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 Techniques	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:** Case 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 5.1 Premises,Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment. 5.2 Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	**05**
06	6.1 Introduction 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-computing/

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.

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
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)
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
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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 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:

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
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

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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Sr.no	Rubrics	Marks
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3.	**Content beyond syllabus presentation**	10 marks
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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	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/Hyperledg er Fabric	Implementation of Mini Project 1. Design, configure and testing of mini project 2. Report submission as per guidelines	**06** **TOTAL: 26**

Sr. No.	Name of the Experiment
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**

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