple container applications and manage application deployments with rollouts in Kubernetes
3	To apply best practices for managing infrastructure as code environments and use terraform to define and deploy cloud
4	To identify and remediate application vulnerabilities earlier and help integrate security in the development process using SAST Techniques.
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
6	To engineer a composition of nano services using AWS Lambda and Step Functions with the Serverless Framework

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 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.	04	LO1, LO2

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. 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	**04**	LO1,LO 3
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 / 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	**04**	LO1,LO 4

		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. 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	**04**	LO1,LO 6
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	**04**	LO1,LO 6

		Framework		

Text books

1. 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

Sr. No.	Name of the Experiment
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.

5)Useful Links:

1. DevOps Bootcamp, Sybgen Learning
2. Len Bass, Ingo Weber, Liming Zhu, “DevOps, A Software Architects Perspective”, Addison Wesley Pearson Publication.
3. https://devops.com/
4. http://git-scm.com/
5. https://github.com/
6. https://education.github.com/git-cheat-sheet-education.pdf
7. John Ferguson Smart,” Jenkins, The Definitive Guide”, O'Reilly Publication.
8. https://www.jenkins.io/
9. https://www.jenkins.io/doc/developer/publishing/continuous-integration/#ji-toolbar
10. https://www.jenkins.io/doc/book/security/
11. https://www.selenium.dev/
12. Karl Matthias & Sean P. Kane, Docker: Up and Running, O'Reilly Publication.
13. https://www.docker.com/
14. https://github.com/docker
15. https://docs.docker.com/compose/
16. https://docs.docker.com/samples/django/
17. https://docs.docker.com/engine/swarm/
18. “Mastering Puppet 5: Optimize enterprise-grade environment performance with Puppet”, by Ryan Russell Yates Packt Publishing (September 29, 2018)
19. https://puppet.com/

6)Term Work:	
1	Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)
7) Continuous assessment exam	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis:
5.	Documentation/Performance:

Course Code:	Course Title	Credit
ITL505	Professional Communication & Ethics-II (PCE-II)	02
1)Prerequisite:		
2)Course Objectives:		
1	To discern and develop an effective style of writing important technical/business documents	
2	To investigate possible resources and plan a successful job campaign.	
3	To understand the dynamics of professional communication in the form of group discussions, meetings, etc. required for career enhancement.	
4	To develop creative and impactful presentation skills.	
5	To analyze personal traits, interests, values, aptitudes and skills.	
6	To understand the importance of integrity and develop a personal code of ethics.	
3)Course Outcomes:		
1	plan and prepare effective business/ technical documents which will in turn	
2	provide solid foundation for their future managerial roles.	
3	strategize their personal and professional skills to build a professional image and meet the demands of the industry.	

4	emerge successful in group discussions, meetings and result-oriented agreeable solutions in group communication situations.
5	develop creative thinking and interpersonal skills required for effective professional communication.
6	apply codes of ethical conduct, personal integrity and norms of organizational behaviour.

4) syllabus

Module		**Content**	**Hrs**
Module 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	06

		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	
Module 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) 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	06

Module 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
Module 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	0 2
Module 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.)	0 8
Module		**CORPORATE ETHICS**	0

6		6.1Intellectual Property Rights Copyrights Trademarks Patents Industrial Designs Geographical Indications Integrated Circuits Trade Secrets (Undisclosed Information) 6.2 Case Studies Cases related to Business/ Corporate Ethics	2
		Total	

	5) Textbooks & refrence boos
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: McGrawHill.
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	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. Press

7) Internal 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

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper

solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

Course Code: ITM501	**Course Title :** **Mini Project – 2 A Web Based Business Model**	**Credit**
Currently same	**Mini Project – 1 A for Front end /backend Application using JAVA**	

1)Prerequisite:

2)Course Objectives:

The course aims:

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.

3)Course Outcomes:

On successful completion, of course, learner/student 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.

4) 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 nfaculties.
- 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.

5) 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

6) 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.

7) 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.

8) 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

Program Structure for Third Year Information Technology

Department Scheme for Autonomous Program

(With Effect

from 2023-2024)

Semester VI

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	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
ITDO601X	**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

# Indicates workload of Learner (Not Faculty)

Course Code	Course Name	Examination Scheme						
		Theory				Term Work	Pract & oral	Total
		Internal Assessment		End Sem Exam	Exam Duration (Hrs)			
		Mid Test (MT)	CA					
ITC601	Data Mining & Business Intelligence	20	20	40	60	3	--	--
ITC602	Web X.0	20	20	40	60	3	-	--
ITC603	Wireless Technology	20	20	40	60	3	-	--
ITC604	AI and DS – 1	20	20	40	60	3	-	--
ITDO601 X	**Department Optional Course – 2**	**20**	**20**	**40**	**60**	**3**	**-**	**--**
ITL601	BI Lab	--	--	--	--	--	25	25
ITL602	Web Lab	--	--	--	--	--	25	25
ITL603	Sensor Lab	--	--	--	--	--	25	25
ITL604	MAD & PWA Lab	--	--	--	--	--	25	25
ITL605	DS using Python Lab (SBL)	--	--	--	--	--	25	25
ITM601	Mini Project – 2 B Based on ML	--	--	--	--	--	25	25
	Total	100	100	200	300	150	150	800

Department Optional Courses:

Department Optional Course III (ELDO701)	Department Optional Course IV (ELDO702)
Software Architecture	Green IT
Image Processing	Ethical Hacking and Forensic

Course Code: ITC601	Course Title: Data Mining & Business Intelligence	Credit
Currently same	**Data Mining & Business Intelligence**	3

1) Prerequisite: Database Management System	
2) Course Objectives:	
1	To introduce the concept of data warehouse data Mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage.
2	To enable students to effectively identify sources of data and process it for data mining.
3	To make students well versed in all data mining algorithms, methods of evaluation.
4	To impart knowledge of tools used for data mining.
5	To provide knowledge on how to gather and analyze large sets of data to gain useful business understanding.
6	To impart skills that can enable students to approach business problems analytically identifying opportunities to derive business value from data.
3) Course Outcomes:	
1	Demonstrate an understanding of the importance of data warehousing and data mining and the principles of business intelligence.
2	Organize and prepare the data needed for data mining using pre preprocessing techniques.
3	Perform exploratory analysis of the data to be used for mining.
4	Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on large data sets.
5	Define and apply metrics to measure the performance of various data mining algorithms.
6	Apply BI to solve practical problems: Analyze the problem domain, use the data collected in enterprise apply the appropriate data mining technique, interpret and visualize the results and provide decision support.

4) syllabus

Module		Content	Hrs
0	Prerequisite	Basic Knowledge of databases	1
I	Data Warehouse (DWH) Fundamentals with Introduction to Data Mining	DWH characteristics, Dimensional modeling: Star, Snowflakes, OLAP operation, OLTP vs OLAP Data Mining as a step in KDD, Kind of patterns to be mined, Technologies used, Data Mining applications. Self-learning Topics: Data Marts, Major issues in Data Mining.	4
II	Data Exploration and Data Preprocessing	Types of Attributes, Statistical Description of Data, Measuring Data Similarity and Dissimilarity. Why Preprocessing? Data Cleaning, Data Integration, Data Reduction: Attribute Subset Selection, Histograms, Clustering, Sampling, Data Cube aggregation, Data transformation and Data Discretization: Normalization, Binning, Histogram Analysis Self-learning Topics Data Visualization, Concept hierarchy generation	5
III	Classification	Basic Concepts; Classification methods: 1. Decision Tree Induction: Attribute Selection Measures, Tree pruning. 2. Bayesian Classification: Naïve Bayes Classifier. Prediction: Structure of regression models; Simple linear regression, Accuracy and Error measures, Precision, Recall, Holdout, Random Sampling, Cross Validation, Bootstrap, Introduction of Ensemble methods, Bagging, Boosting, AdaBoost and Random forest. Self-learning Topics: Multiple linear regression, logistic regression, Random forest, nearest neighbour classifier, SVM	8
IV	Clustering and Outlier Detection	Cluster Analysis: Basic Concepts; Partitioning Methods: K-Means, K Medoids; Hierarchical Methods: Agglomerative, Divisive, BIRCH; Density-Based Methods: DBSCAN. What are outliers? Types, Challenges; Outlier Detection Methods:	8

		Supervised, Semi Supervised, 08 CO4 Unsupervised, Proximity based, Clustering Based. Self-learning Topics Hierarchical methods : Chameleon, Density based methods: OPTICS, Grid based methods: STING, CLIQUE	
V	Frequent Pattern Mining	Basic Concepts: Market Basket Analysis, Frequent Itemset, Closed Itemset, and Association Rules; Frequent Itemset. Mining Methods: The Apriori Algorithm: Finding Frequent Itemset Using Candidate Generation, Generating Association Rules from Frequent Itemset, Improving the Efficiency of Apriori, A pattern growth approach for mining Frequent Itemset, Mining Frequent Itemset using vertical data formats; Introduction to Advance Pattern Mining: Mining Multilevel Association Rules and Multidimensional Association Rules. Self-learning Topics: Association Mining to Correlation Analysis, lift, Introduction to Constraint-Based Association Mining	8
VI	Business Intelligence	What is BI? Business intelligence architectures; Definition of decision support system; Development of a business intelligence system using Data Mining for business Applications like Fraud Detection, Recommendation System Self-learning Topics: Clickstream Mining, Market Segmentation, Retail industry, Telecommunications industry, Banking & finance CRM, Epidemic prediction, Fake News Detection, Cyberbullying, Sentiment Analysis etc.	5
		Total	**39**

5) Textbooks:	
1	Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3nd Edition.
2	P. N. Tan, M. Steinbach, Vipin Kumar, “Introduction to Data Mining”, Pearson Education.
3	Paulraj Ponniah “Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals” Wiley Publications
6) Reference Books:	
1	Michael Berry and Gordon Linoff “Data Mining Techniques”, 2nd Edition Wiley Publications.
2	Michael Berry and Gordon Linoff “Mastering Data Mining- Art & science of CRM”, Wiley Student Edition.
3	Vikram Pudi & Radha Krishna, “Data Mining”, Oxford Higher Education.
4	Data Mining https://onlinecourses.nptel.ac.in/noc21_cs06/preview

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Sample_Autonomous_Syllabus_Web X.0

Course Code: ITC302	**Course Title:**	**Credit**
ITC402	Web X.0	3
Prerequisite: **Object Oriented Programming, Python Programming, HTML and CSS**		
2) Course Objectives: The course aims:		
1	To understand the digital evolution of web technology.	
2	To learn Typescript and understand how to use it in web applications.	
3	To empower the use of AngularJS to create web applications that depend on the Model-View-Controller Architecture.	
4	To gain expertise in a leading document-oriented NoSQL database, designed for speed, scalability, and developer agility using MongoDB.	
5	To build web applications quickly and with less code using the Flask framework.	
6	To gain knowledge of Rich Internet Application Technologies.	
3) Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Understand the basic concepts related to web analytics and semantic web.	
2	Understand how TypeScript can help you eliminate bugs in your code and enable you to scale your code.	
3	Understand AngularJS framework and build dynamic, responsive single-page web applications.	
4	Apply MongoDB for frontend and backend connectivity using REST API. Apply Flask web development framework to build web applications with less code.	
5	Develop Rich Internet Application using proper choice of Framework.	

4) Syllabus

Module	Module Name	Content	Hrs
Module 1	Introduction to WebX.0	Evolution of WebX.0; Web Analytics 2.0: Introduction to Web Analytics, Web Analytics 2.0, Clickstream Analysis, Strategy to choose your web analytics tool, Measuring the success of a website; Web3.0 and Semantic Web: Characteristics of Semantic Web, Components of Semantic Web, Semantic Web Stack, N-Triples and Turtle, Ontology, RDF and SPARQL	**4**
Module 2	Typescript	Overview, TypeScript Internal Architecture, TypeScript Environment Setup, TypeScript Types, variables and operators, Decision Making and loops, TypeScript Functions, TypeScript Classes and Objects, TypeScript Modules	**6**
Module 3	Introduction to AngularJS	Overview of AngularJS, Need of AngularJS in real web sites, AngularJS modules, AngularJS built-in directives, AngularJS custom directives, AngularJS expressions, AngularJS Data Binding, AngularJS filters, AngularJS controllers, AngularJS scope, AngularJS dependency injection, AngularJS Services, Form Validation, Routing using ng-Route, ng-Repeat, ng-style, ng-view, Built-in Helper Functions, Using Angular JS with Typescript	8
Module 4	MongoDB and Building REST API using MongoDB	MongoDB: Understanding MongoDB, MongoDB Data Types, Administering User Accounts, Configuring Access Control, Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Accessing and Manipulating Databases, Manipulating MongoDB Documents from Node.js, Accessing MongoDB from Node.js, Using Mongoose for Structured Schema and Validation. REST API: Examining the rules of REST APIs, Evaluating API patterns, Handling typical CRUD functions (create, read, update, delete), Using Express and Mongoose to interact with MongoDB, Testing API endpoints	**8**
Module 5	**Flask**	Introduction, Flask Environment Setup, App Routing, URL Building, Flask HTTP Methods, Flask Request Object, Flask cookies, File Uploading in Flask	**6**
Module 6	Rich Internet Application	AJAX: Introduction and Working Developing RIA using AJAX Techniques: CSS, HTML, DOM, XML HTTP Request, JavaScript, PHP, AJAX as REST Client	**5**

		Introduction to Open Source Frameworks and CMS for RIA: Django, Drupal, Joomla	
		Total	37

5) Textbooks:

1. Boris Cherny, “Programming TypeScript- Making Your Javascript Application Scale”, O’Reilly Media Inc.
2. Adam Bretz and Colin J. Ihrig, “Full Stack JavaScript Development with MEAN”, SitePoint Pty. Ltd.
3. Simon Holmes Clive Harber, “Getting MEAN with Mongo, Express, Angular, and Node”, Manning Publications.
4. Miguel Grinberg, “Flask Web Development: Developing Web Applications with Python”, O’Reilly.
5. Dr. Deven Shah, “Advanced Internet Programming”, StarEdu Solutions

6) Reference Books:

1. Yakov Fain and Anton Moiseev, “TypeScript Quickly”, Manning Publications.
2. Steve Fenton, “Pro TypeScript: Application - Scale Javascript Development”, Apress
3. Brad Dayley, Brendan Dayley, Caleb Dayley, “Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications”, 2nd Edition, Addison-Wesley Professional

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	***Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC**	10 marks
2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

***** Rubrics 1 compulsory, along with rubrics rubrics 2 or (rubrics 3 & 4) students can select.
***** For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9) Rubrics for slow learners:-
1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)
2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)
3) Multiple Choice Questions (Quiz) (5 marks)
4) Literature review of papers/journals (5 marks)
5) Library related work (5 marks)

10) Rubrics for Indirect Assessment :-
1. Mock Viva/Practical
2. Skill Enhancement Lecture

11) End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five need to be solved.

Course Code: ITC603	**Course Title: Wireless Technology**	**Credit**
Currently same	**Wireless Technology**	3
1) Prerequisite: Principle of Communication, Computer Network and Network Design, Computer Network Security.		
2) Course Objectives:		
1	Discuss the Fundamentals of Wireless Communication.	
2	Comprehend the Fundamental Principles of Wide Area Wireless Networking Technologies and their Applications.	
3	Explain Wireless Metropolitan and Local Area Networks.	
4	Describe Wireless Personal Area Networks and Ad hoc Networks.	
5	Learn and Analyze Wireless Network Security Standards.	
6	Study the Design Considerations for Wireless Networks.	
3) Course Outcomes:		
1	Describe the basic concepts of Wireless Network and Wireless Generations.	
2	Demonstrate and Evaluate the various Wide Area Wireless Technologies.	
3	Analyze the prevalent IEEE standards used for implementation of WLAN and WMAN Technologies.	
4	Appraise the importance of WPAN, WSN and Ad-hoc Networks.	
5	Analyze various Wireless Network Security Standards.	
6	Review the design considerations for deploying the Wireless Network Infrastructure.	

4) syllabus

Module		Content	Hrs
0	Prerequisite	Digital Modulation Techniques – ASK, FSK, BPSK, QPSK; Electromagnetic Spectrum; Multiplexing Techniques – FDM, TDM, OFDM; OSI and TCP/IP Model; Need for Security, Types of Security Threats and Attacks.	2
I	Fundamentals of Wireless Communication	Introduction to Wireless Communication - Advantages, Disadvantages and Applications; Multiple Access Techniques - FDMA, TDMA, CDMA, OFDMA; Spread Spectrum Techniques – DSSS, FHSS; Evolution of wireless generations – 1G to 5G (Based on technological differences and advancements); 5G – Key requirements and drivers of 5G systems, Use cases, Massive MIMO. Self-learning Topics: Modulation Techniques - QAM, MSK, GMSK	7
II	Wide Area Wireless Networks	Principle of Cellular Communication – Frequency Reuse concept, cluster size and system capacity, cochannel interference and signal quality; GSM – System Architecture, GSM Radio Subsystem, Frame Structure; GPRS and EDGE – System Architecture; UMTS – Network Architecture; CDMA 2000 – Network Architecture; LTE – Network Architecture; Overview of LoRa & LoRaWAN. Self-learning Topics:- IS-95	9
III	Wireless Metropolitan and Local Area Networks	IEEE 802.16 (WiMax) – Mesh mode, Physical and MAC layer; IEEE 802.11(Wi-Fi) – Architecture, Protocol Stack, Enhancements and Applications. Self-learning Topics:- WLL(Wireless Local Loop). Self-learning Topics:- HR–WPAN (UWB)	6
IV	Wireless Personal Area Networks and Ad hoc Networks	IEEE 802.15.1 (Bluetooth) – Piconet, Scatter net, Protocol Stack; IEEE 802.15.4 (ZigBee) – LRWPAN Device Architecture, Protocol Stack; Wireless Sensor Network – Design Considerations, Issues and Challenges, WSN Architecture, Applications; Introduction of Ad hoc Networks – MANET and VANET – Characteristics, Applications, Advantages and Limitations; Over view of E-VANET(Electrical Vehicular AdHoc Networks). Self-learning Topics:- HR–WPAN (UWB)	4
V	Wireless Network Security	Security in GSM; UMTS Security; Bluetooth Security; WEP; WPA2. Self-learning Topics :- Study of Wireless Security Tools.	8
VI	Wireless Network	Cisco Unified Wireless Network; Designing Wireless Networks with Lightweight Access Points and Wireless	8

	Design Considerations	LAN Controllers. Self-learning Topics:- Cisco Unified Wireless Network Mobility Services	
		Total	**39**

5) Textbooks:	
1	Wireless Communications, T.L. Singal, McGraw Hill Education.
2	Wireless Communications and Networking, Vijay Garg, Morgan Kaufmann Publishers
3	Wireless Mobile Internet Security, 2nd Edition, Man Young Rhee, A John Wiley & Sons, Ltd., Publication.
6) Reference Books:	
1	Cellular Communications: A Comprehensive and Practical Guide, Nishith Tripathi, Jeffery H Reed, Wiley.
2	Wireless Communications- Principles & Practice,Theodore S. Rappaport, Prentice Hall Series
3	Wireless Communications and Networks", William Stallings, Pearson / Prentice Hall.
4	Adhoc & Sensor Networks Theory and Applications, Carlos de Morais Cordeiro,Dharma Prakash Agrawal, World Scientific,2nd Edition.

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:

1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITC604	AI and DS -I	3

1)Prerequisite: Engineering Mathematics III (ITC301) 2. Data Structures and Analysis (ITC302) 3. Engineering Mathematics IV (ITC401

2)Course Objectives: The course aims:

1	To model a decision making for a new problem in an uncertain domain
2	To demonstrate Cognitive skills of Artificial Intelligence.
3	To become familiar with the basics of Fuzzy Logic and Fuzzy Systems.
4	To become familiar with Deep Learning Concepts and Architectures.
5	To define and apply metrics to measure the performance of various learning algorithms.
6	To enable students to analyze data science methods for real world problems.

3)Course Outcomes: On successful completion, of course, learner/student will be able to:

1	Design models for reasoning with uncertainty as well as the use of unreliable information
2	Analyze the process of building a Cognitive application.
3	Design fuzzy controller system.
4	Apply learning concepts to develop real life applications.
5	Evaluate performance of learning algorithms.
6	Analyze current trends in Data Science.

4) Syllabus

Module		Content	Hrs

Module 1 Introduction to AI		Introduction: Introduction to AI, AI techniques, Problem Formulation. Intelligent Agents: Structure of Intelligent agents, Types of Agents, Agent Environments PEAS representation for an Agent. Self-Learning Topics : Identify application areas of AI, **Design PEAS model for real life applications**.	04
Module 2 Search Techniques		Uninformed Search Techniques: Uniform cost search, Depth Limited Search, Iterative Deepening, Bidirectional search. Informed Search Methods: Heuristic functions, Best First Search, A*, Hill Climbing, Simulated Annealing. Constraint Satisfaction Problem Solving: Crypto-Arithmetic Problem, Water Jug, Graph Coloring. Adversarial Search: Game Playing, Min-Max Search, Alpha Beta Pruning. Comparing Different Techniques. Self-Learning Topics : IDA*, SMA*	09
Module 3 Knowledge Representation using First Order Logic		Knowledge and Reasoning: A Knowledge Based Agent, WUMPUS WORLD Environment, Propositional Logic, First Order Predicate Logic, Forward and Backward Chaining, Resolution. Planning as an application of a knowledge based agent. Concepts of Partial Order planning, Hierarchical Planning and Conditional Planning. Self-Learning Topics: Representing real world problems as planning problems, **Knowledge reasoning in WUMPUS WORLD.**	**06**
Module 4 Introduction to DS		Introduction and Evolution of Data Science, Data Science Vs. Business Analytics Vs. Big Data, Data Analytics, Lifecycle, Roles in Data Science Projects. Self-Learning Topics : **Compare Data Science and Data Mining, Applications and Case Studies of Data Science in various Industries, Governance, Healthcare and E-commerce.**	04
Module 5 Exploratory Data Analysis		Introduction to exploratory data analysis, Typical data formats. Types of EDA, Graphical/Non graphical Methods, Univariate/multivariate methods Correlation and covariance, Degree of freedom Self-learning Topics: Statistical Methods for Evaluation including ANOVA. Self-Learning Topics: **Computation of ANOVA and Chi-Square Test in Machine learning application, Implementation** of graphical EDA methods.	08
Module 6 Introduction to ML		Introduction to Machine Learning, Types of Machine Learning: Supervised (Logistic Regression, Decision Tree, Support Vector	08

		Machine) and Unsupervised (K Means. K Medoid Clustering, Hierarchical Clustering, Association Rules) Issues in Machine learning, Application of Machine Learning Steps in developing a Machine Learning Application. Self-Learning Topics: Real world case studies on machine learning. **Performance evaluation of machine learning.**	
		Total	**39**

5) Textbooks:	
1	Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Pearson Education.
2	. Elaine Rich, Kevin Knight, Shivshankar B Nair, Artificial Intelligence, McGraw Hill, 3rd Edition.
3	Howard J. Seltman, Experimental Design and Analysis, Carnegie Mellon University, 2012/1.
4	Ethem Alpaydın, "Introduction to Machine Learning", MIT Press
6) Reference Books:	
1	Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Publication.
2	George Lugar, AI-Structures and Strategies for Complex Problem Solving., 4/e, 2002, Pearson Education.
3	Data Science & Big Data Analytics, 1st Edition, 2015, EMC Education Services, Wiley. ISBN: 978- 1118876138
4	Tom M.Mitchell "Machine Learning" McGraw Hill
5	Richard I. Levin, David S. Rubin "Statistics for Management" Pearson
6	Vivek Belhekar, "Statistics for Psychology using R" SAGE
7) Links	
1	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs83/
2	https://nptel.ac.in/courses/106/105/106105077/

3	https://www.coursera.org/specializations/jhu-data-science
4	https://www.coursera.org/learn/machine-learning
5	https://www.udemy.com/course/statistics-for-data-science-and-business-analysis

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed and the Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	***Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC**	10 marks
2.	**Creating Proof of concept /case studies/assignments**	10 marks
3.	**Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)**	5 marks
4.	**Multiple Choice Questions (Quiz**)	5 marks

***** Rubrics 1 compulsory, along with rubrics rubrics 2 or (rubrics 3 & 4) students can select.

***** For sr.no.1, the date of the certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) *Case study*, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment** / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5 marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code: ITDO6011	Course Title:Software Architecture	Credit
Currently same	**Software Architecture**	3
1) Prerequisite: Software Engineering, Any Programming Language		
2) Course Objectives:		
1	To understand the importance of architecture in building effective, efficient, competitive software products.	
2	To understand the need, design approaches for software architecture to bridge the dynamic requirements and implementation	
3	To learn the design principles and to apply for large scale systems including distributed, network and heterogeneous systems	
4	To understand principal design decisions governing the system.	
5	To understand different notations used for capturing design decisions.	
6	To understand different functional and non-functional properties of complex software systems	
3) Course Outcomes:		
1	Understand the need of software architecture for sustainable dynamic systems.	
2	Have a sound knowledge on design principles and to apply for large scale systems.	
3	Apply functional and non-functional requirements	
4	Design architectures for distributed, network and heterogeneous systems	
5	Have good knowledge on service oriented and model driven architectures and the aspect-oriented architecture.	
6	Have a working knowledge to develop appropriate architectures through various case studies	

4) syllabus

Module		Content	Hrs
0	Prerequisite	Software Engineering Concepts, Knowledge of Any programming Language	2
I	Basic Concepts and Architectures Design	Terminology, Models, Processes, Stakeholders, Design Process, Architectural Conceptions, Styles and architectural Patterns, Architectural conceptions in absences of experience, connectors, 4+1 view model of Architecture Self Learning Topics : Technical Paper "What_is_included_in_software_architectur"	7
II	Architectural Modeling and Analysis	Modeling Concepts, Ambiguity, Accuracy and Precisions, Complex Modeling, Evaluating Modeling Techniques, Specific Modeling Techniques, Analysis Goals, Scope of Analysis, Formality of Architectural Models, Types of Analysis, Level of Automation, System Stakeholders, Analysis Techniques Self Learning Topics: Technical Paper "Specification of Requirements and Software Architecture for the Customisation of Enterprise Software"	9
III	Implementation, Deployment and Mobility	Implementation Concepts, Existing Frameworks, Overview of Deployment and Mobility Challenges, Software Architecture and Deployment, Software Architecture and Mobility Self Learning Topics: Technical Paper"Application of Distributed System in Neuroscience: A Case Study of BCI Framework"	6
IV	Applied Architectures and Styles	Distributed and Network Architectures, Architectures for Network Based Applications, Decentralized Architectures, Service oriented Architectures and Web Services. Self Learning Topics:Technical Paper "Analysing the Behaviour of Distributed Software Architectures: a Case Study"	6
V	Designing for Non-Functional Properties	Efficiency, Complexity, Scalability and Heterogeneity, Adaptability, Dependability Self Learning Topics: Technical Paper "ThreatModeling-in-Agile-Software-Development"	4
VI	DomainSpecific Software Engineering	Domain-Specific Software Engineering, Domain- Specific Architecture, Software Architects Roles Self Learning Topics: Research Paper "A Case Study of the Variability Consequences of the CQRS"	5

		Total	**39**

5) Textbooks:	
1	Software Architecture, Foundations, Theory, and Practise, Richard Taylor, Nenad Medvidovic, Eric M Dashofy, Wiley Student Edition.
2	The Art of Software Architecture: Design Methods and Techniques, Stephen T.Albin, Wiley India Private Limited.
3	Software Architecture in Practice by Len Bass, Paul Clements, Rick Kazman, Pearson
6) Reference Books:	
1	DevOps A Software Architect's Perspective, Len Bass, Ingo Weber, Liming Zhu, Addison Wesley
2	Essentials of Software Architecture, Ion Gorton, Second Edition, Springer-verlag, 2011

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
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2.	GATE Based Assignment test/Tutorials etc	10 marks
3.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
4.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:

1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO6013	Green IT	3
1)Prerequisite:		
2)Course Objectives: environmental Studies		
1	To understand what Green IT is and How it can help improve environmental Sustainability	
2	To understand the principles and practices of Green IT.	
3	To understand how Green IT is adopted or deployed in enterprises.	
4	To understand how data centres, cloud computing, storage systems, software and networks can be made greener.	
5	5 To measure the Maturity of Sustainable ICT world.	
6	To implement the concept of Green IT in Information Assurance in Communication and Social Media and all other commercial field.	
3)Course Outcomes:		
1	Describe awareness among stakeholders and promote green agenda and green initiatives in their working environments leading to green movement	
2	Identify IT Infrastructure Management and Green Data Centre Metrics for software Development	
3	Recognize Objectives of Green Network Protocols for Data communication.	
4	Use Green IT Strategies and metrics for ICT development.	
5	5 Illustrate various green IT services and its roles.	
6	Use new career opportunities available in IT profession, audits and others with	

	special skills such as energy efficiency, ethical IT assets disposal, carbon footprint estimation, reporting and development of green products, applications and services.

4) syllabus

Module		Content	Hrs
Module 1 Introduction		Environmental Impacts of IT, Holistic Approach to Greening IT, Green IT Standards and Eco-Labeling, Enterprise Green IT Strategy Hardware: Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose Software: Introduction, Energy-Saving Software Techniques Self learning Topics: Evaluating and Measuring Software Impact to Platform Power	9
Module 2 Software development and data centers		Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics Data Centres and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, Green Data Centre Metrics Self-learning Topics: Sustainable Software: A Case Study, Data Centre Management Strategies: A Case Study	07
Module 3 Data storage and communication		Storage Media Power Characteristics, Energy Management Techniques for Hard Disks Objectives of Green Network Protocols, Green Network Protocols and Standards Self learning Topics: System-Level Energy Management	06
Module 4 Information		Approaching Green IT Strategies, Business Drivers of Green IT Strategy	06

systems, green it strategy and metrics		Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Measuring the Maturity of Sustainable ICT: A Capability Maturity Framework for SICT, Defining the Scope and Goal, Capability Maturity Levels Self learning Topics: Business Dimensions for Green IT Transformation	
Module 5 Green IT services and roles		Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), SITS Strategic Framework Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise: IT Usage and Hardware Self learning Topics: Inter-organizational Enterprise Activities and Green Issues, Enablers and Making the Case for IT and the Green Enterprise	06
Module 6 Managing and regulating green IT		Strategizing Green Initiatives, Implementation of Green IT, Communication and Social Media The Regulatory Environment and IT Manufacturers, Nonregulatory Government Initiatives, Industry Associations and Standards Bodies, Green Building Standards, Social Movements and Greenpeace. Self learning Topics: Information Assurance, Green Data Centers, Case Study: Managing Green IT	05
		Total	**39**

5) Textbooks:	
1	San Murugesan, G. R. Gangadharan, Harnessing Green IT, WILEY 1st Edition-2013
2	Mohammad Dastbaz Colin Pattinson Babak Akhgar, Green Information Technology A Sustainable Approach, Elsevier 2015
3	Reinhold, Carol Baroudi, and Jeffrey HillGreen IT for Dummies, Wiley 2009
6) Reference Books:	
1	Mark O'Neil, Green IT for Sustainable Business Practice: An ISEB Foundation Guide, BCS
2	Jae H. Kim, Myung J. Lee Green IT: Technologies and Applications, Springer, ISBN: 978-3-642-22178-1

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept/assignments**	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) **Case study,** Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) **Library related work** (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO6014	Ethical Hacking and Forensics	3
1)Prerequisite: Computer Networks, Computer Network Security		
2)Course Objectives:		
1	To understand the concept of cybercrime and principles behind ethical hacking.	
2	To explore the fundamentals of digital forensics, digital evidence and incident response.	
3	To learn the tools and techniques required for computer forensics.	
4	To understand the network attacks and tools and techniques required to perform network forensics.	
5	To learn how to investigate attacks on mobile platforms.	
6	To generate a forensics report after investigation.	
3)Course Outcomes:		
1	Define the concept of ethical hacking.	
2	Recognize the need of digital forensics and define the concept of digital	
3	Apply the knowledge of computer forensics using different tools and techniques.	
4	Detect the network attacks and analyze the evidence.	
5	Apply the knowledge of computer forensics using different tools and techniques.	
6	List the method to generate legal evidence and supporting investigation Reports	

4) syllabus

Module		Content	Hrs
Module 1 Cybercrime and Ethical Hacking		Introduction to Cybercrime, Types of Cybercrime, Classification of Cybercriminals, Role of computer in Cybercrime, Prevention of Cybercrime. Ethical Hacking, Goals of Ethical Hacking, Phases of Ethical Hacking, Difference between Hackers, Crackers and Phreakers, Rules of Ethical Hacking. Self Learning Topics: exploring various online hacking tools for Reconnaissance and scanning Phase	07
Module 2 Digital Forensics Fundamentals		Introduction to Digital Forensics, Need and Objectives of Digital Forensics, Types of Digital Forensics, Process of Digital Forensics, Benefits of Digital Forensics, Chain of Custody, Anti Forensics. Digital Evidence and its Types, Rules of Digital Evidences. Incident Response, Methodology of Incident Response, Roles of CSIRT in handling incident. Self Learning Topics: Pre Incident preparation and Incident Response process	06
Module 3 Computer forensics		Introduction to Computer Forensics, Evidence collection (Disk, Memory, Registry, Logs etc), Evidence Acquisition, Analysis and Examination(Window, Linux, Email, Web, Malware) , Challenges in Computer Forensics, Tools used in Computer Forensics. **real time case studies on current scenario** Self Learning Topics: Open source tool for Data collection & analysis in windows or Unix	08
Module 4 Network forensics		Introduction, Evidence Collection and Acquisition (Wired and Wireless), Analysis of network evidences(IDS, Router,), Challenges in network forensics, Tools used in network forensics. Self Learning Topics: IDS types and role of IDS in attack prevention	08
Module 5 Mobile		Introduction, Evidence Collection and Acquisition, Analysis of Evidences, Challenges in mobile forensics, Tools used in mobile forensics	06

Forensics		Self Learning Topics: Tools / Techniques used in mobile forensics	
Module 6 Report Generation		Goals of Report, Layout of an Investigative Report, Guidelines for Writing a Report, sample for writing a forensic report. Self Learning Topics: For an incident write a forensic report.	04
		Total	**39**

5) Textbooks:	
1	John Sammons, "The Basics of Digital Forensics: The Premier for Getting Started in Digital Forensics", 2nd Edition, Syngress, 2015.
2	Nilakshi Jain, Dhananjay Kalbande, "Digital Forensic: The fascinating world of Digital Evidences" Wiley India Pvt Ltd 2017.
3	Jason Luttgens, Matthew Pepe, Kevin Mandia, "Incident Response and computer forensics",3rd Edition Tata McGraw Hill, 2014.
6) Reference Books:	
1	Sangita Chaudhuri, Madhumita Chatterjee, "Digital Forensics", Staredu, 2019.
2	Bill Nelson,Amelia Phillips,Christopher Steuart, "Guide to Computer Forensics and Investigations" Cengage Learning, 2014.
3	Debra Littlejohn Shinder Michael Cross "Scene of the Cybercrime: Computer Forensics Handbook", 2nd Edition Syngress Publishing, Inc.2008

7) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

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Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

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5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
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8.	Multiple Choice Questions (Quiz)	5 marks

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1.) **Case study**, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment** / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)
4) Literature review of papers/journals (5 marks)
5) Library-related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical
2. Skill Enhancement Lecture
3. **Extra Assignments**/lab/lecture

11)End Semester Theory Examination:	
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2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Sample Template for Lab Work

Lab Code	Lab Name	Credit
ITL601	Business Intelligence Lab	**1**

1)Prerequisite: The Lab experiments aims:	
2)Lab Objectives:	
1	To introduce the concept of data Mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage.
2	To enable students to effectively identify sources of data and process it for data mining.
3	To make students well versed in all data mining algorithms, methods, and tools.
4	To learn how to gather and analyze large sets of data to gain useful business understanding.
5	To impart skills that can enable students to approach business problems analytically by identifying opportunities to derive business value from data.
6	To identify and compare the performance of business.
Lab Outcomes:On successful completion, of course, learner/student will be able to:	
1	Identify sources of Data for mining and perform data exploration.
2	Organize and prepare the data needed for data mining algorithms in terms of attributes and class inputs, training, validating, and testing files.
3	Implement the appropriate data mining methods like classification, clustering or association mining on large data sets using open-source tools like WEKA.
4	Implement various data mining algorithms from scratch using languages like Python/ Java etc.
5	Evaluate and compare performance of some available BI packages.
6	Apply BI to solve practical problems: Analyze the problem domain, use

	the data collected in enterprise apply the appropriate data mining technique, interpret and visualize the results and provide decision support.

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)	
Sr. No.	**Name of the Experiment**
1	Tutorial on a) Design Star and Snowflake Schema
2	Implement using tools or languages like JAVA/ python/R a) Data Exploration b) Data preprocessing
3	Implement and evaluate using languages like JAVA/ python/R a) Classification Algorithms b) Clustering Algorithms c) Frequent Pattern Mining Algorithms
4	Perform and evaluate using any open-source tools a) Classification Algorithms b) Clustering Algorithms c) Frequent Pattern Mining Algorithms
5	Detailed case study of any one BI tool such as Pentaho, Tableau and QlikView
6	Business Intelligence Mini Project: Each group assigned one new case study for this A BI report must be prepared outlining the following steps: a) Problem definition, identifying which data mining task is needed b) Identify and use a standard data mining dataset available for the problem. Some links for data mining datasets are: WEKA, Kaggle, KDD cup, Data Mining Cup, UCI Machine Learning Repository etc. c) Implement appropriate data mining algorithm d) Interpret and visualize the results e) Provide clearly the BI decision that is to be taken as a result of mining

5)Text books:	
1	Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3nd Edition.
2	G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, 1st Edition, Wiley India.
3	Paulraj Ponniah “Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals” Wiley Publications

6) Term Work:	
1	**Term Work shall consist of at least 10 Practical based on the above list, but not limited to. 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)**
7) Continuous assessment exam:	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis
5.	Documentation/Performance:

Sample Template for Lab Work

Lab Code	Lab Name	Credit
		1

1)Prerequisite:	
2) Lab Objectives: The course aims:	
1	
2	
3	
4	
5	
6	
3) Lab Outcomes: On successful completion, of course, learner/student will be able to:	
1	
2	
3	
4	
5	

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)

Sr. No.	**Name of the Experiment**
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	

5) Useful Links:	
1	
2	
3	
4	

6) Term Work:	
1	Term Work shall consist of at least 12 Practical's 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)
7) Continuous assessment exam	
1	Experiment submission on time
2	Web page design aspects considered in Web page development
3	Explanation/concepts
4	Documentation

Sample Template for Lab Work

Lab Code	Lab Name	Credit
ITL603	Sensor Lab	**1**

1)Prerequisite: The Lab experiments aims:	
2)Lab Objectives:	
1	Learn various communication technologies, Microcontroller boards and sensors.
2	Design the problem solution as per the requirement analysis done using sensors and technologies.
3	Study the basic concepts of programming/sensors/ emulators.
4	Design and implement the mini project intended solution for project based earning.
5	Build, test and report the mini project successfully.
6	Improve the team building, communication and management skills of the students.
Lab Outcomes:On successful completion, of course, learner/student will be able to:	
1	Differentiate between various wireless communication technologies based on the range of communication, cost, propagation delay, power and throughput.
2	Conduct a literature survey of sensors used in real world wireless applications.
3	Demonstrate the simulation of WSN using the Network Simulators (Contiki/ Tinker CAD/ Cup carbon etc).
4	Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing

5	Report and present the findings of the study conducted in the preferred domain
6	Demonstrate the ability to work in teams and manage the conduct of the research study. L1,L2,L3

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)	
Sr. No.	**Name of the Experiment**
1	Introduction to 8086, 8051 and Python programming
2	Study of various wireless communication technologies like IEEE 802.15.1, IEEE 802.15.4 and IEEE 802.11. Mini Project: Allocation of the groups
3	Study of various types of sensors and display devices (eg. DHT-11/22, HC-SR04, MFRC 522, PIR Sensor) and demonstration of their interfacing using Arduino/ Raspberry pi. Mini Project: Topic selection
4	Installation and testing the simulation tools (eg. TinkerCad/Cupcarbon/ContikiCooja). Mini Project: Topic validation and finalizing software and Hardware requirement.
5	Study of interfacing of Arduino/ Raspberry pi with Wireless Technologies (eg. HC-05, XBee S2C by Digi, ESP controller). Mini Project: Hardware procurement
6	Implementation of the Mini Project: 1. Design, configure, testing the Mini Project. 2. Report submission as per the guidelines.

6) Term Work:	
1	**Term Work shall consist of at least 10 Practical based on the above list, but not limited to. 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)
7) Continuous assessment exam:	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis
5.	Documentation/Performance:

Course Code:ITL604	Course Title: MAD & PWA Lab	Credit
Currently same	**MAD & PWA Lab**	01
1) Prerequisite: HTML/HTML5, CSS3, Javascrip		
2) Lab Objectives:		
1	Learn the basics of the Flutter framework.	
2	Develop the App UI by incorporating widgets, layouts, gestures and animation	
3	Create a production ready Flutter App by including files and firebase backend service	
4	Learn the Essential technologies, and Concepts of PWAs to get started as quickly and efficiently as possible	
5	Develop responsive web applications by combining AJAX development techniques with the jQuery JavaScript library.	
6	Understand how service workers operate and also learn to Test and Deploy PWA	
3) Lab Outcomes:		
1	Understand cross platform mobile application development using Flutter framework	
2	Understand cross platform mobile application development using Flutter framework	
3	Analyze and Build production ready Flutter App by incorporating backend services and deploying on Android / iOS	
4	Understand various PWA frameworks and their requirements	

5	Design and Develop a responsive User Interface by applying PWA Design techniques
6	Develop and Analyse PWA Features and deploy it over app hosting solutions

Sr. No.	**Module**	**Name of the Experiment**
1	Basics of Flutter Programming	Introduction of Flutter, Understanding Widget Lifecycle Events,Dart Basics, Widget Tree and Element Tree, Basics of Flutter installation, Flutter Hello World App.
2	Developing Flutter UI:Widgets, Layouts, Gestures, Animation	USING COMMON WIDGETS: SafeArea, Appbar, Column, Row, Container, Buttons, Text , Richtext,Form ,Images and Icon. BUILDING LAYOUTS : high level view of layouts, Creating the layout, Types of layout widgets APPLYING GESTURES: Setting Up GestureDetector, Implementing the Draggable and Dragtarget Widgets,Using the GestureDetector for Moving and Scaling ADDING ANIMATION TO AN APP :Using Animated Container,Using Animated

		CrossFade,Using Animated Opacity,Using Animation Controller, Using Staggered Animation CREATING AN APP'S NAVIGATION: Using the Navigator,Using the Named Navigator Route,Using the Bottom NavigationBar,Using the TabBar and TabBarView
3	Creating Production Ready Apps	Working with files : Including libraries in your Flutter app, Including a file with your app, Reading/Writing to files, Using JSON. Using Firebase with Flutter: Adding the Firebase and Firestore Backend,Configuring the Firebase Project,Adding a Cloud Firestore Database and Implementing Security Testing and Deploying of Flutter Application: Widget testing, Deploying Flutter Apps on Android / iOS
4	Introduction to Progressive Web App	Introduction to Progressive Web App ● Why Progressive Web App ● Characteristics of PWA ● PWAs and Hybrid Apps vs. Mobile Apps ● PWA Requirements: HTTPS, Service Workers, and Web App Manifest ● PWA framework tools ● Use cases
5	Creating Responsive UI	Creating Responsive UI using JQuery Mobile / Material UI / Angular UI / React UI ● Understanding the concept of responsive web design ● Comparing responsive, fluid,

		and adaptive web ● keys to great Progressive Web App UX ● Responsive Design – The Technicalities ● Flexible grid-based layout ● Flexible images and video ● Smart use of CSS splitting the website behavior (media queries)
6	Web App Manifest & Service Workers	Web App Manifest: Understand the basic format and workings of the Web App Manifest file. ● Using an App Manifest to Make your App Installable ● Understanding App Manifest Properties ● Simulating the Web App on an Emulator ● Installing the Web App - Prerequisites ● Understanding manifest.json Service Workers: Making PWAs work offline with Service workers ● Introduction to Service Workers ● Service Workers Lifecycle (Registration, Installation and Activation) ● Implement Service Workers Features (Events) ● Handling cached content ● Enabling offline functionality ● Serving push notifications ● Loading cached content for new users ● Background synchronization ● Using IndexedDB in the Service Worker ● Geo-fencing Deploy a PWA to GitHub Pages as a free SSL enabled static app hosting solution. ● Initialising the PWA as a Git repo ● Testing with Lighthouse ● Deploying via GitHub Pages

5)Text books:	
1	Beginning Flutter a Hands-on Guide to App Development, Marco L. Napoli, Wiley, 2020
2	Beginning App Development with Flutter: Create Cross-Platform Mobile Apps, By Rap Payne, 2019
3	Progressive Web Application Development by Example: Develop fast, reliable, and engaging user experiences for the web, Packt Publishing Limited ,2018
4	Building Progressive Web Apps,O'Reilly 2017
5	Progressive Web Apps with Angular: Create Responsive, Fast and Reliable PWAs Using Angular, Apress; 1st ed. edition (28 May 2019)

6) Term Work:	
1	**Term Work shall consist of at least 10 Practical based on the above list, but not limited to. 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)**
7) Continuous assessment exam:	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept:
3.	Algorithm/implementation:
4.	Analysis
5.	Documentation/Performance:

Sample Template for Data Science Lab

Lab Code	Lab Name	Credit
ITL605	DS using Python Skill based Lab	**1**

1)Prerequisite: Artificial Intelligence and Data Science-I, Python Programming, Data Mining & Business Intelligence.	
2) Lab Objectives: The course aims:	
1	To know the fundamental concepts of data science and analytics.
2	To learn data collection, preprocessing and visualization techniques for data science.
3	To Understand and practice analytical methods for solving real life problems based on Statistical analysis.
4	To learn various machine learning techniques to solve complex real-world problems.
5	To learn streaming and batch data processing using Apache Spark
6	To map the elements of data science to perceive information
3) Lab Outcomes: On successful completion, of course, learner/student will be able to:	
1	Understand the concept of Data science process and associated terminologies to solve real-world problem.

2	Analyze the data using different statistical techniques and visualize the outcome using different types of plots.
3	Analyze and apply the supervised machine learning techniques like Classification, Regression or Support Vector Machine on data for building the models of data and solve the problems.
4	Apply the different unsupervised machine learning algorithms like Clustering, Decision Trees, Random Forests or Association to solve the problems.
5	Design and Build an application that performs exploratory data analysis using Apache Spark.
6	Design and develop a data science application that can have data acquisition, processing, visualization and statistical analysis methods with supported machine learning technique to solve the real-world problem.

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)

Sr. No.	**Name of the Experiment**
1*	To implement Data preparation using NumPy and Pandas a. Derive an index field and add it to the data set. b. Find out the missing values. c. Obtain a listing of all records that are outliers according to the any field. Print out a listing of the 10 largest values for that field. Do the following for the any field. i. Standardize the variable. ii. Identify how many outliers there are and identify the most extreme outlier
2*	To implement Data Visualization / Exploratory Data Analysis for the selected data set using Matplotlib and Seaborn

	a. Create a bar graph, contingency table using any 2 variables. b. Create normalized histogram. Describe what this graphs and tables indicates
3*	To implement Data Modeling a. Partition the data set, for example 75% of the records are included in the training data set and 25% are included in the test data set. Use a bar graph to confirm your proportions. b. Identify the total number of records in the training data set. Validate your partition by performing a two-sample Z-test.
4	To implement Statistical Hypothesis Test using Scipy and Sci-kit learn. Correlation Tests 1. Pearson's Correlation Coefficient 2. Spearman's Rank Correlation 3. Kendall's Rank Correlation 4. Chi-Squared Test
5*	To implement Regression Analysis a. Perform Logistic Regression to find out relation between variables. Apply regression Model techniques to predict the data on above dataset
6*	To implement Classification modelling a. Choose classifier for classification problem. b. Evaluate the performance of classifier
7*	To implement Clustering a. Clustering algorithms for unsupervised classification. b. Plot the cluster data.

8*	To implement any machine learning techniques using available data set to develop a recommendation system
9*	To implement Exploratory data analysis using Apache Spark and Pandas
10*	To implement Batch and Streamed Data Analysis using Spark
11	Mini-Project

5) Useful Links:	
1	https://www.w3schools.com/python/pandas/default.asp
2	https://matplotlib.org/stable/gallery/index.htm
3	https://seaborn.pydata.org/examples/index.html
4	https://docs.scipy.org/doc/scipy/reference/linalg.html#module-scipy.linalg
5.	https://scikit-learn.org/stable/auto_examples/index.html
6	https://www.tutorialspoint.com/scipy/scipy_integrate.htm
7	https://machinelearningmastery.com/statistical-hypothesis-tests-in-python-cheatsheet/

8	https://data-flair.training/blogs/data-science-project-ideas/

6) Term Work:	
1	Term Work shall consist of at least 12 Practical based on the above list. **Also, Term work Journal must include at least 2 assignments.** Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks (Mini Project) +05 Marks (Attendance)
7) Continuous assessment exam	
1	Experiment submission on time
2	Explanation/Concepts
3	Algorithm implementation
4	Presentation/Analysis
5	Performance/Documentation

Course Code: ITM601	**Course Title :** **Mini Project – – 2 B Web Based on ML**	**Credit**
Currently same	**Mini Project – 1 A for Front end /backend Application using JAVA**	

1)Prerequisite:

2)Course Objectives:

The course aims:

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.

3)Course Outcomes:

On successful completion, of course, learner/student 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.

4) 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 nfaculties.
- 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.

5) 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

6) 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.

7) 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.

8) 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

Vivekanand Education Society's Institute of Technology

(Affiliated to VESIT, Approved by AICTE & Recognized by Govt. of Maharashtra)

Department of

Information Technology

Academic Year 2023-24

Semester VII and VIII

Program Structure for Fourth Year
Information Technology
Scheme for Autonomous Program
(With Effect from 2023-2024)

Semester VII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. Tut.	Theory	Pract.	Total
ITC701	AI and DS –II	3	--	3	--	3
ITC702	Internet of Everything	3	--	3		3
ITDO701X	Department Optional Course – 3	3	--	3	--	3
ITDO702X	Department Optional Course –4	3	--	3	--	3
ITIO701X	Institute Optional Course – 1	3	--	3	--	3
ITL701	Data Science Lab	--	2	--	1	1
ITL702	IOE Lab	--	2	--	1	1
ITL703	Secure Application Development	--	2	--	1	1
ITL704	Recent Open Source Project Lab	--	2	--	1	1
ITP701	Major Project I	--	6#	--	3	3
Total		**15**	**14**	**15**	**7**	**22**

Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral & Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Mid-Test (MT)	Continuous Assessment (CA)	Total					
ITC701	AI and DS –II	20	20	40	60	2	-	-	100
ITC702	Internet of Everything	20	20	40	60	2	-	-	100
ITDO701X	Department Optional Course –3	20	20	40	60	2			100
ITDO702X	Department Optional Course –4	20	20	40	60	2	-	-	100
ILO701X	Institute Optional Course – 1	20	20	40	60	2	--	-	100
ITL701	Data Science Lab	-	-	-	-	-	25	25	50
ITL702	IOE Lab	-	-	-	-	-	25	25	50
ITL703	Secure Application Development						25	25	50
ITL704	Recent Open Source Project Lab	-	-	-	-	-	25	25	50
ITP701	Major Project I						25	25	50
Total		**100**	**100**	**200**	**300**	**-**	**125**	**125**	**750**

# indicates work load of Learner (Not Faculty), for Major Project

ITDO701X	**Department Optional Course –3**
ITDO7011	Storage Area Network
ITDO7012	High Performance computing
ITDO7013	Infrastructure Security
ITDO7014	Software Testing and QA

ITDO702X	**Department Optional Course –4**
ITDO7021	MANET
ITDO7022	AR – VR
ITDO7023	Quantum Computing
ITDO7024	Information Retrieval System

Institute Level Optional Course (ILO)

ILO701X	Institute Optional Course – 1
ILO7011	Product Lifecycle Management
ILO7013	Management Information System
ILO7016	Cyber Security and Laws

Course Code:	Course Title	Credit
ITC701	**AI and DS -II**	**3**
1)Prerequisite: AI and DS - 1 (ITC604) , Data Mining & Business Intelligence (ITC601)		
2)Course Objectives:		
1	To model a decision making for a new problem in an uncertain domain	
2	To demonstrate Cognitive skills of Artificial Intelligence.	
3	To become familiar with the basics of Fuzzy Logic and Fuzzy Systems.	
4	To become familiar with Deep Learning Concepts and Architectures.	
5	To define and apply metrics to measure the performance of various learning algorithms..	
6	To enable students to analyze data science methods for real world problems.	
3)Course Outcomes:		
1	Design models for reasoning with uncertainty as well as the use of unreliable information	
2	Analyze the process of building a Cognitive application.	
3	Design fuzzy controller system.	
4	Apply learning concepts to develop real life applications.	
5	Evaluate performance of learning algorithms.	
6	Analyze current trends in Data Science.	

4) Syllabus

Module	Content	Hrs
Module 1 Uncertainty	Uncertainty in AI, Inference using full joint distributions, Bayes Theorem, the semantics of Bayesian Networks, Inference in Bayesian networks, Decision Theory, Markov Decision Processes. Self-learning Topics: Hidden Markov Model (HMM), Gaussian Mixture Model (GMM)	08
Module 2 Cognitive Computing	Foundation of Cognitive Computing, Design Principles for Cognitive Systems, Natural Language Processing in Support of a Cognitive System, Representing Knowledge in Taxonomies and Ontologies, Applying Advanced Analytics to Cognitive Computing, The Process of Building a Cognitive Application. Self-learning Topics: Cognitive Systems such as IBM's Watson.	06
Module 3 Fuzzy Logic & Its Applications	Introduction to Fuzzy Sets, Properties of Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Membership Functions, Fuzzy Relations with Operations and its Properties, Fuzzy Composition: Max-Min Composition, Max-Product Composition, Defuzzification Methods, Architecture of Mamdani Type Fuzzy Control System, Design of Fuzzy Controllers like Domestic Shower Controller, Washing Machine Controller, Water Purifier Controller, etc. Self-learning Topics: Other Fuzzy Composition Operations, Fuzzy Inference System (FIS) & ANFIS.	**06**
Module 4 Introduction to Deep Learning	Introduction to Deep Learning, ANN, Machine Learning VsDeep Learning, Working of Deep Learning; Convolutional Neural Network: Introduction, Components of CNN Architecture, Properties of CNN, Architectures of CNN, Applications of CNN, Recurrent Neural Network: Introduction, Simple RNN, LSTM Implementation, Deep RNN, Autoencoder: Introduction, Features, Types, Applications of Deep Learning. Self-learning Topics: Restricted Boltzmann Machine(RBM).	**06**
Module 5 Advanced ML Classification Techniques	Ensemble Classifiers: Introduction to Ensemble Methods,Bagging, Boosting, Random forests, Improving classification, accuracy of Class-Imbalanced Data. Metrics for Evaluating Classifier Performance, Holdout Method and Random Subsampling, Cross-Validation,	**07**

	Bootstrap, Model Selection Using Statistical Tests of Significance, Comparing Classifiers Based on Cost–Benefitand ROC Curves. Self-learning Topics: comparative analysis of different ML techniques	
Module 6 Trends and applications in Data Science	Data Science: applications and case studies, Data science for text, image, video, audio,**gesture recognition** **Application of Data science in Healthcare, Governance, Industry and Agriculture.** **Self-learning Topics: Large Scale Visual Recognition Challenge, ImageNet Large Scale Visual Recognition Challenge (ILSVRC).**	**06**
	Total	**39**

5) Textbooks:	
1	Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition, Pearson Education.
2	Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles, “Cognitive Computing and Big Data Analytics”, Wiley India, 2015
3	S.N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, Wiley Publication.
4	Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr. D Karthika Renuka, “Deep Learning Using Python”, Wiley India, 2020.
5	B. Uma Maheshwari, R. Sujatha, “Introduction to Data Science Practical Approach with R and Python”, Wiley India, 2021.
6	François Chollet, “Deep Learning with Python”, Manning Publications, 2018.
7	Han J, Kamber M, Pei J, “Data Mining Concepts and Techniques”, Third Edition, Morgan Kaufmann.

6) Reference Books:	
1	Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw Hill Publication.
2	Ethem Alpaydin , “Introduction to Machine Learning”, PHI Learning Pvt. Ltd.
3	Jon Krohn, Grant Beyleveld, Aglae Bassens, “Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence”, Pearson Education
4	Prateek Joshi, “Artificial Intelligence with Python”, Packt Publishing.

7) Links	
1	https://d2l.ai/index.html
2	https://onlinecourses.nptel.ac.in/noc20_cs62/preview
3	https://onlinecourses.nptel.ac.in/noc22_cs35/preview
4	https://www.coursera.org/specializations/deep-learning
5	https://onlinecourses.nptel.ac.in/noc22_cs56/preview

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed and the Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	**Mini Project** / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/**Tutorials** etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	• 5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment** / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITC702	**Internet of Everything**	**3**
1)Prerequisite: Ports, Timers ,Programming of controller , How to use IDE to write code of microcontroller, TCP-IP protocol stack		
2)Course Objectives:		
1	To comprehend Characteristics and Conceptual Framework of IoT	
2	To understand levels of the IoT architectures	
3	To correlate the connection of smart objects and IoT access technologies.	
4	To Interpret edge to cloud protocols	
5	To explore data analytics and data visualization on IoT Data	
6	To explore IoT applications.	
3)Course Outcomes:		
1	Describe the Characteristics and Conceptual Framework of IoT.	
2	Differentiate between the levels of the IoT architectures.	
3	Analyze the IoT access technologies	
4	Illustrate various edge to cloud protocol for IoT	
5	Apply IoT analytics and data visualization.	
6	Analyze and evaluate IoT applications.	

4) Syllabus

Module	Content	Hrs
Module 1 Introduction to IoT	**Introduction to IoT-** Defining IoT, Characteristics of IoT, Conceptual Framework of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Brief review of applications of IoT. **Self-learning Topics:** Hardware and software development tools for - Arduino, NodeMCU, ESP32, Raspberry Pi, for	04

	implementing internet of things, Simulators-Circuit.io, Eagle, Tinker cad	
Module 2 IoT Architecture	**Drivers Behind New Network Architectures:** Scale, Security, Constrained Devices and Networks, Data, Legacy Device Support **Architecture:** The IoT World Forum (IoTWF) Standardized Architecture: Layer 1-7, IT and OT Responsibilities in the IoT Reference Model, Additional IoT Reference Models A Simplified IoT Architecture The Core IoT Functional Stack: Layer 1-3, Analytics Versus Control Applications, Data Versus Network Analytics Data Analytics Versus Business Benefits, Smart Services, **IoT Data Management and Compute Stack:** Fog Computing, Edge Computing, The Hierarchy of Edge, Fog, and Cloud **Self-learning Topics:** Brief review of applications of IoT: Connected Roadways, Connected Factory, Smart Connected Buildings, Smart Creatures etc,	06
Module 3 Principles of Connected Devices and Protocols in IoT	**Sensors**: Temperature, Humidity, level, flow etc. **Actuators**: Analog and Digital actuators, like relay, Switch etc. **Protocols in IoT:** RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE) roles, LiFi, WPAN std : 802.15 standards: Bluetooth, IEEE 802.15.4. **Self-Learning Topics/Part of Continuous assessment:** Zigbee, Z-wave, Narrow Band IoT, Internet Protocol and Transmission Control Protocol, 6LoWPAN, WLAN and WAN , IEEE 802.11, Long-range Communication Systems and Protocols: Cellular Connectivity-LTE, LTE-A, LoRa and LoRaWAN	**08**
Module 4 Edge to Cloud Protocol	HTTP, WebSocket, Platforms. HTTP - MQTT -. Complex Flows: **IoT Patterns:** Real-time Clients, MQTT, MQTT-SN, Constrained Application Protocol (CoAP), Streaming Text Oriented Message Protocol (STOMP), Advanced Message Queuing Protocol (AMQP), Comparison of Protocols. (**Part of Continuous assessment**- students are expected to demonstrate the protocol for few applications without hardware using dummy datasets)	**08**
Module 5	Defining IoT Analytics, IoT Analytics challenges, IoT analytics for the cloud, Strategies to organize Data for IoT Analytics,	**06**

IoT and Data Analytics	Linked Analytics Data Sets, Managing Data lakes, The data retention strategy, visualization and Dashboarding. **Self-learning Topics:** AWS and Hadoop Technology (**Part of Continuous assessment**- students are expected to demonstrate the protocol for few applications without hardware using dummy datasets. Designing visual analysis for IoT data, creating a dashboard, creating, and visualizing alerts).	
Module 6 IoT Application Design	Prototyping for IoT and M2M **Case study related to:** Home Automation (Smart lighting, home intrusion detection), Cities (Smart Parking), Environment (Weather monitoring, weather reporting Bot, Air pollution monitoring, Forest fire detection, Agriculture (Smart irrigation), Smart Library. **Introduction to I-IoT**, Use cases of the I-IoT, IoT and I-IoT – similarities and differences, **Introduction to Internet of Behaviour (IoB).** Self-learning Topics: Internet of Behaviours (IoB) and its role in customer services	**06**
	Total	**38**

5) Textbooks:	
1	Arsheep Bahga (Author), Vijay Madisetti, Internet Of Things: A Hands-On Approach Paperback, Universities Press, Reprint 2020
2	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, IoT Fundamentals Networking Technologies, Protocols, and Use Cases for the Internet of Things CISCO.
3	Analytics for the Internet of Things (IoT) Intelligent Analytics for Your Intelligent Devices.Andrew Minteer,Packet
4	Giacomo Veneri , Antonio Capasso," Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0", Packt
6) Reference Books:	
1	Pethuru Raj, Anupama C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases by , CRC press
2	Raj Kamal, Internet of Things, Architecture and Design Principles, McGraw Hill Education, Reprint 2018.
3.	Perry Lea, Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, Packt Publications, Reprint 2018.
4.	Amita Kapoor, "Hands on Artificial intelligence for IoT", 1st Edition, Packt Publishing, 2019.
5.	Sheng-Lung Peng, Souvik Pal, Lianfen Huang Editors: Principles of Internet of Things (IoT)Ecosystem:Insight Paradigm, Springe

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed and the Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks

2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept**	10 marks
5.	**Mini Project / Extra Experiments/ Virtual Lab**	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification, the grading must be done accordingly.

9)Rubrics for slow learners: -

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment: -

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carries 20 marks
4	Any three questions out of five needs to be solved.

Course Code	Course Title	Credit
ITDO7011	Storage Area Network	3

1) Prerequisite: Operating System, Computer Organization, Computer Networks.

2)Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To provide the knowledge of types Storage Network.
2	To examine NAS technology and its applications in Storage Area Networks.
3	To study Emerging Technologies in SAN.
4	To define backup, recovery, disaster recovery and business continuity in the storage area Network.
5	To learn cloud based storage virtualization technologies in SAN.
6	To understand the logical and physical components of storage infrastructures.

3) Course Outcomes:

Sr. No.	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Identify the limitations of the client-server architecture and evaluate the need for data protection and storage centric architectures such as Intelligent storage system.
2	Understand various SAN technologies.
3	Interpret and examine NAS technologies and its application in Storage Area Network.
4	Explain Different I/O Techniques in SAN.
5	DescribeCloud based storage virtualization technologies in SAN.
6	Explain Storage infrastructure management with security.

4) DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Components of a Storage System Environment, Disk drive components, RAID levels, Cloud Computing	**02**
I	Introduction to Storage Area Network	**Intelligent Storage Systems (ISS)**, Storage Provisioning, Types of Intelligent Storage Systems **Evolution of Storage System:** Server- Centric IT Architecture and its Limitations, Storage-Centric IT Architecture and its Advantages, SAN & its advantages. **Self-learning Topics:** Case Study on Replacing a server with Storage networks**.**	**04**
II	Networked Attached Storage & its Application	**Local File Systems:** File systems and databases,Journaling, Snapshots,Volume manager **Network File Systems, and File Servers:** Network Attached Storage (NAS), Performance bottlenecks in file servers, Acceleration of network file systems, Case study: The Direct Access File System (DAFS), **Shared Disk File Systems:** A case study The General Parallel File System (GPFS), **Applying NAS solution:** NAS workload characterization, applying NAS to departmental workloads, enterprise web workloads, and specialized workloads; Considerations when integrating SN and NAS: Differences and similarities, the need to integrate, future storage connectivity and integration. **Self-learning Topics:** Case study on Successful SAN Deployment steps**.**	**07**

III	Storage I/O Technique s	The Physical I/O Path from the CPU to the Storage System, SCSI, The Fibre Channel Protocol Stack, Fibre Channel SAN, IP Storage, Infiniband-based Storage Networks, Fibre Channel over Ethernet (FCoE). **Self-learning Topics: C**ase Study on FCoE SAN.	**06**
IV	Backup and Data Archive	**Introduction to Business Continuity:** Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis **Backup and Archive:** Backup Purpose, Backup Considerations, Backup Granularity,Recovery Considerations, Backup Methods ,Backup Architecture, Backup and Restore Operations, Backup Topologies **Self-learning Topics:** Case Study on Replication strategy	**06**
V	Storage Area Network as a Service for Cloud Computing & Virtualization	**Virtualization and the cloud:** Cloud infrastructure virtualization, Cloud platforms, Storage virtualization, SAN virtualization **Virtualization Appliances:** Black Box Virtualization, In-Band Virtualization Appliances, Out-of-Band Virtualization Appliances High Availability for Virtualization Appliances, Appliances for Mass Consumption. **Storage Automation and Virtualization:** Policy-Based Storage Management, Application-Aware Storage Virtualization, Virtualization-Aware Applications. **Self-learning Topics:** Case study on symmetric and asymmetric virtualization in networks.	**06**
VI	Securing and Managing storage infrastructure	**Securing and Storage Infrastructure:** Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing Storage Infrastructure in Virtualized and Cloud Environments. **Managing the Storage Infrastructure:** Monitoring the Storage Infrastructure, Storage Infrastructure Management activities, Storage Infrastructure Management Challenges, Information Lifecycle Management, Storage Tiering **Self-learning Topics:** Case study on SAN Management and Standards**.**	**08** **TOTAL:39**

4)Text Books:

1. G. Somasundaram, Alok Shrivastava, EMC Educational Services, ―Information Storage and Management‖, Wiley India.

2. Storage Virtualization, Author: Clark Tom, Publisher: Addison Wesley Publishing Company

3. Ulf Troppens, Wolfgang Muller-Friedt, Rainer Wolafka, ―Storage Networks Explained‖ Wiley Publication

4. "Introduction to Storage Area Networks" Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel, Libor Miklas, IBM Redbooks.

5)References:

1. Richard Barker and Paul Massiglia, ìStorage Area Network Essentials: A Complete Guide to Understanding and Implementing SANsî, Wiley India.
2. Storage Networks: The Complete Reference, by Robert Spalding(Author)
3. ―Storage Network Management and Retrieval‖, Vaishali Khairnar, Nilima Dongre. Wiley

6) Online Reference:

1. https://www.itprc.com/ultimate-guide-to-storage-area-networks/
2. https://www.techtarget.com/searchstorage/definition/storage-area-network-SAN
3. https://www.snia.org/educational-library/object-storage-trends-use-cases-2021
4. https://www.sciencedirect.com/topics/computer-science/network-attached-storage
5. https://www.techtarget.com/searchstorage/tip/Understand-your-storage-infrastructure-management
6. https://sites.google.com/site/testwikiforfirstciscolab/shd/14-securing-the-storage-infrastructure
7. https://www.techtarget.com/searchdatabackup/tip/What-is-the-difference-between-archives-and-backups

7) Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. (Total 40) Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr.no	Rubrics	Marks

1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept**	**10 marks**
5.	**Mini Project / Extra Experiments/ Virtual Lab**	**10 marks**
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification, the grading must be done accordingly.

9)Rubrics for slow learners: -

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment: -

1. Mock Viva/Practical
2. Skill Enhancement Lecture
3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carries 20 marks
4	Any three questions out of five needs to be solved.

Course Code	Course Name	Credit
ITDO7012	High Performance Computing	3

1)Prerequisite: Computer Organization, C Programming, Data structures and Algorithm Analysis.

2) Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	Learn the concepts of high-performance computing.
2	Gain knowledge of platforms for high performance computing.
3	Design and implement algorithms for parallel programming applications.
4	Analyze the performance metrics of High Performance Computing.
5	Understand the parallel programming paradigm, algorithms and applications.
6	Demonstrate the understanding of different High Performance Computing tools.

3)Course Outcomes:

Sr. No.	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Understand fundamentals of parallel Computing.
2	Describe different parallel processing platforms involved in achieving High Performance Computing.
3	Demonstrate the principles of Parallel Algorithms and their execution.
4	Evaluate the performance of HPC systems.
5	Apply HPC programming paradigm to parallel applications.
6	Discuss different current HPC Platforms.

4) DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Computer Organization, C Programming, Data structures and Algorithm Analysis.	**02**
I	Introduction	**Introduction to Parallel Computing:** Motivating Parallelism, Scope of Parallel Computing, Levels of parallelism (instruction, transaction, task, thread, memory, function), Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation). **Self-learning Topics:** Parallel Architectures: Interconnection network, Processor Array, Multiprocessor.	**05**
II	Parallel Programming Platforms	**Parallel Programming Platforms:** Implicit Parallelism: Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines. **Self-learning Topics:** Trends in Microprocessor & Architectures, Limitations of Memory System Performance.	**04**
III	Parallel Algorithm And Concurrency	**Principles of Parallel Algorithm Design:** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Basic Communication operations: Broadcast and Reduction Communication types. **Self-learning Topics: Parallel Algorithm Models**	**09**
IV	Performance Measures for HPC	**Performance Measures:** Speedup, execution time, efficiency, cost, scalability, Effect of granularity on performance, Scalability of Parallel Systems, Amdahl‘s Law, Gustavson‘s Law. **Self-learning Topics:** Performance Bottlenecks.	**05**

V	Programming Paradigms for HPC	**Programming Using the Message-Passing Paradigm :** Principles of Message Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topology and Embedding. **Parallel Algorithms and Applications :** One-Dimensional Matrix-Vector Multiplication, Graph Algorithms, Sample Sort, Two-Dimensional Matrix Vector Multiplication. **Self-learning Topics:** Introduction to OpenMP.	**09**
VI	General Purpose Graphics Processing Unit(GPGPU) Architecture and Programming	OpenCL Device Architectures, Introduction to OpenCL Programming. **Self-learning Topics:** Introduction to CUDA architecture, and Introduction to CUDA Programming.	**05** **TOTAL:39**

5)Text Books:

1. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar , ―Introduction to Parallel Computing‖, Pearson Education, Second Edition, 2007.
2. Kai Hwang, Naresh Jotwani, ―Advanced Computer Architecture: Parallelism, Scalability, Programmability‖, McGraw Hill, Second Edition, 2010.
3. Edward Kandrot and Jason Sanders, ―CUDA by Example – An Introduction to General Purpose GPU Programming‖, Addison-Wesley Professional ©, 2010.
4. Georg Hager, Gerhard Wellein, ―Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.
5. Benedict Gaster, Lee Howes, David Kaeli, Perhaad Mistry, Dana Schaa , ―Heterogeneous Computing with OpenCL‖ , 2nd Edition, Elsevier, 2012.

6)References Books:

1. Michael J. Quinn, ―Parallel Programming in C with MPI and OpenMP‖, McGraw-Hill International Editions, Computer Science Series, 2008.
2. Kai Hwang, Zhiwei Xu, ―Scalable Parallel Computing: Technology, Architecture, Programming‖, McGraw Hill, 1998.
3. Laurence T. Yang, MinyiGuo, ―High- Performance Computing: Paradigm and Infrastructure‖ Wiley, 2006.
4. Fayez Gebali, ―Algorithms and Parallel Computing‖, John Wiley & Sons, Inc., 2011.

)Online References:

Sr. No.	Website Name
1.	https://onlinecourses.nptel.ac.in/noc21_cs46/preview
2.	https://onlinecourses.nptel.ac.in/noc22_cs21/preview

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. (Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

8) Continuous Assessment: -
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept**	**10 marks**
5.	**Mini Project / Extra Experiments/ Virtual Lab**	**10 marks**
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification, the grading must be done accordingly.

9)Rubrics for slow learners: -

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment: -

1. Mock Viva/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carries 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO7013	**Infrastructure Security**	**3**
1)Prerequisite: Programming Language (C++, Java), Software Engineering		
2)Course Objectives:		
1	To understand underlying principles of infrastructure security.	
2	To explore software vulnerabilities, attacks and protection mechanisms to learn security aspects of wireless network infrastructure and protocols.	
3	To investigate web server vulnerabilities and their countermeasures	
4	To investigate cloud infrastructure vulnerabilities and their countermeasures.	
5	To learn the different attacks on Open Web Applications and Web services.	
6	To learn the different security policies	
3)Course Outcomes:		
1	Understand the concept of vulnerabilities, attacks and protection mechanisms	
2	Analyze and evaluate software vulnerabilities and attacks on databases and operating systems.	
3	Explain the need for security protocols in the context of wireless communication.	
4	Understand and explain various security solutions for Cloud infrastructure.	
5	Understand, and evaluate different attacks on Open Web Applications and Web services.	
6	Design appropriate security policies to protect infrastructure components**.**	

4) Syllabus

Module	Content	Hrs
Prerequisite	Basic of OSI Model, Topology and Computer Networks, Cryptography and Network Security.	02

Module 1 Introduction	Cyber-attacks, Vulnerabilities, Defense Strategies and Techniques, Authentication Methods- Password, Token and Biometric, Access Control Policies and Models (DAC,MAC, RBAC, ABAC, BIBA, Bell La Padula), Self-Learning Topics: Authentication and Access Control Services- RADIUS, TACACS, and TACACS+	04
Module 2 Software Security	Memory and Address Protection, File Protection Mechanism, User Authentication, Database Security Requirements, Reliability and Integrity, Sensitive Data, Inference Attacks, Multilevel Database Security Self-Learning Topics: Format String, File System Security (Windows and Linux OS), **Cross-Site Scripting, SQL Injection, Rootkits, Malware, Viruses**	08
Module 3 Wireless Security	Mobile Device Security- Security Threats, Device Security, IEEE 802.11xWireless LAN Security, VPN Security, Wireless Intrusion Detection System (WIDS) Self-Learning Topics: Wireshark, Cain and Abel, Aircrack	06
Module 4 Cloud Security	Cloud Security Risks and Countermeasures, Data Protection in Cloud, Cloud Application Security, Cloud Identity and Access Management, Cloud Security as a Service. Self-Learning Topics: Metasploit, Ettercap.	06
Module 5 Web Security	Web Security Considerations, User Authentication and Session Management, SSL, SSH, Privacy on Web, Web Browser Attacks, Account Harvesting, Web Bugs, Clickjacking, Session Hijacking and Management, Phishing and Pharming Techniques, DNS Attacks, Web Service Security, Secure Electronic Transaction, Email Attacks, Web Server Security as per OWASP, Firewalls. Self-Learning Topics: Penetration Testing tools: SQL Map, Wapiti, **Cookies, HTTPS, Cross- Site Request Forgery**	08
Module 6 Security and Risk Management	Security Policies, Business Continuity Plan, Risk Analysis, Incident Management, Legal System and Cybercrime, Ethical Issues in Management Security Management. Self-Learning Topics: The Indian IT Act, Indian Cyber Law	05
	Total	**39**

5) Textbooks:	
1	Computer Security Principles and Practice, William Stallings, Sixth Edition, Pearson Education
2	Security in Computing, Charles P. Pfleeger, Fifth Edition, Pearson Education
3	Network Security and Cryptography, Bernard Menezes, Cengage Learning
4	Network Security Bible, Eric Cole, Second Edition, Wiley
6) Reference Books:	
1	Web Application Hackers Handbook by Wiley.
2	Computer Security, Dieter Gollman, Third Edition, Wiley
3	CCNA Security Study Guide, Tim Boyle, Wiley
4	Introduction to Computer Security, Matt Bishop, Pearson.
5	Cloud Security and Privacy, Tim Mather, Subra Kumaraswamy, Shahed Latif , O'Riely.
6	Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
7) Links	
1	https://www.coursera.org
2	https://nptel.ac.in

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed and the Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	Content beyond syllabus presentation	10 marks
2.	Case studies/assignments	10 marks
3.	Multiple Choice Questions (2 Quiz)	05 marks

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment** / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO7014	**Software Testing and Quality Assurance**	**3**

1)Prerequisite: Programming Language (C++, Java), Software Engineering

2)Course Objectives:

1	To provide students with knowledge in Software Testing techniques.
2	To provide knowledge of Black Box and White Box testing techniques.
3	To provide skills to design test case plans for testing software.
4	To prepare test plans and schedules for testing projects.
5	To understand how testing methods can be used in a specialized environment.
6	**To understand the concepts Software Quality Assurance and how testing methods can be used as an effective tool in providing quality assurance concerning software.**

3)Course Outcomes:

1	Investigate the reason for bugs and analyze the principles in software testing to prevent and remove bugs
2	Understand various software testing methods and strategies.
3	Manage the testing process and testing metrics.
4	Understand fundamental concepts of software automation and use automation tools.
5	Apply the software testing techniques in the real time environment
6	**Use practical knowledge of a variety of Standards to test software and quality attributes**

4) Syllabus

Module	Content	Hrs
Prerequisite	Software Engineering Concepts, Basics of programming Language	02

Module 1 Testing Methodology	Introduction, Goals of Software Testing, Software Testing Definitions, Model for Software Testing, Effective Software Testing vs Exhaustive Software Testing, Software Failure Case Studies, Software Testing Terminology, Software Testing Life Cycle (STLC), Software Testing methodology, Verification and Validation, Verification requirements, Verification of high level design, Verification of low level design, validation. Self-learning Topics: Study any system/application, find requirement specifications and design the system. Select software testing methodology suitable to the application.	07
Module 2 Testing Techniques	Dynamic Testing: Black Box Testing: Boundary Value Analysis, Equivalence Class Testing, State Table Based testing, Cause-Effect Graphing Based Testing, Error Guessing. White Box Testing Techniques: need, Logic Coverage Criteria, Basis Path Testing, Graph Matrices, Loop Testing, Data Flow testing, Mutation testing. Static Testing. Validation Activities: Unit validation, Integration, Function, System, Acceptance Testing. Regression Testing: Progressive vs. Regressive, Regression Testing, Regression Testability, Objectives of Regression Testing, Regression Testing Types, Define Problem, Regression Testing Techniques. Self-learning Topics: Select the test cases (positive and negative scenarios) for the selected system and Design Test cases for the system using any two studied testing techniques.	09
Module 3 Managing the Test Process	Test Management: test organization, structure and of testing group, test planning, detailed test design and test Specification. Software Metrics: need, definition and Classification of software matrices. Testing Metrics for Monitoring and Controlling the Testing Process: attributes and corresponding metrics, estimation model for testing effort, information flow matrix used for testing, function point and test point analysis. Efficient Test Suite Management: minimizing the test suite and its benefits, test suite minimization problem, techniques and measuring effectiveness. Self-learning Topics: **Test Suite Prioritization its types,** Design quality matrix for your selected system	08
Module 4 Test Automation	Automation and Testing Tools: need, categorization, selection and cost in testing tools, guidelines for testing tools. Study of testing tools: JIRA, Bugzilla, TestDirector and IBM Rational Functional Tester, Selenium etc. Self-learning Topics: Write down test cases, execute and manage using studied tools	05

Module 5 Testing for specialized environment	Agile Testing, Agile Testing Life Cycle, Testing in Scrum phases, Challenges in Agile Testing Testing Web based Systems: Web based system, web technology evaluation, traditional software and web based software, challenges in testing for web based software, testing web based testing Self-learning Topics: Study the recent technical papers on software testing for upcoming technologies (Mobile, Cloud, Blockchain, IoT)	04
Module 6 Quality **Assurance and Management**	**Software Quality, Software Quality Assurance, Software Quality Assurance Plan,** Software Quality Management, McCall's quality factors and Criteria, ISO 9000:2000, SIX sigma, Software quality management Self-learning Topics: Case Studies to Identify Quality Attributes Relationships for different types of Applications (Web based, Mobile based etc.)	08
	Total	**39**

5) Textbooks:	
1	Software Testing Principles and Practices Naresh Chauhan Oxford Higher Education
2	Software Testing and quality assurance theory and practice by Kshirasagar Naik, Priyadarshi Tripathy , Wiley Publication
6) Reference Books:	
1	Effective Methods for Software Testing , third edition by Willam E. Perry, Wiley Publication
2	Software Testing Concepts and Tools by Nageswara Rao Pusuluri , Dreamtech press

7) Links	
1	www.swayam.gov.in
2	www.coursera.org
3	http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099 -1689
4	https://onlinecourses.nptel.ac.in/noc17_cs32/preview
5	https://www.youtube.com/channel/UC8w8_H_1uDfi2ftQx7a64uQ

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed and the Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	Content beyond syllabus presentation	10 marks
2.	Creating case studies/assignments	10 marks
3.	Multiple Choice Questions (2 Quiz)	05 marks

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment** / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO7021	Mobile Ad- hoc Network	3

1)Prerequisite: Wireless Technology

2)Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To identify and distinguish major issues associated with ad-hoc networks.
2	To analyze the basic concepts for designing a routing protocol for MANETs.
3	To explore and analyze routing protocols of Ad-hoc network.
4	To learn the concepts of Transport layer and Security issues for MANETs.
5	To apply fundamental principles characteristics of QoS and understand the need of Energy Management in wireless ad-hoc network.
6	To learn the basic concepts of Sensor Networks for Communication in Mobile Ad-hoc network.

3)Course Outcomes:

Sr. No.	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Understand the fundamentals of Mobile ad-hoc Networks.
2	Understand and be able to use advanced concept of MAC layer protocols more effectively.
3	Analyse different routing technologies for designing a routing protocol.
4	Understand the concepts of Transport layer and security features of Ad-hoc network.
5	Create the awareness of QoS and Energy Management in Ad hoc network.
6	Demonstrate the ability of wireless sensor network.

4)DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours

0	Prerequisite	Fundamentals of Wireless Communication, Wireless Metropolitan and Local Area Networks: IEEE 802.16 (WiMax) – Mesh mode, IEEE 802.11(Wi-Fi) – Architecture, Wireless Ad hoc Networks: WPAN Device Architecture, Wireless Sensor Network Applications, Advantages and Limitations, Wireless Network Security: Security in GSM; UMTS Security; Bluetooth Security; WEP.	**02**
I	Introduction to Ad-hoc Wireless Networks	Introduction: Cellular and Ad Hoc Wireless Networks, Applications of Ad Hoc Wireless Networks, Issues In Ad Hoc Wireless Networks: Medium Access Scheme, Routing, Multicasting, Transport Layer Protocols, Pricing, Quality of Service Provisioning, Addressing and Service Discovery, Energy Management, Scalability, Deployment Considerations, Ad Hoc Wireless Internet **Self-learning Topics:** Global Mobile Ad Hoc Network Market	**05**
II	Medium Access Control Protocols	Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols with Reservation Mechanisms and Scheduling Mechanisms, IEEE 802.11a and HiperLan standard **Self-learning Topics:** MAC Protocols that use Directional Antennas and Other MAC Protocols	**07**
III	Routing Protocols	**Routing Protocols inAd-hoc Wireless Networks:** Introduction, Design issues, Classification of Routing Protocols: Routing information update mechanism, Use of temporal information for routing, Routing topology, Utilization of specific resources, **Multicast Routing in Ad-hoc Wireless Networks**: Introduction, Design Issues, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols **Self-learning Topics:** Table Driven Routing Protocols, Classifications of Multicast Routing Protocols	**08**
IV	Transport Layer and Security Protocols	**Transport Layer in Ad-hoc Wireless Networks**: Introduction, Design Issues and Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions. **Security in Ad-hoc Wireless Networks:** Issues and Challenges in Security Provisioning, Network Security Attacks classification. **Self-learning Topics:** TCP over Transport Layer Solutions, Key Management and Secure Touting	**07**

V	Quality of Service and Energy Management	**Quality of Servicein Ad-hoc Wireless Networks**: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions **Energy ManagementinAd-hoc Wireless Networks**: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes **Self-learning Topics:** MAC Layer Solutions Battery Management Schemes	**06**
VI	Wireless Sensor Networks	Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering **Self-learning Topics:** Location Discovery and Quality of a Sensor Network	**04** **TOTAL:39**

4)Text Books:

1. C. S. Ram Murthy, B. S. Manoj, ―Ad Hoc Wireless Networks: Architectures and Protocols‖, Prentice Hall of India, 2nd Edition, 2005
2. C. K. Toh, ―Adhoc Mobile Wireless Networks‖, Pearson Education, 2002
3. Wireless Communications & Networks, By William Stallings, Second Edition, Pearson Education

5)References Books:

1. Shih-Lin Wu Yu-Chee Tseng, ―Wireless Ad Hoc Networking: Personal-Area, Local-Area, and the Sensory-Area Networks‖, Auerbach Publications, 2007
2. Subir Kumar Sarkar, ―Adhoc Mobile Wireless Network: Principles, Protocols and Applications‖ CRC Press
3. Prashant Mohapatra and Sriramamurthy, ―Ad Hoc Networks: Technologies and Protocols‖, Springer International Edition, 2009

6)Online References:

1. https://www.cousera.org
2. https://nptel.ac.in

7) Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40) Mid Term test is to be conducted when approx. 50% syllabus is completed and the Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	**Mini Project** / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/**Tutorials** etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment** / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO7022	**Augmented reality and virtual reality**	**3**
1)Prerequisite: computer graphics		
2)Course Objectives:		
1	To understand the concepts of Augmented Reality and related technologies	
2	To understand the AR tracking system and use of computer vision in AR/MR.	
3	To describe the technology for multimodal user interaction and authoring in AR.	
4	To understand primitives of computer graphics fundamental.	
5	To analyze various Hardware devices suitable for VR	
6	To analyze visual physiology and issues related to it	
3)Course Outcomes:		
1	Identify and compare different Augmented Reality and Mixed Reality Technologies	
2	Apply concepts of Computer Vision for tracking in AR and MR Systems.	
3	Model different interfaces and authoring in AR/MR.	
4	Solve Computer Graphics Problems	
5	Analyze application of VR hardware and software components.	
6	Identify issues related to visual physiology.	

4) Syllabus

Module	Content	Hrs
Module 1 Introduction to Augmented Reality and Mixed Reality	**VR Introduction, Tracking in VR** Definition and Scope, AR Architecture, Related Fields of AR (like Mixed Reality, Virtual Reality, Immersive Reality, Extended Reality) General Architecture of Mixed Reality System, Algorithm Steps in Mixed Reality Self-Learning Topics: How AR/MR are related to Ubiquitous Computing, Multidimensional Systems.	**06**
Module 2 Tracking and Computer Vision for AR and MR	Multimodal Displays; Visual Perception; Spatial Display Model, Visual Displays; Tracking, Calibration and Registration; Coordinate Systems; Characteristics of Tracking Technology; Stationary Tracking Systems; Mobile Sensors; Optical Tracking; Sensor Fusion; Marker Tracking; Multiple Camera Infrared Tracking; Natural Feature Tracking by Detection; Incremental Tracking; Simultaneous Localization and Tracking; Outdoor Tracking Self-Learning Topics: Indoor Tracking, Full Body Tracking	**06**
Module 3 Interaction, Modeling and Annotation and Authoring	Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Multi-view Interfaces, Haptic Interaction, Multimodal Interaction, Specifying Geometry, Specifying Appearance, Semi-automatic Reconstruction, Free-form Modeling, Annotation, Requirement of AR Authoring, Elements of Authoring, Stand-alone Authoring Solutions, Plug-in Approaches. Self-Learning Topics: Case Study on Object Annotation in Real Time, Avatar Modeling	**06**
Module 4 Geometry of Virtual World	Geometric Modeling, **2D to 3D transformations**, Homogenous coordinate system, 3D rotation and 6 degree of freedom, Viewport Transformation Self learning topics: Eye Transformation, demo of 2D transformation	**08**
Module 5 Introduction to VR	Introduction to VR and definitions and its components., Hardware components: Display devices: LCD, OLED Audio: Speakers, Earphones, Bone conduction Touch: Haptic Device GPU and CPU, Input devices like game controller, data glows, Joysticks Tracking Hardware: Industrial measurement Unit-IMU, Gyroscope, accelerometer Software component: Java3D, VRML Self Learning topics: Feedback mechanisms in VR environment	**06**
Module 6	Functioning of Eye with photoreceptors, Resolution for VR, Eye movements and issues with it in VR, Orientation	**07**

Visual Physiology, perception and tracking	tracking, Tracking with camera, **steps for VR applications design** Self learning topics: Light House approach	
	Total	**39**

5) Textbooks:	
1	Dieter Schmalsteig and Tobias Hollerer, ―Augmented Reality- Principles and Practice‖, Pearson Education, Inc. 2016 Edition.
2	Chetankumar G Shetty, ―Augmented Reality- Theory, Design and Development‖, Mc Graw Hill, 2020 Edition
3	Alan B. Craig, ―Understanding Augmented Reality – Concepts and Applications‖, Morgan Kaufmann, Elsevier, 2013 Edition
4	Hearn and Baker, ―Computer Graphics- C version‖, 2nd edition, Pearson, 2002
5	R. K Maurya, ―Computer Graphics with Virtual Reality‖, 3rd Edition, Wiley India, 2018.
6	Steven M. LaVelle,‖ Virtual Reality‖, Cambridge University press, 2019
7	Grigore Burdea, Philippe Coiffet, ―Virtual Reality Technology‖, 2nd Edition, Wiley India, 2003
8	Vince, ―Virtual Reality Systems‖, 1st Edition, Pearson Education, 2002
6) Reference Books:	
1	Borko Furht, ―Handbook of Augmented Reality‖, Springer, 2011 Edition
2	Erin Pangilinan, Steve Lukas, and Vasanth Mohan, ―Creating Augmented and Virtual Realities- Theory and Practice for Next-Generation Spatial Computing‖, O‘Reilly Media, Inc., 2019 Edition.

3	Jens Grubert, Dr. Raphael Grasset, ―Augmented Reality for Android Application Development‖, PACKT Publishing, 2013 Edition.
4	George Mather, ―Foundations of Sensation and Perception‖, Psychology Press book; 3rd Edition, 2016
5	Tony Parisi, ― Learning Virtual Reality‖, 1st edition, O'Reilly, 2015
6	Alan Craig and William Sherman,‖ Understanding virtual reality: Interface, application and design‖, 2nd Edition, Morgan Kaufmann Publisher, 2019
7	Peter Shirley, Michael Ashikhmin, and Steve Marschner, ―Fundamentals of Computer Graphics‖ ,A K Peters/CRC Press; 4th Edition, 2016.
7) Links	
1	http://www.nptel.ac.in/
2	http://www.coursera.org/
3	https://nptel.ac.in/courses/121/106/121106013/
4	http://msl.cs.uiuc.edu/vr/
5	http://msl.cs.uiuc.edu/vr/

8) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

9) Continuous Assessment:-
Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-
*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept /case studys**	10 marks
5.	**Mini Project** / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5marks

10)Rubrics for slow learners:-

1.) **Case study**, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / Extra assignment / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

12)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO7023	Quantum Computing	3

1)Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To know the fundamentals of Quantum computing and its applications.
2	To understand the efficient quantum algorithms for several basic promise problems.
3	To gain knowledge about quantum computers and their principles.
4	To understand the principles, quantum information and limitation of quantum operations formalizing.
5	To gain knowledge about different quantum error and its correction techniques.
6	To gain knowledge about different quantum cryptographic algorithms.

2)Course Outcomes:

Sr. No.	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Basics of Quantum computing and its applications.
2	Solve various problems using quantum algorithms.
3	Methodology for quantum computers and their principles.
4	Comprehend quantum noise and operations.
5	Gain knowledge about different quantum error correction techniques.
6	To gain knowledge about different quantum cryptographic algorithms.

3) DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
I	FUNDAMENTALS OF QUANTUM	Fundamental Concepts: Introduction and Overview – Global Perspectives – Quantum Bits – Quantum Computation –	07

		Quantum Algorithms – Experimental Quantum Information	

	COMPUTING	Processing – Quantum Information. Problems on Qubits **Self-learning Topics:** Detail ofQuantum computing and its applicationshttps://www.ibm.com/quantum-computing/what-is-quantum-computing/		
II	QUANTUM COMPUTATIO N	Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database. Problems on Boolean functions and Quantum gates, Quantum gates and circuits. **Self-learning Topics:** Application of Quantum Computing	**08**	CO2
III	QUANTUM COMPUTERS	Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance. **Self-learning Topics:** Qiskit	**06**	CO3
IV	QUANTUM INFORMATIO N S	Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information. Problems on Measurement **Self-learning Topics:**Case study on Quantum noise and operations.	**07**	CO4
V	QUANTUM ERROR CORRECTION	Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation. **Self-learning Topics:**Case study on Quantum error correction.	**05**	CO5
VI	QUANTUM CRYPTOGRAP HY	Quantum Cryptography-Private Key Cryptography, Privacy Amplification and Information Reconciliation, Quantum Key Distribution, Privacy and Coherent Information, The Security of Quantum Key Distribution. Problems on Quantum error correction and cryptography. **Self-learning Topics:** Attacks on Quantum Cryptography	**06** **TOTAL:39**	CO6

4)Text Books:

1. Chris Bernhardt,‖ Quantum Computing for Everyone‖, (The MIT Press) Hardcover – Illustrate ,September 2020,
2. Willi-Hans Steeb; ―Problems and Solutions in Quantum Computing and Quantum Information‖, Yorick Hardy Academic Consulting and Editorial Services (ACES) Private Limited, January 2020.
3. M.A. Nielsen and I.Chuang,―Quantum Computation and Quantum Information‖, Cambridge University Press 2010.

5)References Books:

1. Computer Science: An Introduction by N. DavidMermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.
2. Parag K. Lala ,Quantum Computing: A Beginner's Introduction Paperback‖ , McGraw Hill November 2020.
3. V. Sahni, ―Quantum Computing‖, Tata McGraw-Hill Publishing company,2007.
4. Nayak, Chetan; Simon, Steven; Stern, Ady; Das Sarma, Sankar, ―NonabelianAnyons and Quantum Computation‖, 2008.

6)Online References:

1. https://www.cousera.org
2. https://nptel.ac.in

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed and the Duration of the midterm test shall be one hour.

8) Continuous Assessment:-
Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	**Mini Project** / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/**Tutorials** etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment** / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO7024	**Information Retrieval System**	**3**
1)Prerequisite: data , information, searching, indexing		
2)Course Objectives:		
1	To learn the fundamentals of the information retrieval system.	
2	To classify various Information retrieval models	
3	To demonstrate the query processing techniques and operations.	
4	To compare the relevance of query languages for text and multimedia data.	
5	To evaluate the significance of various indexing and searching techniques for information retrieval.	
6	**To develop an good user interfaces as per the application requirements**	
3)Course Outcomes:		
1	Define and describe the objectives of the basic concepts of the Information retrieval system	
2	Evaluate the taxonomy of different information retrieval models	
3	Try to solve and process text and multimedia retrieval queries and their operations	
4	Evaluate text processing techniques and operations in the information retrieval system	
5	Demonstrate and evaluate various indexing and searching techniques.	
6	**Design the user interface and select the required application**	

4) Syllabus

Module	Content	Hrs
Module 1 Introduction	**Indexing , searching**, Motivation for IR,, Basic Concepts, The Retrieval Process, Information System: Components, parts and types on information system; Definition and objectives on information retrieval system, Information versus Data Retrieval. Search Engines and browsers Self-learning Topics: Search Engines , Search API	**08**
Module 2 Information retrieval models	Modeling: Taxonomy of Information Retrieval Models, Retrieval: Formal Characteristics of IR models, Classic Information Retrieval, Alternative Set Theoretic models, Probabilistic Models, Structured text retrieval Models, models for Browsing; Self-learning Topics: Terrier	**06**
Module 3 Query processing and operations	Query Languages: Keyword based Querying, Pattern Matching, Structural Queries, Query Protocols; Query Operations: User relevance feedback, Multimedia IR models: Data Modeling Self-learning Topics: Proximity Queries and Wildcard Queries	**06**
Module 4 Text processing	Text and Multimedia languages and properties: Metadata, Markup Languages, Multimedia; Text Operations: Document Preprocessing, Document Clustering. **Text Processing Applications** Self-learning Topics: Digital Library : Greenstone	**06**
Module 5 Indexing and searching	Inverted files, Other indices for text, Boolean Queries, Sequential Searching, Pattern Matching, Structural Queries, Compression; Multimedia IR: Indexing and Searching:- A Generic Multimedia indexing approach, , Automatic Feature extraction; Searching Web: Challenges, Characterizing the web, Search Engines. Browsing, Meta searches, Searching using Hyperlinks. Self-learning Topics: Koha	**07**

Module 6 User Interface and **Applications**	**User interface requirement (good and bad interface). Video information retrieval, image information retrieval, 3D retrieval, audio and music retrieval** Self-learning Topics: SeeSoft	**06**
	Total	**39**

5) Textbooks:	
1	Modern Information Retrieval, Ricardo Baeza-Yates,berthier Ribeiro- Neto, ACM Press-Addison Wesley
2	Information Retrieval Systems: Theory and Implementation, Gerald Kowaski, Kluwer Academic Publisher
3	Storage Network Management and Retrieval by Dr. Vaishali Khairnar, Nilima Dongre, Wiley India.
6) Reference Books:	
1	Introduction to Information Retrieval By Christopher D. Manning and Prabhakar Raghavan, Cambridge University Press
2	Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons
3	Introduction to Modern Information Retrieval. G.G. Chowdhury. NealSchuman
7) Links	
1	https://www.geeksforgeeks.org/what-is-information-retrieval/
2	https://nlp.stanford.edu/IR-book/
3	https://en.wikipedia.org/wiki/Information_retrieval

7) Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)

Mid Term test is to be conducted when approx. 50% syllabus is completed and the Duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	**Mini Project** / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/**Tutorials** etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

9)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment** / Question paper solution (10 marks)

3) Multiple Choice Questions (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code	Course Name	Credits
ILO7011	Product Life Cycle Management	03

1)Course Objectives: Students will try :

1. To familiarize the students with the need, benefits and components of PLM
2. **To Enable the learners to product design and development processes.**
3. To acquaint students with Product Data Management & PLM strategies
4. To give insights into new product development program and guidelines for designing and developing a product
5. To familiarize the students with Virtual Product Development
6. **To familiarize the Learner with design for environments, Life cycle assessment.**

2)Course Outcomes: Students will be able to :

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. **Understand the concept of product data ,product data management and PDM implementation.**
5. **Understand and illustrate the concept of product design for the environment and life cycle assessment.**
6. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

3)Detailed Syllabus:

Module	Detailed Contents	Hrs
01	**Introduction to Product Lifecycle Management (PLM):**Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications **PLM Strategies:**Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy , Change management for PLM	10

02	**ProductDesign:**Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process	**09**
03	**Product Data Management (PDM):**Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	**05**
04	**From sustainable Development to design for environment** 4.1 Sustainable Development,**Key factors in sustainable Development**, Design for Environment. 4.2 **The Environment driving PLM- External Drivers: scale, Complexity , cycle times, globalization, regulations , Internal Drivers- Productivity innovation, collaboration, quality. Boardroom Driver-IT Value Map: income, revenue, costs. Comparing lean manufacturing, ERP,CRM and PLM,** Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	**05**
05	Life Cycle Assessment and Life Cycle Cost Analysis 5.1Premises,Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment. 5.2Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	**05**
06	6.1Introduction VPD, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies.	**05** **TOTAL:39**

4)Reference Books:

1 John Stark, ―Product Lifecycle Management: Paradigm for 21st Century Product Realisation‖, Springer-Verlag, 2004. ISBN: 1852338105
2 Fabio Giudice, Guido La Rosa, Antonino Risitano, ―Product Design for the environment- A life cycle approach‖, Taylor & Francis 2006, ISBN: 0849327229
3 Saaksvuori Antti, Immonen Anselmie, ―Product Life Cycle Management‖, Springer, Dreamtech, ISBN: 3540257314
4 Michael Grieve, ―Product Lifecycle Management: Driving the next generation of lean thinking‖, Tata McGraw Hill, 2006, ISBN: 0070636265

5)Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall
be one hour.

6)Continuous Assessment: -

Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be selected from the following: -

Sr. No	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	Content beyond syllabus presentation	10 marks
4.	Creating Proof of concept	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab etc	10 marks
6.	Case based Assignment/test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO7013	**Management Information System**	**3**
1)Prerequisite: data , information, searching, indexing		
2)Course Objectives:		
1	To discuss the roles played by information technology in today's business.	
2	To understand the Intelligent Techniques for Data Analytics.	
3	To determine ethical and privacy issues in management systems.	
4	To compare the relevance of query languages for text and multimedia data.	
5	To evaluate the significance of various indexing and searching techniques for information retrieval.	
6	**To develop an good user interfaces as per the application requirements**	
3)Course Outcomes:		
1	The impact of information systems on an organisation's growth.	
2	The principal tools and technologies for accessing information from databases to improve business performance and decision making	
3	The ethical frameworks and security concerns in information systems	
4	The various business models used for social computing	
5	IT infrastructure and its components and its current trends	
6	Various enterprise-wide knowledge management systems and its functionalities	

4) Syllabus:

Module	Detailed Contents	Hrs
01	**Introduction to Information Systems (IS):** Computer Based Information Systems, Impact of IT on organisations,	**4**

	Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS.	
02	**Database and Business Intelligence:** Database Approach, Big Data, Data warehouse and Data Marts **Managing data resources:** Establishing an information policy, ensuring data quality **Business intelligence (BI):** Decision Making Process, BI for Data analytics and Presenting Results	**8**
03	**Ethical and Social Issues in Information Systems:** Ethical issues and Privacy, Information Security. Threat to IS, and Security Controls	**6**
04	**Social Computing (SC):** SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C. Mobile commerce.	**7**
05	**Emerging Technologies:** **The Emerging Mobile Digital Platform:** Consumerization of IT and BYOD (Bring Your Own Device), Grid Computing, Virtualization, Cloud Computing, Green Computing, High-Performance and Power-Saving Processors, Autonomic Computing **Contemporary Software Platform Trends:** Web Services and Service-Oriented Architecture, Software Outsourcing and Cloud Services **Management Issues:** Dealing with Platform and Infrastructure Change Management and Governance	**7**
06	**Information System within Organization:** Knowledge management System, Knowledge management value	**7**

	chain, Decision Support System, Transaction Processing Systems, ERP and ERP support of Business Process.	**TOTAL:39**

5)Textbooks:	
1	Kelly Rainer, Brad Prince, Management Information Systems, Wiley
2	K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 13th Ed. © Pearson Education Limited 2014
6)Reference Books:	
1	MIS: Management Perspective, D.P. Goyal, Vikas Publishing House Pvt. Ltd, 4th Edition.
2	D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008.

7)Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.

Mid Term test is to be conducted when approx. 50% syllabus is completed. Duration of the midterm test shall be one hour.

8)Continuous Assessment: -

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following: -

Sr.no	**Rubrics**	**Marks**

1.	***Certificate course for 4 weeks or more: -** **NPTEL/ Coursera/ Udemy/any MOOC**	**10 marks**
2.	Wins in the event/competition/hackathon	10 marks
3.	**Content beyond syllabus presentation**	**10 marks**
4.	Creating Proof of concept	10 marks
5.	**Mini Project / Extra Experiments/ Virtual Lab**	**10 marks**
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	**Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject (in other institutes)**	**5 marks**
8.	**Multiple Choice Questions (Quiz)**	**5 marks**

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

Course Code	Course Name	Credits
ILO7016	Cyber Security and Laws	03

1)Objectives:

1. To understand and identify different types cybercrime and cyber law
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

2)Outcomes: Learner will be able to…

1. Understand the concept of cybercrime and its effect on outside world
2. Interpret and apply IT law in various legal issues
3. Distinguish different aspects of cyber law
4. Apply Information Security Standards compliance during software design and development

Module	Detailed Contents	Hrs
01	**Introduction to Cybercrime:** Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.	4
02	**Cyber offenses & Cybercrime:** How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Bot nets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops	9
03	**Tools and Methods Used in Cyber line** Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	6

04	**The Concept of Cyberspace** E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law , The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	8
05	**Indian IT Act.** Cyber Crime and Criminal Justice : Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	6
06	**Information Security Standard compliances** SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	6 **TOTAL:39**

3)Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

4)Continuous Assessment: -

Continuous Assessment is of 20 marks. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be selected from the following: -

Sr. No	Rubrics	Marks
1.	Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Content beyond syllabus presentation	10 marks
3.	Mini Project	10 marks
4.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
5.	Multiple Choice Questions (Quiz)	5 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

Lab Code	Lab Name	Credit
ITL701	**Data Science Lab**	**1**

1)Prerequisite: Artificial Intelligence and Data Science-I, Python Programming, Data Mining & Business Intelligence.	
2) Lab Objectives: The course aims:	
1	To apply reasoning for a problem in an uncertain domain.
2	To discuss the solution after building a Cognitive application.
3	To familiarize the students with the basics of Fuzzy Logic and Fuzzy Systems
4	To familiarize the students with Learning Architectures and Frameworks.
5	To define and apply metrics to measure the performance of various learning algorithms.
6	To enable students to analyze data science methods for real world problems.
3) Lab Outcomes: On successful completion, of course, learner/student will be able to:	
1	Implement reasoning with uncertainty.
2	Explore use cases of Cognitive Computing
3	Implement a fuzzy controller system
4	Develop real life applications using learning concepts.
5	Evaluate performance of applications.
6	Implement and analyze applications based on current trends in Data Science.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
I	Uncertainty in AI	Implement Inferencing with Bayesian Network in Python	**02**
II	Cognitive Computing	● Building a Cognitive Healthcare application ● Smarter cities: Cognitive Computing in Government ● Cognitive computing in Insurance ● Cognitive computing in Customer Service	**04**
III	Fuzzy Logic & Its Applications	● Implementation of Fuzzy Membership Functions. ● Implementation of fuzzy set Properties. ● Design of a Fuzzy control system ● using Fuzzy tool.	**04**
IV	Introduction to Deep Learning	ImplementingDeep Learning Applications like a. Image Classification System b. Handwritten Digit Recognition System (like MNIST Dataset) c. Traffic Signs Recognition System. d. Image Caption Generator	**06**
V	Advanced ML Classification Techniques	● Implementation of supervised learning algorithm like a. Ada-Boosting b. Random forests ● Evaluation of Classification Algorithms.	**05**
VI	Mini-project on trends and applications in Data Science	Build text/ image/ video/ audio based DS Applications such as a. Chatbot b. Document Classification c. Sentiment Analysis d. Bounding Box Detection e. Music/Video Genre Classification	**05** **TOTAL: 26**

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)

Sr. No.	**Name of the Experiment**
1*	To Implement Inferencing with Bayesian Network in python
2*	To build a Cognitive text based application to understand context for a Customer service application/ Insurance/ Healthcare Application/ Smarter Cities/ Government etc.
3*	To build a Cognitive based application to acquire knowledge through images for a Customer service application/ Insurance/ Healthcare Application/ Smarter Cities/ Government etc.
4	To build an adaptive and contextual Cognitive based Customer service application/ Insurance/ Healthcare Application/ Smarter Cities/ Government etc.
5*	To build a Cognitive Analytics for personalization of Customer service application/ Insurance/ Healthcare Application/ Smarter Cities/ Government etc.
6*	**To implement Fuzzy Membership Functions.**
7*	To implement fuzzy set Properties
8*	To design a Fuzzy control system using Fuzzy tool/library.
9*	To implement CNN Deep Learning Applications like i) Image Classification System ii) Handwritten Digit Recognition System (like MNIST Dataset) iii) Traffic Signs Recognition
10*	To implement supervised learning algorithm like i) Ada-Boosting

	ii) Random forests
11*	Analysis and comparison of different Machine learning and Deep learning algorithms
12	Mini-Project – To build text/ image/ video/ audio based Data Science/AI based Application

5) Useful Links:	
1	https://wisdomplexus.com/blogs/cognitive-computing-examples/
2	http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning_old/labs/explist.php
3	https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0132951702167633 9249401_ shared/overview
4	https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_0132950021926830 0841860_ shared/overview
5.	https://www.udemy.com/course/ibm-watson-for-artificial-intelligence-cognitive-co mputing/

6) Term Work:	
1	Term Work shall consist of at least 12 Practical based on the above list. **Also, Term work Journal must include at least 2 assignments.** Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks (Mini Project) +05 Marks (Attendance)
7) Continuous assessment exam	

1	Experiment submission on time
2	Explanation/Concepts
3	Algorithm implementation
4	Presentation/Analysis
5	Performance/Documentation

Lab Code	Lab Name	Credit
ITL702	**Internet of Everything Lab**	**1**

1)Prerequisite:	
2)Lab Objectives:	
1	To learn different types of sensors
2	To design the problem solution as per the requirement analysis done using sensors.
3	To study the basic concepts of programming/sensors/ emulators.
4	To design and implement the mini project intended solution for project-based learning.
5	To build and test the mini project successfully.
3)Lab Outcomes:	
1	Identify the requirements for the real-world problems.
2	Conduct a survey of several available literatures in the preferred field of study
3	Study and enhance software/ hardware skills.
4	Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing.
5	To report and present the findings of the study conducted in the preferred domain.

4)Suggested framework for Mini-Project: Experiments:	
Implementation of one application using minimum 2 to 3 sensors.	
Sr. No.	**Name of the Experiment**
1*	Selection of the application in consent with the faculty
2*	Selection of the sensors and actuators along with its specifications
3*	Selection of the controller and protocols to be used. Design the framework.
4	Implementation of application with the sensors and the actuators
5*	Implementation of Analytics
6*	Final demonstration

5)Useful Links:	
1	IoT Analytics -Things https://thingspeak.com
2	https://www.contiki-ng.org/
3	http://www.ideationinstru.com/training.htm

6)Term Work:	
1	Term work shall consist of Mini-Project based on the above syllabus and guidelines. Journal must include at least 2 assignments. The final certification and acceptance of term work indicates that performance in mini project work is satisfactory and minimum passing marks may be given in term work. The distribution of marks for term work shall be as follows: Mini project …… . (15) Marks. Assignments……..… (05) Marks. Attendance…… (05) Marks TOTAL:…… (25) Marks.
7) Assignments:	
1	Study of IoT Simulation tools
2.	Study of AWS analytics tool

Course Code:	Course Title	Credit
ITL703	Secure Application Development	1

1)Prerequisite: Knowledge of programming languages like java/python/C is required.

2)Lab Objectives:

Sr. No	Lab Objectives
The Lab experiments aims:	
1	To understand the secure programming of application code.
2	To understand the Owasp methodologies and standards.
3	Understand and Identify main vulnerabilities inherent in applications.
4	Understand how Data Validation and Authentication can be applied for application.
5	Understand how to apply Security at Session Layer Management.
6	Understand how to apply to secure coding for cryptography.

3)Lab Outcomes:

Sr. No	Lab Outcomes
On successful completion, of course, learner/student will be able to:	
1	Apply secure programming of application code.
2	Understand the Owasp methodologies and standards.
3	Identify main vulnerabilities inherent in applications.
4	Apply Data Validation and Authentication for application
5	Apply Security at Session Layer Management
6	Apply secure coding for cryptography.

4)DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Programming Language and Web application basic concepts.	**02**

I	Introduction to Secure Programming	Introduction to laws, standards and guidelines of cyber security. What do you mean by attacks, types of attacks and statistics of main vulnerabilities? Lab1: Study of different laws and standards of cyber security.	**04**
II	Methodologies for developing secure code	Software Development Lifecycle. Risk Analysis. Threat Modeling. Study different SAST (Static Application Security Testing) tools. Study different top 10 methodologies and guidelines of OWASP (Open Web Application Security Project) for the secure application development. Any top 5 OAT. Best eight guidelines for Secure Coding. Understand the flow of Verification testing for secure coding. Lab2: Case study for SDLC. Lab3: Exercise on Threat Modeling. Lab4: Study of SAST Tools (open Source like GitHub, GitLab and so on) and use at least one for practical Lab5: Study and implement at least any 5 methodologies of OWASP. Lab6: Study and implement at least any 5 OAT Denial of Inventory for E-commerce Website..	**06**
III	VAPT of Applications	Introduction to the HTTP protocol.Owasp Web Security Testing Guidelines. Tools for VAPT testing. Lab7:Use Burp proxy to test web applications.	**04**
IV	Data Validation & Authentication	vulnerabilities like SQL Injection vulnerability, LDAP and XPath Injection vulnerabilities, Cross- Site Scripting (XSS) vulnerability, OS Command, LFI/RFI, Unvalidated file upload and buffer overflow etc. Lab8: Registration Page Data Validation. Lab9: SQL injection vulnerability allows login page to bypass. Lab10: LDAP and XPath Injection vulnerabilities for login /registration page. Lab11: Cross-Site Scripting (XSS) vulnerability Lab Lab12: OS Command vulnerability Lab Lab13: LFI/RFI or Unvalidated file upload or Buffer Overflow vulnerability Lab. Lab14: Online Password attack.	**05**

V	Security in Session Layer	Introduction to Session Layer in Web Applications and management. Session Management Best practices according to OWASP. Lab15: Session Management for Web Application.	**03**
VI	Secure Coding for cryptography.	Overview of cryptography and guidelines for using encryption. Types of cryptography ie symmetric and asymmetric. Hashing Algorithms etc. Lab16: Symmetric and Asymmetric Lab17: Symmetric Encryption and Hashing.	**02** **TOTAL: 26**

5)Text & References Books:

1. Fundamental Practice for Secure Software Development.
2. The OWASP Automated Threat Handbook - Web Applications.
3. OWASP Alpha Release Code Review Guide 2.0
4. Secure Programming HOWTO
5. OWASP Quick reference guide 2.

6)Online References:

Sr. No.	Website Links
1	https://www.udemy.com/course/secure-coding-secure-application-development/
2	https://kirkpatrickprice.com/blog/secure-coding-best-practices/
3	https://owasp.org/www-project-automated-threats-to-web-applications/assets/oats/EN/OAT- 021 Denial of Inventory

7)Term Work:

Term Work shall consist of at least 10 to 12 practical based on the above list. Also Term Work Journal must include at least 2 assignments as mentioned in above syllabus.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiments) + 5 Marks (Assignment) + 5 Marks (Attendance)

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

Course Code	Course Title	Credit
ITL704	**Recent Open Source Project Lab**	1
1) Prerequisite: Basic Concepts of OS, Programming Language, Network and DBMS.		
2) Lab Objectives:		
1	To understand the basic concepts of Open Source Software.	
2	To understand the GPL(General Public Licence) and Contribute to Open Source.	
3	To Understand Contributing to Open Source in different Operating System.	
4	To Understand Contributing to Open Source in different Technologies.	
5	To Understand Contributing to Open Source in different Network Management..	
6	To Understand Contribute to Open Source in different Applications and Services	
3) Lab Outcomes:		
1	Understand and apply the basic concepts of Open Source Software..	
2	Identify the difference between the GPL(General Public Licence) and Contribute to Open Source	
3	Apply and evaluate your knowledge for the Contribute to Open Source in different Operating Systems.	
4	Apply and evaluate your knowledge for the Contribute to Open Source in different Technologies.	
5	Apply and evaluate your knowledge for the Contribute to Open Source in different Network Management..	
6	Apply and evaluate your knowledge for the Contribute to Open Source in different Applications and Services.	

4) Syllabus

Module		Content	Hrs
0	Prerequisite	Basic Concepts of OS, Programming Language, Network and DBMS.	2
1	Introduction to OSS	Overview of OSS. Basic Concepts of OSS. Advantages of OSS. Difference between free and open source software. What is GPL and Contribute to Open Source Project. Different ways to contribute.	4

2	Contribute to Open Source Project.	Overview of Contribute Open Source Project. Steps or Guidelines of Contribute to Open Source Projects : 1. Why to Contribute to open source Project. 2. What do you mean by Contribute Open Source Projects. 3. Identifying the new/existing open source projects to contribute. 4. Submit your contribute to open source.5. Results after submitting your contribute to Open Source	4
3	Contribute to Open Source in Operating System.	As per Contribute to Operating System to introduce new OS version, Improve OS by removing bugs, Improve existing Skill sets for growth in career. Interact with Stakeholders for feedback and provide training and mentoring. Start own Startup.	4
4	Contribute to Open Source in Technologies .	As per Contribute to various emerging technologies like AI/ML/DL/Blockchain/IoT/Data Analytics/Cyber Security/Andriod/iOS/Flutter/DeVoPs/Virtualization and Cloud Computing etc. To improve technologies. Introduce new version of technologies, Improve technologies by removing bugs, Improve existing Skill sets for growth in career. Interact with Stakeholders and provide training and mentoring. Start own Startup	4
5	Contribute to Open Source in Network Management .	As per Contribute to different types of Network and Management Systems like LAN/WAN/MAN/Adhoc Network/Data Centre/Wireless Network/Enterprise Network etc. To improve Networks as a Network administrator. Design own Network as per customer requirements, Improve existing Skill sets for growth in career. Interact with Stakeholders and provide training and mentoring. Start own Startup.	4
6	Contribute to Open Source in Application & Cloud Services.	As per Contribute to various Applications or Case studies using Cloud Services etc. To improve applications, remove bugs. Improve existing Skill sets for growth in career. Interact with Stakeholders and provide training and mentoring. Start own Startup.	4
		Total	**26**

5) Textbooks:	
1	IForge Your Future with Open Source: Build Your Skills. Build Your Network. Build the Future of Technology. 1st Edition
6) Reference :	
1	https://github.com/freeCodeCamp/how-to-contribute-to-open-source
2	https://opensource.guide/how-to-contribute/#why-contribute-to-open-source

Course Code	Course Name	Credits
ITP701	Major Project – I	03

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 Major 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 shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of major project-I and major project-II.
- 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 major project-I & II 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 VESIT.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Major Project, 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. Major Project-I in semester VII and Major Project-II in semesters VIII.
- However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Major Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to Scopus paper publications in Journal/Conference or motivate for Copyright or Indian Patent as an extension of the Major Project-1 with suitable improvements/modifications after testing and analysis in even semester. This policy can be adopted on case by case basis.

Guidelines for Assessment of Major Project:
Term Work

1. The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of major project to be evaluated on continuous basis, minimum two reviews in each semester VII and VIII.
2. 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.
3. Distribution of Term work marks for both semesters shall be as below;
    a. Marks awarded by guide/supervisor based on log book : 10
    b. Marks awarded by review committee 10
    c. Quality of Project report 05

Review/progress monitoring committee may consider following points for assessment based on either one year major project as mentioned in general guidelines.

One-year project:

- In semester VII entire theoretical solution shall be ready, including components/system selection and cost analysis, building of working prototype. Two reviews will be conducted based on presentation given by students group.
    - First shall be for finalization of problem and proposed solution of the problem
    - Second shall be on readiness of working and testing of prototype to be conducted.
- In semester VIII expected work shall be procurement of testing and validation of results based on work completed in an odd semester.
    - First review is based on improvements in testing and validation results cum demonstration for publication to be conducted.
    - Second review shall be based on paper presentation in conference/journal or copyright or Indian patent in last month of the said semester.

Assessment criteria of Major Project.
Major Project shall be assessed based on following criteria;

- Quality of survey/ need identification
- Clarity of Problem definition based on need.
- Innovativeness in solutions
- Feasibility of proposed problem solutions and selection of best solution
- Cost effectiveness
- Societal impact
- Innovativeness
- Cost effectiveness and Societal impact
- Full functioning of working model as per stated requirements
- Effective use of skill sets
- Effective use of standard engineering norms
- Contribution of an individual's as member or leader
- 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.

Guidelines for Assessment of Major Project Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the VESIT.
- Major 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 organizations 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 Scopus Conferences/Journals or copy right or Indian Patent.

Major 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
9. Publications in Sem VIII.

Program Structure for Fourth Year
Information Technology
Scheme for Autonomous Program
(With Effect from 2023-2024)

Semester VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Pract. Tut.	Theory	Pract.	Total
ITC801	Blockchain and DLT	3	--	3	--	3
ITDO801X	Department Optional Course – 5	3	--	3	--	3
ITDO802X	Department Optional Course – 6	3	--	3	--	3
ITIO801X	Institute Optional Course – 2	3	--	3	--	3
ITL801	Blockchain Lab	--	2	--	1	1
ITL802	Cloud computing	--	2	--	1	1
ITP801	Major Project II	--	12#	--	6	6
Total		12	16	12	8	20

Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral & Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Mid-Test	Continuous Assessment	Total					
ITC801	Blockchain and DLT	20	20	40	60	2	-	-	100
ITDO801X	Department Optional Course – 5	20	20	40	60	2	-	-	100
ITDO802X	Department Optional Course – 6	20	20	40	60	2	-	-	100
ITIO801X	Institute Optional Course – 2	20	20	40	60	2	--	-	100
ITL801	Blockchain Lab	--					25	25	50
ITL802	Cloud computing	--	-	-	-	-	25	25	50
ITP801	Major Project II	--	-	-	-	-	100	50	150
Total		80	80	160	240	-	150	100	650

# indicates work load of Learner (Not Faculty), for Major Project

ITDO801X	**Department Optional Course – 5**
ITDO8011	Big Data Analytics
ITDO8012	Reinforcement learning
ITDO8013	Simulation and Modeling
ITDO8014	Knowledge management

ITDO802X	**Department Optional Course –6**
ITDO8021	User Interface Design
ITDO8022	Robotics
ITDO8023	ERP
ITDO8024	Cloud computing and Services

Institute Level Optional Course (ILO)

ILO801X	**Institute Optional Course – 2**
ILO8011	Project Management
ILO8012	Finance Management
ILO8013	Entrepreneurship Development and Management

Course Code:	Course Title	Credit
ITC801	**Blockchain and DLT**	**3**
1)Prerequisite: Cryptography and Distributed Systems		
2)Course Objectives: The course aims:		
1	To get acquainted with the concept of Distributed ledger system and Blockchain	
2	To learn the concepts of consensus and mining in Blockchain through the Bitcoin network	
3	To understand Ethereum and develop-deploy smart contracts using different tools and frameworks.	
4	To understand permissioned Blockchain and explore Hyperledger Fabric.	
5	To understand different types of crypto assets.	
6	To apply Blockchain for different domains IOT, AI and Cyber Security.	
3)Course Outcomes: On successful completion, of course, learner/student will be able to:		
1	Describe the basic concept of Blockchain and Distributed Ledger Technology.	
2	Interpret the knowledge of the Bitcoin network, nodes, keys, wallets and transactions	
3	Implement smart contracts in Ethereum using different development frameworks.	
4	Develop applications in permissioned Hyperledger Fabric network.	
5	Interpret different Crypto assets and Crypto currencies	
6	Analyze the use of Blockchain with AI, IoT and Cyber Security using case studies.	

4) Syllabus

Module	Content	Hrs
Module 1 Introduction to DLT and Blockchain	Introduction to Blockchain: Technical definition of Blockchain. Elements of a blockchain Features of Blockchain Type of Blockchain, What is DLT. DLT V/S Blockchain CAP theorem Byzantine Generals Problem Consensus Mechanism and its Type Cryptographic primitives and data structure used in blockchain. Block in a Blockchain: Structure of a Block, Block Header Hash	04

	and Block Height, The Genesis Block, Linking Blocks in the Blockchain, Merkle Tree. Self-learning Topics: Blockchain Demo	
Module 2 Bitcoin	What is Bitcoin and the history of Bitcoin, Bitcoin Transactions, Bitcoin Concepts: keys, addresses and wallets, Bitcoin Transactions, UTXO. Validation of transactions, Bitcoin Keys , Addresses, ECC , Base58 , BIP-38 , Pay-to Script and Multisig Addresses, Vanity Addresses , Concept of Wallet, Wallet Technologies in Bitcoin HD wallet from Seed. Transaction Scripts and Scripts address, Bitcoin Mining and Difficulty levels Structure of Blocks and Blockheader and Genesis Block , linking of Block. Bitcoin Network: Bitcoin Core node and API, Peer-toPeer Network Architecture, Node Types and Roles, Incentive based Engineering, The Extended Bitcoin Network, Bitcoin Relay Networks, Network Discovery, Full Nodes, Simplified Payment Verification (SPV) Nodes, SPV Nodes Basics of Bitcoin Forensics: Analysis of Address and Wallet , Clustering of Addresses following Money. Self-learning Topics: Study and compare different consensus algorithms like PoA, PoS, pBFT	08
Module 3 Permissionless Blockchain: Ethereum	Introduction to Ethereum, Ethereum 1.0 and 2.0 , Turing completeness EVM and compare with bitcoin Basics of Ether Units, Ethereum Wallets Working with Metamask EOA and Contracts Transaction:: Structure of Transaction, Transaction Nonce, Transaction GAS, Recipient, Values and Data, Transmitting Values to EOA and Contracts Smart Contracts and Solidity Development environment and client , Basic of Solidity and Web 3 Life cycle of Smart contract, Smart Contract programming using solidity, Metamask (Ethereum Wallet), Setting up development environment, Use cases of Smart Contract, Smart Contracts: Opportunities and Risk. Smart Contract Deployment: Introduction to Truffle, Use of Remix and test networks for deployment. Self-learning Topics: Smart contract development using Java or Python	**10**
Module 4 Permissioned Blockchain: Hyperledger Fabric	Introduction to Framework, Tools and Architecture of Hyperledger Fabric Blockchain. Components: Certificate Authority, Nodes, Chain codes, Channels, Consensus: Solo, Kafka, RAFT Designing Hyperledger Blockchain Other Challenges : Interoperability and Scalability of blockchain. Self-learning Topics: Fundamentals of Hyperledger Composer	07
Module 5 Crypto assets and Cryptocurrencies	ERC20 and ERC721 Tokens, comparison between ERC20 & ERC721, NFT, ICO, STO, Different Crypto currencies. Self-learning Topics: Defi, Metaverse, Types of cryptocurrencies	04

Module 6 Blockchain Applications & case studies	Blockchain in IoT, AI, Cyber Security Self-learning Topics: Applications of Blockchain in various domains Education, Energy, Healthcare, realestate, logistics, supply chain	04
	Total	**37**

5) Textbooks:	
1	"Mastering Bitcoin, PROGRAMMING THE OPEN BLOCKCHAIN", 2nd Edition by Andreas M. Antonopoulos, June 2017, Publisher(s): O'Reilly Media, Inc. ISBN: 9781491954386.
2	Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly.
3	Blockchain Technology, Chandramouli Subramanian, Asha A George, Abhillash K. A and Meena Karthikeyen, Universities press
4	Hyperledger Fabric In-Depth: Learn, Build and Deploy Blockchain Applications Using Hyperledger Fabric, Ashwani Kumar, BPB publications
5	Solidity Programming Essentials: A beginner's Guide to Build Smart Contracts for Ethereum and Blockchain, Ritesh Modi, Packt publication.
6	Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond, Chris Burniske & Jack Tatar.
6) Reference Books:	
1	Mastering Blockchain, Imran Bashir, Packt Publishing 2. Mastering Bitcoin Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media
2	Blockchain Technology: Concepts and Applications, Kumar Saurabh and Ashutosh Saxena, Wiley.
3	The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, Antony Lewis. for Ethereum and Blockchain, Ritesh Modi, Packt publication.
4	Mastering Bitcoin Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media

7) Links	
1	www.swayam.gov.in/
2	www.coursera.org
3	https://ethereum.org/en/ 5.
4	https://www.trufflesuite.com/tutorials
5	https://hyperledger-fabric.readthedocs.io/en/release-2.2/whatis.h
6	. https://andersbrownworth.com/blockchain/

7) Internal Assessment:

Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks (Total 40 marks).

Mid Term test is to be conducted when approx. 50% syllabus is completed and the duration of the midterm test shall be one hour.

8) Continuous Assessment:-

Continuous Assessment is of 20 marks**.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics are to be followed are given below:-

Sr.no	Rubrics	Marks
1.	Case study/Research Paper presentation and discussion on Application.	10 marks
2.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes) or Assignments	5 marks
3.	Multiple Choice Questions (Quiz)	5 marks

9)Rubrics for slow learners:-

1.) Presentation on recent trends in the said course (10 marks)

2. **Extra assignment** / Question paper solution (10 marks)

3) Library related work (5 marks)

10)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. Extra Assignments/lab/lecture

11)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO8011	Big Data Analytics	3

Course Objectives:

Sr.No	Course Objectives
1	To provide an overview of an exciting growing field of Big Data analytics.
2	To discuss the challenges traditional data mining algorithms face when analyzing Big Data.
3	To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
4	To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5	To introduce to the students several types of big data like social media, web graphs and data streams.
6	To enable students to have skills that will help them to solve complex real-world problems in decision support.

Course Outcomes:

Sr. No	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Explain the motivation for big data systems and identify the main sources of Big Data in the real world.
2	Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store, retrieve and process Big Data for Analytics.
3	Implement several Data Intensive tasks using the Map Reduce Paradigm.
4	Apply several newer algorithms for Clustering Classifying and finding associations in Big Data.
5	Design algorithms to analyze Big data like streams, Web Graphs and Social Media data.
6	Design and implement successful Recommendation engines for enterprises.

Prerequisite: AI and DS

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Data Mining, Data Science	**02**
I	Introduction to Big Data	Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Big Data Challenges, Examples of Big Data in Real Life, Big Data Applications **Self-learning Topics:** Identification of Big Data applications and its solutions	**03**
II	Introduction to Big Data Frameworks	What is Hadoop? Core Hadoop Components; Hadoop Ecosystem; Working with Apache Spark What is NoSQL? NoSQL data architecture patterns: Key value stores, Graph stores, Column family (Bigtable) stores, Document stores, MongoDB **Self-learning Topics:** HDFS vs GFS, MongoDB vs other NoSQL system, Implementation of Apache Spark	**06**
III	MapReduce Paradigm	MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step . Illustrating use of MapReduce with use of real life databases and applications. **Self-learning Topics:** Implementation of MapReduce algorithms like Word count, Matrix-Vector and Matrix Matrix algorithm	**07**
IV	Mining Big Data Streams	The Stream Data Model: A DataStream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-Indyk, Motwani Algorithm, Query Answering in the DGIM Algorithm. **Self-learning Topics:** Streaming services like Apache Kafka/Amazon Kinesis/Google Cloud DataFlow. Standard spark streaming library. Integration with IOT devices to capture real time stream data.	**07**

V	Big Data Mining Algorithms	Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce Classification Algorithms: Overview SVM classifiers, Parallel SVM, KNearest Neighbor classifications for Big Data, One Nearest Neighbour. **Self-learning Topics:** Standard libraries included with spark like graphX, MLlib	**07**
VI	Big Data Analytics Applications	**Link Analysis :** PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank: PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm. **Mining Social- Network Graphs :** Social Networks as Graphs, Types , Clustering of Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map Reduce. **Recommendation Engines:** A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering **Self-learning Topics:** Sample applications like social media feeds, multiplayer game interactions, retail industry, financial data analysis. Use case like location data, real-time stock trades, log monitoring etc	**07**
		Total	**39**

Text Books:

1. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press. 2. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press.
3. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press
4. Rajkumar Buyya, ,Rodrigo N. Calheiros and Amir Vahid Dastjerdi, “Big Data Principles and Paradigms”,

Morgan Kaufmann **References Books:**

1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited 3. Hadoop: The Definitive Guide by Tom White, O'Reilly Publications

Online References:

1. https://nptel.ac.in/courses/106/104/106104189/
2. https://nptel.ac.in/courses/106106142/
3. https://nptel.ac.in/courses/106105186/

Rubrics / Assessment:

Sr. No	Rubrics	Marks
1.	Certificate course for 4 weeks or more: - NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Content beyond syllabus presentation	10 marks

Course Code	Course Name	Credit
ITDO8012	Reinforcement Learning	03

Course Objectives:

Sr.No	Course Objectives
1	Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning.
2	Introduce to statistical learning techniques where an agent explicitly takes actions and interacts with the world.
3	Implement in code common RL algorithms.
4	Describe multiple criteria for analyzing RL algorithms & evaluate algorithms on these metrics: e.g. regret, sample complexity, computational complexity, empirical performance, convergence, etc.
5	Know how to implement dynamic programming as an efficient solution approach to an industrial control problem.
6	Explore solutions to the Exploration-Exploitation Dilemma.

Course Outcomes:

Sr.No	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Learn how to define RL tasks and the core principles behind the RL, including policies, value functions, deriving Bellman equations.
2	Evaluate work with tabular methods to solve classical control problems.
3	Apply Markov Decision Processes to solve real-world problems.
4	Understand the dynamic programming for policy Evaluation.
5	Implement reinforcement learning problems based on averaging sample returns using Monte Carlo method.
6	Recognize current advanced techniques and applications in RL.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Probability distributions and expected values, and basic linear algebra (e.g., inner products).	**02**

I	Introduction to Reinforcement Learning:	**Reinforcement Learning**: Key features and Elements of RL, Types of RL, rewards. **Reinforcement Learning Algorithms**: Q-Learning, State Action Reward State Action (SARSA), **Self-learning Topics:** Deep Q Neural Network (DQN)**,** Applications of RL	**04**
II	Bandit problems and online learning:	An n-Armed Bandit Problem, Action-Value Methods Tracking a Nonstationary Problem, Optimistic Initial Values Upper-Confidence-Bound Action Selection Gradient Bandits **Self-learning Topics:** Associative Search (Contextual Bandits)	**07**
III	Markov Decision Processes:	The Agent–Environment Interface, Goals and Rewards, Returns, Markov properties, Markov Decision Process, Value Functions and Optimal Value Functions, **Self-learning Topics:** Optimality and Approximation	**07**
IV	Dynamic Programming:	Policy Evaluation (Prediction), Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration **Self-learning Topics:**	**07**
V	Monte Carlo Methods and Temporal-Difference Learning	Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, TD Prediction, TD control using Q-Learning **Self-learning Topics:** Off -policy Prediction via Importance Sampling	**07**
VI	Applications and Case Studies	Elevator Dispatching, Dynamic Channel Allocation, Job-Shop Scheduling **Self-learning Topics:** Study of applications.	**05** **TOTAL:39**

Text Books:

1. Reinforcement Learning: An Introduction, by Richard S. Sutton and Andrew G. Barto
2. Alessandro Palmas, Dr. Alexandra Galina Petre, Emanuele Ghelfi, The Reinforcement Learning Workshop: Learn how to Apply Cutting-edge Reinforcement Learning Algorithms to a Wide Range of Control Problems, 2020 Packt publishing.
3. Phil Winder, Reinforcement Learning Industrial Applications with Intelligent Agents, O'Reilly
4. Dr Engr S M Farrukh Akhtar, Practical Reinforcement Learning, Packt Publishing, 2017.

References Books:

1. Maxim Lapan, Deep Reinforcement Learning Hands-On: Apply modern RL methods, with deep Q-networks, value iteration, policy gradients, TRPO, AlphaGo Zero.
2. Csaba Szepesv´ari, Algorithms for Reinforcement Learning, Morgan & Claypool Publishers
3. Alberto Leon-Garcia, Probability, Statistics and Random Processes for Electrical Engineering, Third Edition, Pearson Education, Inc.

8) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

9) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	**Content beyond syllabus presentation**	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

10)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment / Question paper solution** (10 marks)

3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code	Course Name	Credit
ITDO8013	**Simulation and Modeling**	**03**

Prerequisite: Probability and Statistics

Course Objectives:

Sr.No	Course Objectives
1	To introduce the discrete event simulation systems.
2	To discuss the modeling techniques of entities, queues, resources and entity transfers in the discrete event environment.
3	To formulate and apply the statistical models in simulation and queuing theory.
4	To gain knowledge of random numbers, random variates and various statistical tests on random numbers.
5	To formulate and build valid models and perform simulation analysis of the system and analyze results properly.
6	To familiarize with various applications of Simulation.

Course Outcomes:

Sr. No	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Understand the meaning of simulation and Identify the common applications of discrete-event system simulation.
2	Practice formulation and modeling skills.
3	Analyze events and inter-arrival time, arrival process, queuing strategies, resources and disposal of entities using statistical models.
4	Understand pseudo-random numbers and perform statistical tests to measure the quality of pseudo-random numbers.
5	Apply different distributions to fit the collected data and describe the process of verification and validation of simulation models.
6	Describe various applications of simulation.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Concepts of Probability: Probability mass function, Probability density function, Mean, Variance, Median, Mode	**02**
I	Introduction to Simulation	SimulationDefinition, When Simulation is an appropriate tool and when it is not, Advantages and disadvantages of simulation, Areas of application of simulation, System and its types, Models and its types, Steps in simulation study **Self-learning Topics:** Monte Carlo simulation	**04**
II	Simulation Examples and General Principles	Simulation Process, Simulation of Single-server and multi-server queueing systems, Simulation of (M, N) Inventory and Newspaper Seller Problem, Simulation of Lead-time Demand Concepts in Discrete Event Simulation, Event Scheduling Algorithm, Manual Simulation of Single Server and Dump Truck Problem using Event Scheduling Algorithm **Self-learning Topics:** Simulation of Reliability Problem, Process Interaction Approach in Simulation.	**08**
III	Mathematical ,Statistical and Queueing Models in Simulation	Statistical Models: Terminology and concepts, Useful statistical models, Discrete Distributions (Bernoulli‘s trial, Binomial and Negative Binomial, Poisson Distributions), Continuous Distributions (Exponential, Uniform, Erlang, Triangular and Normal Distributions), Poisson Process, Queueing Models: Queuing Notations, Long Run Performance Measures, M/M/1 and M/G/1 Queueing Systems **Self-learning Topics:**	**08**
IV	Random Numbers and Variates	Random Number Generation: Why are random numbers required in simulation? Properties of random numbers, Linear Congruential Method to generate Random Numbers, Test for Uniformity: Kolmogorov-Smirnov, Chi-Square, Test for Independence: Runs up and runs down, Runs above and below mean, Poker test), Random Variate Generation: Inverse Transform Technique, Direct Transformation for Normal and Lognormal distribution, Acceptance Rejection Technique **Self-learning Topics:** Tests for Autocorrelation	**08**

V	Analysis of Simulation Data	Steps in Input Modeling, Goodness-of-fit tests, Selecting Input Model without data, Multivariate and Time Series Models,Model Building verification and validation,Verification of simulation models, Naylor and Finger Approach for calibration and Validation of simulation models **Self-learning Topics:** Input-Output Validation: Using Historical Input Data	**06**
VI	Applications of Simulation	High-Level Computer-System Simulation and Memory Simulation, Simulation of Manufacturing and Material Handling Systems **Self-learning Topics:** Simulation of Computer Networks	**03** **TOTAL: 39**

Text Books:

1. J. Banks, J. S. Carson, B. L. Nelson and D. M. Nicol (2001), Discrete Event System Simulation, 3rd Ed., Prentice-Hall.
2. J. Banks, J. S. Carson, B. L. Nelson and D. M. Nicol (2001), Discrete Event System Simulation, 4th Ed., Prentice-Hall.

References Books:

1. A. M. Law and W. D. Kelton (2000), Simulation Modeling and Analysis, 4th Ed., McGraw Hill.
2. K. S. Trivedi (2001), Probability and Statistics with Reliability, Queuing and Computer Science Applications, Eastern Economy Edition, Prentice-Hall (India).
3. Banks C M, Sokolowski J A, Principles of Modeling and Simulation, Wiley
4. Geoffrey Gordon, System Simulation, EEE
5. Narsing Deo, System Simulation with Digital Computer; PHI

Online References:

1. https://www.udemy.com/course/discrete-event-system-simulation/
2. https://www.tutorialspoint.com/modelling_and_simulation/index.html

8) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

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8.	Multiple Choice Questions (Quiz)	5 marks

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10)Rubrics for slow learners:-

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3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

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2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

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Course Code	Course Name	Credit
ITDO8014	Knowledge Management	03

Prerequisite: An introductory course in IT/ IS

Course Objectives:

Sr.No	Course Objectives
1	Establish a foundation of key terms and concepts, historical events and contributions, organizational benefits, and guiding principles on which to build greater understanding of knowledge management.
2	Appreciate the role and use of knowledge for individuals, as well as organizations and institutions.
3	Increase information and understanding about knowledge transfer using low- and high technology strategies.
4	Explore the future of knowledge management and its influence on our jobs, communities, and society.
5	Explore different tools for knowledge codification and knowledge transfer.
6	Discuss impact of knowledge management on product, people and organization, etc. with qualitative and quantitative measures.

Course Outcomes:

Sr. No	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Discuss KM, learning organizations, intellectual capital and related terminologies in clear terms and understand the role of knowledge management in organizations.
2	Demonstrate an understanding of the history, concepts, and the antecedents of management of knowledge and describe several successful knowledge management systems.
3	Evaluate the impact of technology including telecommunications, networks, and Internet/intranet role in managing knowledge.
4	Discuss new jobs, roles and responsibilities resulting from the New or Knowledge Economy Ponder KM‘s current and future impact on individuals, organizations and society at large.
5	Apply different tools for knowledge transfer and Business Intelligence in knowledge sharing.
6	Analyze different modes of knowledge conversion and testing tools for knowledge codification.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Meaning of data, information, knowledge and expertise Meaning of epistemology, Types of Knowledge -Subjective & Objective views of knowledge, procedural Vs. declarative, tacit Vs. explicit, general Vs. specific.	**02**
I	Introduction to Knowledge Management	What is Knowledge? Data, information and knowledge, Knowledge management process, Types of expertise – associational, motor skill, theoretical Characteristics of knowledge – explicitness, codifiability, teachability, specificity, Reservoirs of knowledge, Meaning of Knowledge Management, Forces Driving Organizational issues in KM, KM Systems & their role, Relevance of KM in today‘s dynamic & complex environment, Future of Knowledge Management **Self-Learning Topics:** Study the various KM process.	**07**
II	Knowledge management system life cycle	Challenges in Building KM Systems – Conventional versus KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – Nonaka‘s Model of Knowledge Creation and Transformation, Knowledge Architecture. **Self-Learning Topics:** Case study for KMSLS.	**06**
III	KM Solutions for capture, sharing & applications	KM Processes, KM Systems, Mechanisms & Technologies, Knowledge Capturing Techniques: Brain Storming – Protocol Analysis – Consensus Decision Making – Repertory Grid- Concept Mapping –Blackboarding, Nominal Group Technique, Delphi method. **Self-Learning Topics:** Study various technologies used in KM in industry.	**06**
IV	Knowledge codification	Modes of Knowledge Conversion – Codification Tools and Procedures – Knowledge Developer‘s Skill Sets – System Testing and Deployment – Knowledge Testing –Approaches to Logical Testing, User Acceptance Testing – KM System Deployment Issues – User Training – Post implementation. **Self-Learning Topics:** Study different tools for testing for KM.	**06**
V	Knowledge transfer and sharing	Transfer Methods – Role of the Internet – Knowledge Transfer in e-world – KM System Tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Decision Making Architecture – Data Management – Knowledge Management Protocols – Managing Knowledge Workers. **Self-Learning Topics:** Case study for transfer methods in KM.	**06**

VI	KM Impact	Dimensions of KM Impact – People, Processes, Products & Organizational Performance Factors influencing impact – universalistic & contingency views Assessment of KM Impact – Qualitative & quantitative measures, Identification of appropriate KM solutions, Competing with Business Analytics, Caveats for managing Knowledge and Business Intelligence, Corporate social Responsibility, Ethical Legal and Managerial Issues: PAPA, Security and controls. **Self-Learning Topics:** Case study on KM impact.	**06** **TOTAL:39**

Text Books:

1. Irma Becerra-Fernandez, Avelino Gonzalez, Rajiv Sabherwal (2004). Knowledge Management Challenges, Solutions, and Technologies. Prentice Hall. ISBN: 0-13-109931-0.
2. Elias M. Awad, Hassan M. Ghaziri (2004). Knowledge Management. Prentice Hall. ISBN: 0-13- 034820-1
3. Donald Hislop, Knowledge Management in Organizations, Oxford 2nd Edition. Ian Watson (2002).
4. Shelda Debowski, Knowledge Management, Wiley India Edition
5. Keri E Pearlson, Carol S. Saunders, Strategic Management of Information System, Wiley India Edition
6.

References Books:

1. Madanmohan Rao (2004). Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions. Butterworth-Heinemann. ISBN: 0750678186.
2. Stuart Barnes (Ed.) (2002). Knowledge Management Systems Theory and Practice. Thomson Learning.
3. Kimiz Dalkir, Knowledge Management in Theory and Practice, Elsevier, Butterworth Hinemann.
4. Applying Knowledge Management: Techniques for Building Corporate Memories. Morgan Kaufmann. ISBN: 1558607609.

Online resources:

1. https://onlinecourses.nptel.ac.in/noc19_mg33/preview
2. https://www.udemy.com/course/knowledge-management/
3. https://www.coursehero.com/file/70272191/km-pdf-imppdf/
4. http://cs.unibo.it/~gaspari/www/teaching/slides_KM6.pdf

8) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
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11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
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4	Any three questions out of five needs to be solved.

Course Code:	Course Title	Credit
ITDO8021	User interface Design	3
1)Prerequisite: Software engineering.		
2)Course Objectives:		
1	To stress the importance of good interface design.	
2	To understand the importance of human psychology as well as social and emotional aspect in designing good interfaces.	
3	To learn the techniques of data gathering, establishing requirements, analysis and data interpretation.	
4	To learn the techniques for prototyping and evaluating user experiences.	
5	To understand interaction design process and evaluate design.	
6	To bring out the creativity in each student – build innovative applications that are usable, effective and efficient for intended usersicient or intended users.	
3)Course Outcomes:		
1	Identify and criticize bad features of interface designs.	
2	Predict good features of interface designs.	
3	Illustrate and analyze user needs and formulate user design specifications.	
4	Interpret and evaluate the data collected during the process.	
5	Evaluate designs based on theoretical frameworks and methodological approaches.	
6	Apply better techniques to improve the user interaction design interfaces.	

4) Syllabus

Module	Content	Hrs
Module 1 Introduction to Interaction Design	Good and Poor Design, What is Interaction Design, The User Experience, The Process Of Interaction Design, Interaction Design and the User Experience, Necessity of UI/UX Self-learning Topics: **Study of Various interactive day to day activites with real time case study**	**07**
Module 2 Understanding and Conceptualizing Interaction Cognitive aspects and Social, Emotional Interaction	Understanding the Problem Space and Conceptualizing Design, Conceptual Model, Interface Types, Cognitive aspects, Social Interaction and the Emerging Social Phenomena, Emotions and the User Experience, Expressive and Frustrating Interfaces, Persuasive TechnologiesSelf-learning Topics: Study of Various interactive Interface Types	**05**
Module 3 Data Gathering, Establishing Requirements, Analysis, Interpretation and Presentation	Establishing Requirements, Five Key Issues, Techniques for Data Gathering, **Practical Limitations and ethics in data gathering** and **data analysis** Interpretation and Presentation, Task Description and Task AnalysisSelf-learning Topics: Any case study of how to gather requirements**. Applying these requirements for task description and Task analysis along with data analysis** (eq.BE Project)	**08**
Module 4 Process of Interaction Design, Prototyping, Construction	Interaction Design Process, Prototyping and Conceptual Design, Interface Metaphors and Analogies Self-learning Topics: Study of two websites with usability concepts	**07**
Module 5 Design rules and Industry standards	Design principles, Principles to support Usability, Standards and Guidelines, Golden rules and Heuristics, ISO/IEC standards .The 15 Rules Every UI/UX Designer Should Know .Self-learning Topics: Study experiments on industry standards and design principles. principles.https://xd.adobe.com/ideas/careertips/15-rules-every-ux-designer-know	**07**
Module 6 Evaluation Techniques and Framework	The Why, What, Where and When of Evaluation, Types of Evaluation, case studies, DECIDE Framework, Usability Testing, conducting experiments, Field studies, Heuristic Evaluation and walkthroughs, Predictive models.Self-learning Topics: Evaluation of any GUI with usability principles.	**05**
	Total	**39**

5) Textbooks:	
1	Interaction Design, by J. Preece, Y. Rogers and H. Sharp. ISBN 0-471-49278-7.
2	Human Computer Interaction, by Alan Dix, Janet Finlay, Gregory D Abowd, Russell Beale
3	Alan Cooper, Robert Reimann, David Cronin, ―About Face3: Essentials of Interaction design‖, Wiley publication.
4	Wilbert O. Galitz, ―The Essential Guide to User Interface Design‖, Wiley publication.
6) Reference Books:	
1	The UX Book, by Rex Hartson and Pardha S Pyla
2	Donald A. Norman, ―The design of everyday things‖, Basic books.
3	Jeff Johnson, ―Designing with the mind in mind‖, Morgan Kaufmann Publication.
4	UI Design: Key to captivate User Understanding, by Nilakshi Jain, Dhananjay Kalbande
7) Online references	
1	https://onlinecourses.nptel.ac.in/noc21_ar05/preview
2	https://nptel.ac.in/courses/124/107/124107008/
3	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ar10/
4	https://nptel.ac.in/courses/107/103/107103083/
5	https://www.youtube.com/watch?v=6C2Ye1makdY&list=PLW-zSkCnZ-gD5TDfs1eL5EnH2mQ0f9g6B
5	https://xd.adobe.com/ideas/process

8) Internal Assessment:
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3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

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11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
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Course Code	Course Name	Credit
ITDO8022	Robotics	03

Prerequisite: Mathematical concepts of Geometry, Linear Algebra, Calculus, Basic Electronics

Course Objectives:

Sr.No.	Course Objectives
1	Learn the basic concepts of Robot.
2	Learn the concepts of Kinematics of Robotics.
3	Learn the different types of Actuators and Sensors in Robot Designing.
4	Learn the concepts of Motions, Velocities and Dynamic Analysis of Force.
5	Learn the concepts of Trajectory and Motion Planning.
6	Learn the different Programming Languages to program Robot.

Course Outcomes:

Sr.	Course Outcomes On successful completion, of course, learner/student will be able to:
1	Understand different types of robot, its characteristics and applications.
2	Analyse kinematics parameters of robotic manipulator.
3	Identify actuators, sensors and control of a robot for different applications.
4	Apply the differential relationships of motion, velocities and dynamic analysis of force.
5	Apply the concept of trajectory and motion planning in robot programming.
6	Use robot programming languages and acquire skills to program robots.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Homogenous Coordinate System, Matrix Representation and its Operations, Vector Algebra: Dot and Cross Products, Orthogonal and Orthonormal Vectors	**02**

I	Introduction and Fundamentals of Robotics	Automation and its types, definition of Robotics and a Robot, History of Robotics, Advantages and Disadvantages of Robot, Robotic Manipulators, Robot Motions, Robot Anatomy, Links and Joints, Classification of Robots, Specification of Robot, Applications of Robots **Self-learning Topics:** Robot Coordinate System, Economic and Social Aspects of Robotics	**04**
II	Direct and Inverse Kinematics	Homogeneous transformation matrices, Inverse transformation matrices, Forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg Representation of Forward Kinematic Equations of Robots, The Inverse Kinematic Solution of Robots, Case Studies: Three Axes Planar Articulated Robot Arm (Mini- Drafter) and Four Axes Adept-1 SCARA robot **Self-learning Topics:** Study of Five Axes Rhino XR- Robot Arm and Six Axes Articulated Intelledex 660 Robot Arm	**08**
III	Actuators and Sensors	Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic Devices, Pneumatic Devices, Electric Motors, Magnetostrictive Actuators, Sensor Characteristics, Position Sensors, Velocity Sensors, Acceleration Sensors, Force and Pressure Sensors, Torque Sensors, Light and Infrared Sensors, Touch and Tactile Sensors, Proximity Sensors, Sniff Sensors, Vision Systems, Voice Synthesizer **Self-learning Topics:** Microprocessor Control of Electric Motors, Microswitches, Range Finders, Voice Recognition Devices	**06**
IV	Motions, velocities and dynamic analysis of force	Differential relationship, Jacobian, Differential motions of a frame and robot, Inverse Jacobian, Lagrangian mechanics, Moments of Inertia, Dynamic equations of robots, Transformation of forces and moment between coordinate frames **Self-learning Topics:** Static Force Analysis of Robots	**08**
V	Trajectory and Motion Planning	Trajectory planning, Joint-space trajectory planning, Cartesian-space trajectories, Concept of motion planning, Bug Algorithms – Bug1, Bug2, Tangent Bug **Self-learning Topics:** Case Study based on real life application of motion planning (eg. Chess Game, Robotic Race, etc.)	**05**

VI	Introduction to Robot Programming	Definition of Robot Program, Robot Programming Techniques like Online programming, Lead-through programming, Walk-through programming, Offline programming, Task programming, Motion Programming, Robotic Programming Language: Overview, Requirements for Standard Robot Language, Introduction to Robot Languages like AL, AML, RAIL, RPL, VAL, etc. Self-learning Topics: Example of Robot Program using VAL.	**06** **TOTAL :39**

Text Books:

1. Robert Shilling, ―Fundamentals of Robotics-Analysis and control‖, PHI, 2003.
2. Saeed B. Niku, ―Introduction to Robotics Analysis, Systems, Applications‖,3rd Edition, Wiley, 2019.
3. Saha, S.K., ―Introduction to Robotics‖, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
4. Ashitava Ghoshal, ―Robotics-Fundamental Concepts and Analysis‖, Oxford University Press, Sixth impression, 2010
5. Mukherjee S., ―Robotics Process Automation‖, 1st Edition, Khanna Publishing House, New Delhi, 2020.

References Books:

1. John J. Craig, ―Introduction to Robotics – Mechanics & Control‖, 3rd Edition, Pearson Education, India, 2009
2. Mark W. Spong & M. Vidyasagar, ―Robot Dynamics & Control‖, 2nd Wiley India Pvt. Ltd., 2004
3. Aaron Martinez & Enrique Fernandez, ―Learning ROS for Robotics Programming‖, 1st Edition, Shroff Publishers, 2013
4. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E. Kavraki and Sebastian Thrun, ―Principles of Robot Motion –Theory, Algorithms and Implementations‖, Prentice-Hall of India, 2005
5. Fu, Gonzalez, Lee, ―Robotics: Control, Sensing, Vision and Intelligence‖, 1st Edition, Mc Graw Hill, India.

Online References:

1. https://swayam.gov.in/nc_details/NPTEL
2. https://www.udemy.com/course/robotics-course/
3. https://www.coursera.org/courses?query=robotics

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8.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

10)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment / Question paper solution** (10 marks)

3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code	CourseName	Credit
ITDO8023	ERP	03

Prerequisite: Basics of software.

Course Objectives:

Sr.No.	Course Objectives
1	To learn the basic concepts of ERP.
2	To learn different technologies used in ERP.
3	To learn the concepts of ERP Manufacturing Perspective and ERP Modules.
4	To learn what are the benefits of ERP.
5	To study and understand the ERP life cycle.
6	To learn the different tools used in ERP.

Course Outcomes:

Sr. No	Course Outcomes On successful completion, of course, learner/student will be able to:
1	Understand the basic concepts of ERP.
2	Identify different technologies used in ERP.
3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules.
4	Discuss the benefits of ERP.
5	Understand and implement the ERP life cycle.
6	Apply different tools used in ERP.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Basics of software.	**02**
I	Introduction to ERP	Enterprise – An OverviewIntegrated Management Information, Business Modeling,Integrated Data Model **Self-Learning Topics:** Study of advantages of ERP.	**04**

II	ERP Technologies	Business ProcessingReengineering(BPR), Data Warehousing, Data Mining, On-lineAnalytical Processing(OLAP),Supply Chain Management (SCM),Customer RelationshipManagement(CRM), MIS - Management Information System,DSS - Decision Support System,EIS - Executive InformationSystem **Self-Learning Topics:** Study different ERP technologies.	**06**
III	ERP Manufacturing Perspective and ERP Modules	MRP - Material Requirement Planning, BOM - Bill Of Material, MRP - Manufacturing Resource Planning, DRP – Distributed Requirement Planning, PDM - Product Data Management. Finance, Plant Maintenance, Quality Management, Materials Management. **Self-Learning Topics:** Study different ERP modules.	**08**
IV	Benefits of ERP	Reduction of Lead-Time, On-timeShipment, Reduction in CycleTime, Improved Resource Utilization, Better CustomerSatisfaction, Improved SupplierPerformance, Increased Flexibility,Reduced Quality, Costs, Improved Information Accuracy and Design-making Capability. **Self-Learning Topics:** Study of benefits of ERP for real time application.	**08**
V	ERP Life cycle	Pre-evaluation Screening, PackageEvaluation, Project Planning Phase,Gap Analysis, Reengineering,Configuration, Implementation Team Training, Testing, GoingLive, End-user Training, Post-implementation (Maintenance mode). **Self-Learning Topics:** ERP testing tools.	**05**
VI	E-Commerce to E-business	E-Business structural transformation, Flexible Business Design, Customer Experience, Create the new techo enterprise, New generation e- business leaders, memo to CEO, Empower your customer, Integrate Sales and Service, Integrated Enterprise applications. Enterprise resource planning the E- business Backbone Enterprise architecture, planning, ERP usage in Real world, ERP Implementation. **Self-Learning Topics:** ERP Applications.	**06** **TOTAL: 39**

Text Books:

1. Enterprise Resource Planning - Alexis Leon, Tata McGraw Hill.
2. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
3. Enterprise Resource Planning - Ravi Shankar & S. Jaiswal , Galgotia

References Books:

1. Guide to Planning ERP Application, Annetta Clewwto and Dane Franklin, McGRaw-Hill,1997
2. The SAP R/3 Handbook, Jose Antonio, McGraw – Hill
3. E-Business Network Resource planning using SAP R/3 Baan and Peoplesoft : A PracticalRoadmap For Success By Dr. Ravi Kalakota

Online References:

1. https://www.udemy.com/
2. https://www.sap.com/
3. www.oracle.com

8) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

9) Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	**Content beyond syllabus presentation**	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks

7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

10)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment / Question paper solution** (10 marks)

3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Lab Code	Lab Name	Credit
ITDO8024	Cloud Computing and Services	03

Prerequisite: Computer Network, Operating System.

Course Objectives:

Sr.No	Course Objectives
1	Understand and analyze the basics of cloud computing, service models, deployment models and architecture.
2	Define and understand the concept of virtualization and related technologies.
3	Understand the different cloud computing services and their relevance‘s.
4	Describe the various services provided by Amazon Web Services cloud platform.
5	Understand and analyze the functionality of Openstack cloud platform & Severless computing.
6	Describe the aspects of Security & Privacy in cloud computing.

Course Outcomes:

Sr. No	Course Outcomes
On successful completion, of course, learner/student will be able to:	
1	Explain the basics concepts of cloud computing like service models, deployment models and its architecture.
2	Describe and apply virtualization in cloud computing.
3	Use and Analyze different cloud computing services.
4	Understand and apply various services provided by Amazon Web Services cloud platform.
5	Discuss the functionality of Openstack cloud platform & Severless computing.
6	Recognize and examine the security and privacy concerns in cloud computing.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Concepts of Computer Network, Network Security and Operating System.	**02**
I	Introduction to cloud computing	Introduction to cloud computing, need for cloud computing and its components, cloud & other similar configurations, cloud types: NIST and Cloud Cube Model, characteristics of cloud computing, deployment models, service models, advantages and disadvantages of Cloud Computing.	**06**

		Self-learning Topics: Study the recent trends in cloud computing architectures and related technologies.	
II	Virtualization	Characteristics of virtualized environment, structures of virtualization, implementation levels of virtualization, mechanisms of virtualization, pros and cons of virtualization, virtualization vs cloud computing, Xen and KVM architecture. **Self-learning Topics:** Comparison between different virtualization platforms.	**06**
III	Cloud Computing Services	SPI Model of Cloud computing, Everything as a Service (XaaS): Database as a Service, Storage as a Service, Security as a Service, Collaboration as a Service, Monitoring as a Service, Network as a Service, Disaster Recovery as a service, Identity management as a Service, Analytics as a Service and Backup as a Service. **Self-learning Topics:** Study of different cloud computing platforms providing XaaS services.	**04**
IV	Amazon Web Service Cloud Platform	Introduction to the AWS Cloud, AWS core services by categories. Compute Service: Introduction to EC2, EC2 Instances, EC2 Amazon Machine Images, Instance Types, Instance Lifecycle. Storage Service: Introducing S3, working with Buckets, setting bucket security, S3 event and notification, bucket properties, working with Elastic Block Store Volumes, Object Storage Vs Block Storage, Archives versus backups, Introduction to Glacier. Virtual Private Cloud: Introduction, Subnet, Elastic Network Interfaces, Internet Gateways, Route Tables, Security Groups. CloudWatch:Introduction, CloudWatch Metrics, CloudWatch Alarms. Database as a Service: Introduction to Amazon Relational Database Service (RDS), Database Engines, Database Instance Classes, Backup and Recovery, Non-relational (No-SQL) Databases, Types of Non relational Databases, Introduction to DynamoDB, Features, Partition and Hash Keys. **Self-learning Topics:** Comparison of AWS services with other cloud service platforms like Azure and GCP.	**09**
V	Openstack Cloud platform & Severless Computing	Open source Cloud Platform: Introduction to Openstack cloud platform, Components and modes of Operations, Architecture of Openstack cloud platform. Mobile Cloud Computing: Definition, architecture, benefits and challenges of mobile cloud computing. Serverless Computing: Introduction, Working with Serverless environment,Basics of severless events and functions, AWS Lambda. **Self-learning Topics:** To study different open source cloud computing	**05**

		platforms and compare them based on different XaaS services provided by them.	
VI	Cloud Security & Privacy	What is security, why is it required in cloud computing, Different types of security in cloud, attacks, and vulnerabilities,IaaS security, PaaS security, SaaS security, trust boundary, Audit and reporting. Introduction to Identity and access Management (IAM), IAM Challenges, IAM Definition, IAM Architecture and Practice, Relevant IAM Standards and Protocols for Cloud Services. Privacy: What Is Privacy? What Are the Key Privacy Concerns in the Cloud?, Legal and Regulatory Implications: Laws and Regulations, Governance, Risk, and Compliance (GRC). **Self-learning Topics:** To assess and analyze how the security and privacyis maintained in different cloud computing platforms.	**07** **TOTAL: 39**

Text Books:

1. Cloud computing Bible, Barrie Sosinsky, Wiley publication.
2. Cloud Computing Black Book, Kailash Jayaswal, Jagannath Kallalurchi, Donald J. Houde, Dr. Deven Shah, Dreamtech Press
3. Mastering Cloud Computing, Rajkumar Buyya, MGH publication
4. AWS certified solution Architect, Joe Baron et.al, Cybex publication
5. Cloud Security and Privacy, Tim Mather, Subra Kumaraswamy, and Shahed Latif, O'Reilly Publication.
6. Cloud security: A comprehensive guide to secure cloud computing by ronold L Krutz and Russell Dean Vines, Wiley publication.

Reference Books:

1. Distributed and Cloud Computing From Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey C. Fox, Jack Dongarra, Morgan Kaufmann Publication
2. Cloud Computing for Dummies, Judith Hurwitz, Wiley Publication
3. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'Reilly Publication.
4. Cloud computing security: foundation and challenges, John R Vecca, CRC Press

Online References:

1. https://www.aws.amazon.com

2. https://www.nttel.ac.in

8) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

9) Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	**Content beyond syllabus presentation**	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

10)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment / Question paper solution** (10 marks)

3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code	Course Name	Credits
ILO8011	Project Management	03

Objectives:

1. To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation throughclosure.

Outcomes: Learner will be able to…

1. Apply selection criteria and select an appropriate project from different options.
2. Write work break down structure for a project and develop a schedule based onit.
3. Identify opportunities and threats to the project and decide an approach to deal with them strategically.
4. Use Earned value technique and determine & predict status of theproject.
5. Capture lessons learned during project phases and document them for futurereference

DETAILED SYLLABUS:

Module	Detailed Contents	Hrs
01	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager. Negotiations and resolving conflicts. Project management in various organization structures. PMknowledge areas as per Project Management Institute (PMI).	5
02	**Initiating Projects:** How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	6

03	**Project Planning and Scheduling:** Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart. Introduction to ProjectManagement Information System (PMIS).	**8**
04	**Planning Projects:** Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan. Risk Management in projects: Risk management planning, Risk identification and risk register. Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	**6**
05	**Executing Projects:** Planning monitoring and controlling cycle. Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings. Monitoring and ControllingProjects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit.ProjectContracting Project procurement management, contracting and outsourcing, engaging with all stakeholders of the projects.Team management, communication and project meetings.Monitoring and ControllingProjects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit.ProjectContracting Project procurement management, contracting and outsourcing,	**8**
06	**Project Leadership andEthics:**Introduction to project leadership, ethics in projects.Multicultural and virtual projects. **Closing theProject:**Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6 **TOTAL: 39**

REFERENCES:

1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7thEd.
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed,Project Management Institute PA,USA
3. Gido Clements, Project Management, CengageLearning.
4. Gopalan, Project Management, , WileyIndia
5. Dennis Lock, Project Management, Gower Publishing England, 9 thEd.

8) Internal Assessment:

Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)

Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

9) Continuous Assessment:-

Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	**Content beyond syllabus presentation**	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

10)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment / Question paper solution** (10 marks)

3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code	Course Name	Credits
ILO8012	Finance Management	03

Objectives:

1. Overview of Indian financial system, instruments andmarket
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management
3. Knowledge about sources of finance, capital structure, dividend policy

Outcomes: Learner will be able to…

1. Understand Indian finance system and corporate finance
2. Take investment, finance as well as dividend decisions
3.

DETAILED SYLLABUS:

Module	Detailed Contents	Hrs
01	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. **Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market **Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	06
02	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	06

03	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	**09**
04	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity‘s Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	**10**
05	**Sources of Finance:** Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance. **Capital Structure:** Factors Affecting an Entity‘s Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure	**05**
06	**Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity‘s Dividend Decision; Overview of Dividend Policy Theories and Approaches— Gordon‘s Approach, Walter‘s Approach, andModigliani- Miller Approach	**03** **TOTAL: 39**

REFERENCES:

1. FundamentalsofFinancialManagement,13thEdition(2015)byEugeneF.BrighamandJoelF. Houston; Publisher: Cengage Publications, NewDelhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, NewDelhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education,

NewDelhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, NewDelhi.

8) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

9) Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	**Content beyond syllabus presentation**	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

10)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment / Question paper solution** (10 marks)

3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Course Code	Course Name	Credits
ILO8013	Entrepreneurship Development and Management	03

Objectives:

1. To acquaint with entrepreneurship and management ofbusiness
2. Understand Indian environment forentrepreneurship
3. Idea of EDP,MSME

Outcomes: Learner will be able to…

1. Understand the concept of business plan andownerships
2. Interpret key regulations and legal aspects of entrepreneurship inIndia
3. Understand government policies forentrepreneurs

DETAILED SYLLABUS:

Module	Detailed Contents	Hrs
01	**Overview Of Entrepreneurship:** Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	04
02	**Business Plans And Importance Of Capital To Entrepreneurship:** Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to theEntrepreneur **Entrepreneurship And Business Development:** Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations	09
03	Women‘s Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development forSMEs, case studies, exercises	05

04	**Indian Environment for Entrepreneurship:** key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc	**08**
05	**Effective Management of Business:** Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises,e-Marketing	**08**
06	**Achieving Success In The Small Business:** Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	**05** **TOTAL: 39**

REFERENCES:

1. Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHillCompany
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, NewDelhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, NewDelhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya PublishingHouse
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIMAhmedabad
8. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann PublicationLtd.
9. Kurakto, Entrepreneurship- Principles and Practices, ThomsonPublication
10. Laghu UdyogSamachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

8) Internal Assessment:
Assessment consists of one)Mid Term Test of 20 marks and Continuous Assessment of 20 marks.(Total 40)
Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

9) Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Wins in the event/competition/hackathon	10 marks
3.	**Content beyond syllabus presentation**	10 marks
4.	**Creating Proof of concept /case studies/assignments**	10 marks
5.	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6.	GATE Based Assignment test/Tutorials etc	10 marks
7.	Participation in event/workshop/talk / competition followed by small report and certificate of participation relevant to the subject(in other institutes)	5 marks
8.	Multiple Choice Questions (Quiz)	5 marks

*****For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

10)Rubrics for slow learners:-

1.) Case study, Presentation, group discussion, technical debate on recent trends in the said course (10 marks)

2. Project based Learning and evaluation / **Extra assignment / Question paper solution** (10 marks)

3) **Multiple Choice Questions** (Quiz) (5marks)

4) Literature review of papers/journals (5 marks)

5) Library related work (5 marks)

11)Rubrics for Indirect Assessment :-

1. **Mock Viva**/Practical

2. Skill Enhancement Lecture

3. **Extra Assignments**/lab/lecture

12)End Semester Theory Examination:	
1	Question paper will be of 60 marks
2	Question paper will comprise a total of five questions
3	All question carry 20 marks
4	Any three questions out of five needs to be solved.

Lab Code	Lab Name	Credit
ITL801	**Blockchain Lab**	**1**

1)Prerequisite: : Programming Langauges	
2) Lab Objectives: The course aims:	
1	To develop and deploy smart contracts on local Blockchain
2	To deploy the smart contract on test networks.
3	To deploy and publish smart contracts on Ethereum test network.
4	To design and develop crypto currency.
5	To deploy chain code on permissioned Blockchain
6	To design and develop a Full-fledged DApp using Ethereum/Hyperledger.
3) Lab Outcomes: On successful completion, of course, learner/student will be able to:	
1	Develop and test smart contract on local Blockchain
2	Develop and test smart contract on Ethereum test networks.
3	Write and deploy smart contract using Remix IDE and Metamask
4	Design and develop Cryptocurrency.
5	Write and deploy chain code in Hyperledger Fabric.
6	Develop and test a Full-fledged DApp using Ethereum/Hyperledger.Science.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Java, Python, JavaScript	**02**
I	Local Blockchain	Introduction to Truffle, establishing local Blockchain using Truffle	**02**

		Mini Project: Allocation of the groups	
II	Smart contracts and	Solidity programming language, chain code (Java/JavaScript/Go), deployment on Truffle local	**04**
III	Deployment and publishing smart contracts on Ethereum test network	Ethereum Test networks (Ropsten/Gorelli/Rinkeby), deployment on test networks, Web3.js/Web3.py for interaction with Ethereum smart contract Mini Project: Topic validation and finalizing software requirements	**04**
IV	Remix IDE and Metamask	Smart contract development and deployment using Metamask and Remix Design and develop Crypto currency Mini Project: Study the required programming language for smart contract	**04**
V	Chain code deployment in Hyperledger Fabric	Chain code deployment in Hyperledger fabric Mini project: Study required front end tools	**04**
VI	Mini-project on Design and Development of a DApps using Ethereum/Hyperled g er Fabric	Implementation of Mini Project 1. Design, configure and testing of mini project 2. Report submission as per guidelines	**06** **TOTAL: 26**

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)	
Sr. No.	**Name of the Experiment**
1*	Write a Python program to understand SHA and Cryptography in Blockchain, Merkle root tree hash
2*	Creation of account in Metamask, Transfer of Amount/Cryptocurrency from one account to another
3*	Study of Block, different parameters of a block, different Blockchain networks, Bitcoin and Ethereum
4	Create a Blockchain using Python
5*	Creation and Deployment of Smart Contract and Transactions using Solidity and Remix IDE.
6*	Introduction to Truffle, Establish local blockchain using Truffle and deployment of Smart Contract
7*	Lab on ERC tokens
8*	Mini Project - Use Case to be implemented on blockchain (Problem Statement, Objective, Literature Survey, proposed Solution, Block Diagram/Flow chart)
9*	Chain code deployment in Hyper ledger fabric

5) Useful Links:	
1	https://trufflesuite.com/
2	https://metamask.io/
3	https://remix.ethereum.org/

4	https://www.hyperledger.org/use/fabric

6) Term Work:	
1	Term Work shall consist of at least 12 Practical based on the above list. **Also, Term work Journal must include at least 2 assignments.** Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks (Mini Project) +05 Marks (Attendance)
7) Continuous assessment exam	
1	Experiment submission on time
2	Explanation/Concepts
3	Algorithm implementation
4	Presentation/Analysis
5	Performance/Documentation

Lab Code	Lab Name	Credit
ITL802	**Cloud Computing**	**1**

1)Prerequisite: The Lab experiments aims:	
2)Lab Objectives:	
1	To make students familiar with key concepts of virtualization.
2	To make students familiar with various deployment models of cloud such as private, public,hybrid and community.
3	To understand the using and adopting appropriate type of cloud for their application.
4	To make students familiar with various service models such as IaaS, SaaS, PaaS, Security as a Service (SECaaS) and Database as a Service.
5	Apply the different service models for the application.
6	To make students familiar with security and privacy issues in cloud computing and how to address them.
3)Lab Outcomes: On successful completion, of course, learner/student will be able to:	
1	To make students familiar with security and privacy issues in cloud computing and how to address them.
2	Analyze various cloud computing service models and implement them to solve the given problems.
3	Design and develop real world web applications and deploy them on commercial cloud(s).
4	Explain major security issues in the cloud and mechanisms to address them.
5	Explore various commercially available cloud services and recommend the appropriate one for the given application.
6	Implement the concept of containerization.

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	DBMS, Programming Language.	**02**
I	Overview& Virtualization.	Introduction and overview of cloud computing. Hosted Virtualization using KVM. Lab1: To study and implement Hosted Virtualization using Virtual Box &KVM. Lab2: To study and Implement Bare-metal Virtualization using Xen,HyperVor VMwareEsxi.	**04**
II	Infrastructure Services.	To study the infrastructure services using different cloud platform Lab3: To study and Implement Infrastructure as a Service usingAWS/MicrosoftAzure/Google cloud platform	**04**
III	Platform Services	To study the different platform services. Lab4: To study and Implement Platform as a Service using AWS Elastic Beanstalk/Microsoft AzureApp Service.	**03**
IV	Cloud Services	IaaS,PaaS,STaaS,DbaaS,IAMandSecurity as a Service on AWS andAzure. Lab5:To study and Implement Security as a Service on AWS/Azure. Lab6:To study and implement Identity and Access Management(IAM) practices on AWS/Azurecloud.	**04**
V	Storage Services	To study the storage services using Docker. Lab7: To study and Implement Storage as a Service using OwnCloud/AWSS3, Glaciers/ AzureStorage. Lab8:To study and Implement Database as a Service on SQL/NOSQLdatabases like AWSRDS,AZURE SQL/MongoDBLab/Firebase. Lab9: To study and Implement Containerization using Dockeron AWS/Azure/Google cloud platform**.**	**04**
VI	Kubermetes	Introduction and overview of Kubernetes. Lab10: To study and implement container orchestration using Kubernetes on AWS/Azure/Google cloud platform	**05** **TOTAL: 26**

4)Suggested Experiments: (minimum number of experiments to be completed can be specified)	
Sr. No.	**Name of the Experiment**
1	Overview & Virtualization: Introduction and overview of cloudcomputing. Hosted Virtualization using KVM. Lab1: To study and implement Hosted Virtualization usingVirtual Box & KVM. Lab2: To study and Implement Bare-metal Virtualization using Xen, HyperV or VMware Esxi.
2	Infrastructure Services: To study the infrastructure services using different cloud platform Lab3: To study and Implement Infrastructure as a Service usingAWS/Microsoft Azure/Google cloud platform
3	Platform Services:To study the different platform services. Lab4: To study and Implement Platform as a Service using AWS Elastic Beanstalk/ Microsoft Azure App Service.
4	Cloud Services:IaaS, PaaS, STaaS, DbaaS, IAM andSecurity as a Service on AWS and Azure. Lab5: To study and Implement Security as a Service onAWS/Azure. Lab6: To study and implement Identity and Access Management (IAM) practices on AWS/Azure
5	Storage Services:To study the storage services using Docker. Lab7: To study and Implement Storage as a Service using Own Cloud/ AWS S3, Glaciers/Azure Storage. Lab8: To study and Implement Database as a Service on SQL/NOSQL databases like AWS RDS, AZURE SQL/MongoDB Lab/ Firebase. Lab9: To study and Implement Containerization using Docker on AWS/Azure/Google cloud platform.
6	Kubermetes:Introduction and overview of Kubernetes. Lab10: To study and implement container orchestration using Kubernetes on AWS/Azure/Google cloud platform

5)Useful Links:	
1	https://phoenixnap.com/kb/ubuntu-install- kvm\
2	NIST Cloud Computing Security Reference Architecture
3	https://docs.citrix.com/en-us/xenserver/7- 1/install.html
4	https://docs.aws.amazon.com
5	https://docs.microsoft.com/en-us/azure
6	https://docs.docker.com/get-started/
7	https://kubernetes.io/docs/home/

6) Term Work:	
1	Term Work shall consist of at least 10 Practical based on the above list, but not limited to. 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)
7) Continuous assessment exam:	
1.	Timely Submission of Experiments weekwise
2.	Explanation/concept
3.	Algorithm/implementation:
4.	Analysis
5.	Documentation/Performance:

Course Code	Course Name	Credits
ITP701	Major Project – II	06

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 fundamentalsto 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 Major 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 shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of major project-I and major project-II.
- 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 major project -I & II 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 VESIT.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship

quality development within the students through the Major Project, 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. Major Project-I in semester VIIand Major Project-II in semesters VIII.

- However, based on the individual students or group capability, with the mentor‘s recommendations, if the proposed Major Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to Scopus paper publications in Journal/Conference or Copyright or Patent as an extension of the Major Project-1 with suitable improvements/modifications after testing and analysis in even semester. This policy can be adopted on case by case basis.

Guidelines for Assessment of Major Project:

Term Work

1. The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of major project to be evaluated on continuous basis, minimum two reviews in each semester VII and VIII.
2. 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.
3. Distribution of Term work marks for both semesters shall be as below;
    a. Marks awarded by guide/supervisor based on log book : 10
    b. Marks awarded by review committee 10
    c. Quality of Project report 05

Review/progress monitoring committee may consider following points for assessment based on either one year major project as mentioned in general guidelines.

One-year project:

- In semester VII entire theoretical solution shall be ready, including components/system selection and cost analysis, building of working prototype. Two reviews will be conducted based on presentation given by students group.
    - First shall be for finalization of problem and proposed solution of the problem
    - Second shall be on readiness of working and testing of prototypeto be conducted.
- In semester VIII expected work shall be procurement of testing and validation of results based on work completed in an odd semester.
    - First review is based on improvements in testing and validation results cum demonstration for publication to be conducted.
    - Second review shall be based on paper presentation in conference/journal or motivate for copyright or Indian patent in last month of the said semester.

Assessment criteria of Major Project.

Major 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.

Guidelines for Assessment of Major Project Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the VESIT.
- Major 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 organizations 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 Scopus Conferences/Journals or copy right or Indian Patent.

Major 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
9. Publications in Sem VIII.