UNIVERSITY OF KERALA

Syllabus For B.Tech INFORMATION TECHNOLOGY

2020 SCHEME

SEMESTER VII

SEMESTER VII

SLOT	**Course No.**	**COURSES**	**L-T-P**	**Hours**	**Credit**
A	ITT401	DATA ANALYTICS	2-1-0	3	3
B	ITTXXX	PROGRAM ELECTIVE – II	2-1-0	3	3
C	ITTXXX	OPEN ELECTIVE	2-1-0	3	3
D	MCN401	INDUSTRIAL SAFETY ENGINEERING	2-1-0	3	-
S	ITL411	DATA ANALYTICS LAB	0-0-3	3	2
T	ITQ413	SEMINAR	0-0-3	3	2
U	ITD415	PROJECT PHASE I	0-0-6	6	2
R\M/H	VAC	Remedial/Minor/Honors course	3-1-0	4*	4
	TOTAL			**28**	**15/19**

PROGRAM ELECTIVE II

SLOT	Course No.	COURSES	L-T-P	Hours	Credit
B	ITT413	MOBILE COMPUTING	2-1-0	3	3
	ITT423	ARTIFICIAL INTELLIGENCE	2-1-0		
	ITT433	OBJECT ORIENTED MODELING AND DESIGN	2-1-0		
	ITT443	ADVANCED DATABASE MANAGEMENT SYSTEMS	2-1-0		
	ITT453	MACHINE LEARNING	2-1-0		
	ITT463	OPTIMIZATION AND METAHEURISTICS	2-1-0		
	ITT473	PROBABILISTIC AND STOCHASTIC MODELLING	2-1-0		

OPEN ELECTIVE (OE)

The open elective is offered in semester 7. Each program should specify the courses (maximum 5) they would like to offer as electives for other programs. The courses listed below are offered by the Department of INFORMATION TECHNOLOGY for students of other undergraduate branches under University of Kerala.

SLOT	Course No.	COURSES	L-T-P	Hours	Credit
C	ITT415	WEB DESIGNING	2-1-0	3	3
	ITT425	MULTIMEDIA TECHNIQUES	2-1-0	3	3
	ITT435	FREE AND OPEN SOURCE SOFTWARE	2-1-0	3	3
	ITT445	MOBILE APPLICATION DEVELOPMENT	2-1-0	3	3

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT401	DATA ANALYTICS	PCC	2	1	0	3

Preamble: This course will equip the learners with the popular technologies used in gathering, storing, manipulating, and analyzing big data. It is designed in such a way that the students will get an exposure to the analytic concepts from basic level to the advanced level.

Prerequisites:

- ITT201 - Data Structures
- ITT 206 - Database Management Systems
- MAT 208 - Probability, Statistics and Advanced Graph theory
- ITT 306 - Data Science

Course Outcomes: After completion of the course the student will be able to:

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe the introductory concepts of data analytics; integrate statistical learning into data analytic processing and tools	Level 2: Understand
CO 2	Summarize the big data concepts, methods, tools and applications; explain the evolution of NoSQL with popular NoSQL products like MongoDB	Level 3: Apply
CO 3	Illustrate the ideas of distributed processing with Hadoop, MapReduce paradigm and related projects namely HBase, Spark, YARN, Hive and Pig	Level 2: Understand
CO 4	Experiment with R language to perform data exploration, wrangling and modelling	Level 3: Apply
CO 5	Analyze how big data techniques could be used in diverse application domains of real world	Level 4: Analyze

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	-	-	-	-	-	-	-	2
CO 2	2	3	3	2	3	-	-	-	-	-	-	2
CO 3	2	2	2	2	3	-	-	-	-	-	-	2
CO 4	2	3	3	3	3	2	-	-	-	2	-	3
CO 5	2	3	3	3	-	3	3	-	-	2	-	3

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	20	15	35
Level 3: Apply	20	15	35
Level 4: Analyse	0	10	10
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Define data analytics.
2. Describe the different types of data analytics with examples.
3. Illustrate data analytics life cycle.
4. Explain different statistical evaluation methods or tests.

Course Outcome 2 (CO 2):

1. Define big data.
2. List the characteristics of big data and different technologies related to it.
3. Explain the tools NoSQL and MongoDB.
4. Explain how MongoDB can be applied to create, update, and delete documents.

Course Outcome 3 (CO 3):

1. Describe the HDFS framework and interface.
2. Outline the Pig and Hive architecture.
3. Illustrate the anatomy of a YARN application.
4. Compare HBase and Hive.

Course Outcome 4 (CO 4):

1. Explain the basic programming concepts in R.
2. Summarize how ggplot2 and dplyr are applied in visualization of R.
3. List the methods of exploratory data analysis.
4. Explore the ways of tidying data.

Course Outcome 5 (CO 5):

1. Discuss Recommender Systems and its types in detail with a case study of Netflix.
2. Analyze Facebook data to do a case study on citizen centric public services.
3. Analyze uplift modelling with a case study on student dropout in higher education.

Model Question Paper

Course Code: ITT401

Course Name: Data Analytics

Max.Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. What is the relationship between BI and data science?
2. Differentiate between descriptive analytics and predictive analytics.
3. What are the steps involved in big data acquisition?
4. Define web data analysis.
5. Draw the architecture of Hive and explain the services provided by it.
6. How does data flow among clients that interact in HDFS?
7. What is the significance of functions gather() and spread() in tidying data? Illustrate with an example.
8. What does geom_ref_line() do? What package does it come from? Why is displaying a reference line in plots that show residuals useful and important?
9. What do you mean by hybrid filtering? What are the advantages?
10. What are the tools used in social media analytics?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11	a	With a diagram, explain the various phases of Data Analytics Lifecycle.	10
	b	What is the significance of ANOVA?	4

OR

12	a	Describe the following resampling techniques: (i)Cross-Validation (ii) Bootstrapping	10
	b	Explain any method to test the difference in sample means of two populations.	4
13	a	Explain the process of data pre-processing in big data acquisition.	8
	b	Write a review about moving data into and out of the database in MongoDB.	6

OR

14	a	How is cloud computing and IoT related to big data?	8
	b	Define NoSQL. Explain Key value data stores.	6
15	a	Explain the role of MapReduce in Hadoop with a suitable example.	9
	b	Describe Spark with an example.	5

OR

16	a	Explain the architecture of HDFS. Discuss on how the MapReduce 7 framework is modified using YARN.	
	b	Discuss on how the MapReduce framework is modified using YARN.	7
17	a	Define ggplot2. What are the features provided by ggplot2?What are the 8 problems faced while using ggplot2 and how can we overcome them?	
	b	Write the R code to import a .csv file, examine its contents and generate its descriptive statistcs	6

OR

18	a.	With examples, illustrate how these R functions help in data analysis. □ filter() □ arrange() □ summarize() □ mutate() □ select()	14
19	a	Explain the insights for using social media as a platform to improve government–citizen interaction.	9
	b	Explain different types of recommender systems.	5

OR

20	a	Analyze uplift modelling with an appropriate example.	7
	b	Elaborate on recommender systems with Netflix application.	7

Syllabus

Module 1: Introduction and statistics for data analytics (7 hours)

Introduction and evolution of data analytics - Types of data analytics - Data analytics life cycle - Statistical methods for evaluation – Resampling

Module 2: Big data, IoT, NoSQL technologies (8 hours)

Introduction to big data, Related Technologies- Cloud computing, IoT, Big data generation, Big data acquisition, Big data analysis- methods and tools,Big data applications
Non-relational databases -MongoDB

Module 3: Big data processing – Hadoop, Spark, Hive, Pig (8 hours)

Hadoop, HDFS and MR, HBase, Spark, YARN, Hive, Pig

Module 4:R programming for data analytics (7 hours)

R programming basics for data analytics, data import and export, visualization, transformation, exploratory analysis, tidying, modelling

Module 5: Popular data analytics case studies (5 hours)

Recommender systems, social media analytics , churn prediction and uplift modeling with appropriate case studies

Text Books

1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley Publishing(1st. ed.). 2015.
2. Thomas Erl, Wajid Khattak, and Paul Buhler. Big Data Fundamentals: Concepts, Drivers &Techniques. Prentice Hall Press, USA.(1st. ed.). 2016.
3. Michael Berthold and David J. Hand. Intelligent Data Analysis: An Introduction Springer-Verlag, Berlin, Heidelberg.(1st. ed.). 1999.
4. Min Chen, Shiwen Mao, Yin Zhang, and Victor C. M. Leung. Big Data: Related Technologies, Challenges and Future Prospects. Springer Publishing Company, Incorporated.2014.
5. Shashank Tiwari. Professional NoSQL.Wrox Press Ltd., GBR. 2011.
6. Kristina Chodorow and Michael Dirolf. Mongo DB: The Definitive Guide. O'Reilly Media, Inc. (1st. ed.). 2010.
7. Tom White. Hadoop: The Definitive Guide. O'Reilly Media, Inc.(4th. ed.). 2015.
8. Hadley Wickham and Garrett Grolemund. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. O'Reilly Media, Inc.(1st. ed.). 2017.
9. Bart Baesens. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications. Wiley Publishing.(1st. ed.). 2014.

References

1. Michael Minelli, Michele Chambers, and AmbigaDhiraj. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses. Wiley Publishing.(Wiley CIO) (1st. ed.). 2013.
2. EelcoPlugge, Tim Hawkins, and Peter Membrey. The Definitive Guide to MongoDB: The NoSQL Database for Cloud and Desktop Computing. Apress, USA. (1st. ed.). 2010.
3. Joe Celko. Joe Celko's Complete Guide to NoSQL: What Every SQL Professional Needs to Know about Non-Relational Databases. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA. (1st. ed.). 2013.
4. Benjamin Bengfort and Jenny Kim. Data Analytics with Hadoop: An Introduction for Data Scientists. O'Reilly Media, Inc. (1st. ed.). 2016.
5. Brett Lantz. Machine Learning with R. Packt Publishing. (2nd. ed.). 2015.
6. The R Manuals - https://cran.r-project.org/manuals.html
7. Carlos A. Gomez-Uribe and Neil Hunt. (2016). *The Netflix Recommender System: Algorithms, Business Value, and Innovation*. ACM Trans. Manage. Inf. Syst. 6, 4, Article 13 (January 2016), 19 pages. DOI:https://doi.org/10.1145/2843948
8. Chicago Reddick, C., Chatfield, A., &Ojo, A. (2017). *A social media text analytics framework for double-loop learning for citizen-centric public services*: A case study of a local government Facebook use. Gov. Inf. Q., 34, 110-125.
9. Diego Olaya, Jonathan Vásquez, Sebastián Maldonado, Jaime Miranda, WouterVerbeke, *Uplift Modeling for preventing student dropout in higher education*,Decision Support Systems,Volume 134, 2020,113320, ISSN 0167-9236,https://doi.org/10.1016/j.dss.2020.113320.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Introduction and statistics for data analytics**	**7 Hours**
1.1	Introduction and evolution of data analytics (Text1: 1.1, 1.1.2, 1.2)	1
1.2	Data Analytics Lifecycle (Text1: 2.1 -2.7)	1
1.3	Types of data analytics (descriptive, prescriptive, predictive, diagnostic) (Text2: 1)	1
1.4	Statistical Methods for Evaluation (Text1: 3.3)	2

1.5	Resampling (Text3: 2.6)	2
2	**Big data, IoT, NoSQL technologies**	**8 Hours**
2.1	Introduction to big data-Definition, features and challenges (Text4:Ch.1)	1
2.2	Related Technologies-Cloud computing and IoT(Text4:Ch.2- 2.1,2.2)	1
2.3	Big data Generation and Acquisition(Text4:Ch.3 – 3.1,3.2)	1
2.4	Big data analysis - (Text4:Ch.5 - 5.2, 5.3, 5.4)	1
2.5	Big data applications (Text4:Ch.6 - 6.2)	1
2.6	NoSQL:introduction and need for NoSQL, column oriented stores, key-value stores, document databases and graph databases (Text5:Ch.1)	1
2.7	MongoDB features , database, collection, documents, data types, configuration, shell,(Text6:Ch.1, 2)	1
2.8	Creating, updating, and deleting documents ,Querying (Text6:Ch.3,4)	1
3	**Big data processing – Hadoop, Spark, Hive, Pig**	**8 Hours**
3.1	What is Hadoop, brief history of Hadoop, comparison with other systems (Text7:Ch.1)	1
3.2	MapReduce data flow, weather dataset example (Text7:Ch.2)	1
3.3	Hadoop Distributed File System (HDFS) concepts, basic commands, HDFS Java interface (Text7:Ch. 3)	1
3.4	HBase (Text7:Ch.17)	1
3.5	YARN, anatomy of a YARN application, scheduling (Text7:Ch. 4)	1
3.6	Pig Latin language, running an example, comparison with databases (Text7:Ch. 16)	1
3.7	Hive data warehousing, shell, running an example, Hive architecture, comparison with databases (Text7:Ch. 17)	1
3.8	Spark framework, example, anatomy of a SPARK job run (Text7:Ch.19)	1
4	**R programming for data analytics**	**7 Hours**
4.1	R programming: basics (Text8: Ch.1)	1
4.2	Data visualization with ggplot2 (Text8: Ch.1)	1
4.3	Data transformation with dplyr (Text8: Ch.3)	1
4.4	Exploratory data analysis in R (Text8: Ch.5)	1.5
4.5	Tidy data with tidyr (Text8: Ch.9)	1.5
4.6	Modelling (Text8: Ch. 18)	1
5	**Popular data analytics case studies**	**5 Hours**

5.1	Recommender system, types (Text9: Ch.8)	1
5.2	Case study: Netflix Recommender system (Ref.7)	1
5.3	Social media analytics: current trends, tools (Text9: Ch.8)	1
5.4	Social media analytics for citizen-centric public services: a case study of a local government Facebook use (Ref.8)	1
5.5	Churn prediction (Text9: Ch.8) Uplift modelling Case study: Uplift Modeling for preventing student dropout in higher education (Ref.9)	1

SEMESTER VII

PROGRAM ELECTIVE II

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT413	MOBILE COMPUTING	PEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates

1. To impart an understanding of basic concepts of cellular mobile communication.
2. To get an awareness of different mobile communication systems.
3. To introduce mobile network layer and mobile transport layer services.
4. To introduce support for mobility in wireless environments.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basic concepts in cellular mobile systems and its design.	Level 2: Understand
CO 2	Summarize telecommunication systems, broadcast systems, and satellite systems.	Level 2: Understand
CO 3	Compare wireless standards such as IEEE 802.11, HIPERLAN and Bluetooth.	Level 2: Understand
CO 4	Discuss mobile network layer concepts such as mobile IP, DHCP and MANET.	Level 2: Understand
CO 5	Explain the concepts of mobile transport layer and support for mobility.	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	-	-	-	-	-	-	-	-	2
CO 2	3	1	-	-	-	-	-	-	-	-	-	2
CO 3	3	2	2	-	-	-	-	-	-	-	-	2
CO 4	3	-	2	-	-	-	-	-	-	-	-	2
CO 5	3	1	1	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	35	35	70
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain cellular systems.

2. Discuss co-channel interference.

3. Define MAC.

Course Outcome 2 (CO2)

1. Compare digital audio broadcasting and digital video broadcasting.

2. List the objectives of IMT-2000

3. Explain DECT protocol architecture.

C**ourse Outcome 3(CO3):**

1. Explain IEEE802.11 system architecture.
2. Describe WATM services.
3. Compare HIPERLAN1 and HIPERLAN 2.

C**ourse Outcome 4(CO4):**

1. Explain agent advertisement and discovery.
2. Differentiate tunnelling and encapsulation.
3. Distinguish between DSDV and DSR.

Course Outcome 5 (CO5):

1. Compare traditional TCP and improved TCP concepts.
2. Explain selective retransmission.
3. List the functions of WSP.

Model Question Paper

Course Code: ITT413

Course Name: MOBILE COMPUTING

Max. Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1	Identify the need for frequency reuse.
2	What are dropped calls? Explain.
3	List the features of GEO, LEO, MEO.
4	Summarize mobile services in GSM.
5	Distinguish between FHSS and DSSS.
6	Describe MAC frame fields.
7	Discuss entities and terminologies used in mobile IP.

8		Explain DHCP.	
9		Summarize approaches to support wireless access.	
10		Detail working of snooping TCP.	

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11	**a**	Compare generations of mobile networks.	10
	b	Write the limitations of conventional mobile systems.	4
		OR	
12	**a**	Differentiate FDMA and TDMA.	6
	b	Explain any two types of handoffs.	8
13		Describe GSM system architecture.	14
		OR	
14		Explain GPRS protocol architecture.	14
15	**a**	Explain infrastructure based architecture of IEEE802.11.	6
	b	Describe distributed foundation wireless MAC using polling.	8
		OR	
16	**a**	Explain Bluetooth protocol architecture.	8
	b	What is WATM? Discuss its importance.	6
17	**a**	Discuss the goals and requirements of mobile IP.	4
	b	Illustrate IP packet delivery.	10
		OR	
18	**a**	Identify MANET security issues.	6
	b	Explain any one MANET routing algorithm.	8
19		Discuss traditional TCP challenges.	14
		OR	
20	**a**	Explain WAP architecture.	9
	b	List the importance, functions and advantages of WTLS.	5

Syllabus

Module 1: Introduction to Cellular Systems (7 Hours)

Introduction to mobile systems, Limitations of conventional system, Basic cellular mobile system- Analog and digital cellular systems, 1G,2G,3G,4G and 5G cellular systems, Cellular radio system design- Frequency reuse, Co-channel interference.

Medium access control- MAC, SDMA, FDMA, TDMA, CDMA, Handoffs and dropped calls- Initiation of handoff, Types of handoffs- Power difference, Mobile assisted, Cell-site, Intersystem.

Module 2: Communication Systems-I (7 Hours)

Telecommunication systems: GSM, System architecture, Protocol, Localization and calling, GPRS- System architecture, Protocol architecture, DECT- System architecture, Protocol architecture, IMT-2000- Basic concepts and Objectives.

Broadcast systems: Digital audio and video broadcasting.

Satellite Systems: GEO, LEO, MEO.

Module 3: Communication Systems-II (7 Hours)

Wireless systems: IEEE 802.11-Architecture, Physical and MAC layer, HIPERLAN-HIPERLAN1, HIPERLAN2, WATM, Bluetooth- Architecture, protocol stack.

Module 4: Mobile Network Layer (7 Hours)

Mobile IP- Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunnelling and encapsulation, Optimizations.

Dynamic Host Configuration Protocol (DHCP), Mobile Ad-hoc Networks (MANETs)- Features, Routing, Routing algorithms-DSDV, DSR, MANET Security issues.

Module 5: Mobile Transport Layer (7 Hours)

Traditional TCP, Classical TCP improvements-Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.

Support for mobility-WWW, WAP.

Text Books

1. Jochen Schiller, Mobile Communications, Pearson Education, Second Edition.

Reference Books

1. C.K.Toh, AdHoc Mobile Wireless Networks, Pearson Education, First Edition.
2. William Stallings, Wireless Communications and Networks, Pearson Education, 2e.
3. Kaveh Pahlavan, Prasanth Krishnamoorthy, Principles of Wireless Networks, Pearson Education.
4. Theodore S. Rappaport, Wireless Communications: Principles and Practice, Pearson Education, 2/e, 2010.
5. William C.Y Lee, Mobile Cellular Telecommunications, McGraw Hill International Editions, 1995.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module1: Introduction to Cellular Systems**	**7 Hours**
1.1	Introduction to mobile systems, Limitations of conventional system, Basic cellular mobile system.	1
1.2	Analog and digital cellular systems, 1G,2G,3G,4G and 5G cellular systems (Comparison only).	1
1.3	Cellular radio system design- Frequency reuse, Co-channel interference.	1
1.4	Medium access control- MAC.	1
1.5	SDMA, FDMA, TDMA, CDMA (Concepts and comparison).	1
1.6	Handoffs and dropped calls- Initiation of handoff, Types of handoffs- Power difference, Mobile assisted, Cell-site, Intersystem.	2
2	**Module 2: Communication Systems-I**	**7 Hours**
2.1	Telecommunication systems: GSM, System architecture, Protocol, Localization and calling.	2
2.2	GPRS- System architecture, Protocol architecture.	1
2.3	DECT- System architecture, Protocol architecture.	1
2.4	IMT-2000- Basic concepts and Objectives.	1
2.5	Broadcast systems: Digital audio and video broadcasting.	1
2.6	Satellite systems – GEO, LEO and MEO.	1
3	**Module 3: Communication Systems-II**	**7 Hours**
3.1	Wireless systems: IEEE 802.11- System architecture and Protocol architecture.	1
3.2	Physical layer-FHSS, DSSS, Infrared.	1
3.3	MAC layer-DFWMAC using CSMA/CA, RTS/CTS, Polling, MAC frames.	2
3.4	HIPERLAN-History, HIPERLAN1, HIPERLAN2 (Only comparison with HIPERLAN 1).	1
3.5	WATM-Motivation, WATM Services.	1
3.6	Bluetooth- Architecture, protocol stack.	1

4	**Module 4: Mobile Network Layer**	**7 Hours**
4.1	Mobile IP: Goals, assumptions and requirements, Entities and terminology.	1
4.2	IP packet delivery, Agent advertisement and discovery.	1
4.3	Registration, Tunnelling and encapsulation, Optimizations.	1
4.4	Dynamic Host Configuration Protocol (DHCP).	1
4.5	Mobile Ad-hoc Networks (MANETs)-Features, Routing- Routing algorithms-DSDV, DSR.	2
4.6	MANET Security issues.	1
5	**Module 5: Mobile Transport Layer**	**7 Hours**
5.1	Traditional TCP: Congestion control, slow start, Fast retransmit/fast recovery, Implications of mobility.	1
5.2	Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP.	1
5.3	Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.	2
5.4	WWW- HTML, HTTP, Wireless access approaches, Architecture.	1
5.5	WAP-Architecture, Protocols-WDP, WTLS, WTP, WSP, WAE (Its functions and advantages only).	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT423	ARTIFICIAL INTELLIGENCE	PEC	2	1	0	3

Preamble: Artificial Intelligence is an elective course for the IT Engineering Graduates. The syllabus is prepared with an aim to emphasize concepts of Artificial Intelligence that solves general problems with the help of search techniques, inferred knowledge, reasoning and learning in discovering decision making information from knowledgebase. It also give emphasis on neural network and expert systems to optimize human effort overall.

Prerequisite: ITT201 Data Structures, ITT304 Algorithm Analysis and Design

Course Outcomes: After the completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the fundamental foundations of artificial intelligence (AI) and familiarize with the search terminologies and uninformed search.	Level 2: Understand
CO 2	Demonstrate various informed search methods to solve AI application problems.	Level 3: Apply
CO 3	Illustrate the concepts of knowledge representation through logics, inference rules and deduce solutions using the principle of resolution.	Level 3: Apply
CO 4	Explain the concept of learning and explore uncertainty with probabilistic reasoning.	Level 2: Understand
CO 5	Describe the basics of neural network and the concepts of expert systems.	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	-	-	-	-	-	-	-	1
CO 2	3	3	3	1	-	-	-	-	-	-	-	1
CO 3	3	2	2	1	-	-	-	-	-	-	-	1
CO 4	3	2	2	2	-	-	-	-	-	-	-	1
CO 5	2	1	2	1	1	1	-	-	-	-	-	1

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	10
Understand	20	35	60
Apply	25	10	30
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. **Part A** contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. **Part B** contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define Artificial Intelligence based on its application.
2. Mention different types of agents and its environment.
3. Explain production system and rules to solve AI problems.
4. State the search terminologies used to compare different algorithms.
5. Compare all uninformed search based on time and space complexity, optimality and completeness.
6. State the procedure to solve AI problem with the help of uninformed search.

Course Outcome 2 (CO2):

1. Explain the significance of informed search over uninformed search.
2. Apply heuristics search methods to solve game playing problems.
3. Demonstrate problem reduction with AND-OR graphs.
4. Explain constraint satisfaction problem. Solve crypt arithmetic problem.
   CROSS+ROADS = DANGER
5. State the application of hill climbing algorithms.
6. Write the algorithm for the Min-Max with two play game example.
7. How alpha-beta pruning method does reduce the search for the chess game?
   Demonstrate by making partial tree for the same.

Course Outcome 3 (CO3):

1. What are the different types of Knowledge?
2. Explain Knowledge Based System.
3. Consider the following facts:
   a. X married to Y
   b. P is Q's brother
   c. The spouse of every married person in the club is also a member of the club.
   d. X,P,Y,Q are all members of the club. Prove by resolution that "Elder is not married".
4. Differentiate between frames and semantic nets to represent knowledge.
5. How can we represent facts in propositional Logic?
6. State all inference rules in FOPL.
7. Give one example to convert the Wff's in to a clausal form.
8. What is forward chaining and backward chaining?

Course Outcome 4 (CO4):

1. Define Inductive learning.
2. Differentiate Learning from taking advice and learning in problem solving.
3. Explain concept learning.
4. Define version space?
5. Explain convergence in version space using Candidate Elimination algorithm.
6. Give an example of decision tree.

Course Outcome 5 (CO5):

1. What is Artificial Neural Network?
2. What are the various steps of Natural Language Processing?
3. Define Expert System and explain briefly its components.
4. What are the used to make expert system?
5. State the application of Expert system.

Model Question Paper

Course Code: ITT423

Course Name: ARTIFICIAL INTELLIGENCE

Max. Marks: 100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Explain the significance of AI applications.
2. List four search strategies used to compare AI algorithms. Give one example.
3. State two heuristic methods to solve Tic-Tac-Toe problem.
4. How simulated annealing helps to overcome the drawbacks of hill climbing?
5. Determine whether the given sentence is satisfiable, contradictory or valid.
   S: (P ∧ Q) V ~ (P ∧Q)
6. Given∀ formulas S1 and S2 below, show that Q(a) is a logical consequence of the two. S1: (x) (P(x) → Q(x)) S2: P(a)
7. State the application of Rote Learning.
8. Amy has two bags. Bag I has 7 red and 2 blue balls and bag II has 5 red and 9 blue balls. Amy draws a ball at random and it turns out to be red. Determine the probability that the ball was from the bag I using the Bayes theorem.
9. Explain non-linear separable problem. Give an example.
10. List the benefits of Expert System.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

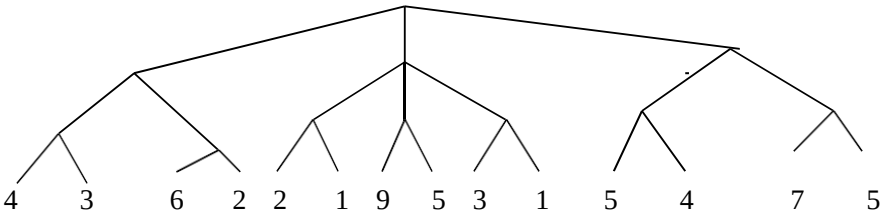
11. a) State and explain seven problem characteristics of AI. 7

    b) Write down the production rules for the water jug problem with example. 7

OR

12. What is uninformed search? Compare all six uninformed search based on time and space complexity, optimality and completeness. 14

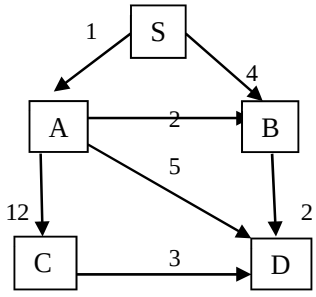
13. Compute the value of alpha at root using alpha-beta pruning. 14



OR

14. a) Write A* Algorithm. Find the best path from S to D. Given heuristic values for each nodes. 10

S	8
A	7
B	3
C	2
D	0



b) Explain the admissibility property of A* algorithm. 4

15. a) Explain resolution principle in FOPL. 4

b) Consider the following sentences: 10

S1. Ashok likes all kinds of food

S2. Apples are food.

S3. Chicken is food.

S4. Anything anyone eats and isn't killed by food..

S5. Bill eats peanuts and still alive.

S6. Sue eats everything bill eats.

Prove that "Ashok likes Peanuts" using resolution.

OR

16. a) How hypotheses formed by pure inductive inference or induction? Explain with examples. 6

b) Convert the well-formed formula to clause form. 8

$\forall X ((Child (X) \wedge Y (Takes (X, Y) \wedge Biscuit (Y))) \rightarrow Loves (john,X)$

17. a) Apply the Candidate Elimination algorithm with example for narrowing the version space? 10
    b) What is explanation based learning? Explain in detail with an example. 4

OR

18. What do you mean by probabilistic reasoning? Explain Bayes Theorem with example. 14

19. a) Explain Mycin and denderal. 6
    b) Explain NLP. State few tools used in Natural Language Processing. 8

OR

20. a) Explain Back propagation with example. 7
    b) What are the characteristic features of expert systems 7

Syllabus

Module 1: Overview of Artificial Intelligence (7 Hours)

Introduction: Artificial Intelligence, Agents- Environments and its types, AI Application areas. Problems, Problem space, Problem characteristics, Production systems. Search algorithm terminologies, Example problems – toy and real world, uninformed searches.

Module 2: Informed Search (7 Hours)

Informed Search: Generate and Test, Best First Search, Heuristics Search, A*, Problem reduction, AO*, Constraint Satisfaction problems, Hill climbing, Simulated annealing. **Adversarial Search:** Min-max search, Alpha beta cut-offs.

Module 3: Knowledge Representation (7 Hours)

Knowledge Representation: Types of Knowledge, Knowledge based system and reasoning, frames, and semantic nets. **Logic and Inferences:** Propositional logic (PL) and Predicate Logic (FOPL), Inference rules, Conversion to clausal form, Unification, Forward & backward Chaining, Resolution refutation proof for PL and FOPL.

Module 4: Learning and Reasoning (7 Hours)

Learning: Rote learning, Learning by Taking Advice, Learning in Problem-solving, Learning from example: induction, Explanation-based learning. Inductive Learning, Winston learning program, Version space, Candidate elimination algorithm, Decision tree.

Reasoning in uncertain environments: Probabilistic reasoning, Bayes theorem.

Module 5: Neural Network and Expert System (7 Hours)

Neural Network: Basics of Neural Network, Back Propagation, Applications of Neural Networks, Natural Language Processing.

Expert system (ES) : Components of Expert System, Expert System Technology, Stages in the development of an Expert System, Expert System Tools, Benefits and Application of Expert Systems.

Text Books

1. Stuart Russell and Peter Norvig, "Artificial intelligence, A modern approach", Pearson, Third Edition, 2010. **[M1],[M2], [M3], [M4]**
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill Publishing Company Ltd., New Delhi, Third Edition, ISBN: 13:978-0-07-008770-5, 2010. **[M1], [M2], [M3], [M4], [M5].**
3. DAN W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall India Ltd., New Delhi, 2009, ISBN: 81-203-0777-1. **[M2], [M4], [M5].**

Reference Books

1. Deepak Khemeni, "A First course in Artificial Intelligence", Tata McGraw Hill, 2013.
2. George. F. Luger, "Artificial Intelligence- Structures and Strategies for Complex Problem Solving", Fourth Edition, Pearson Education, 2002.
3. Brachman, R. and Levesque, H. 2004. Knowledge Representation and Reasoning, Morgan Kaufmann.
4. Patrick Henry Winston, Artificial intelligence, Addison Wesley, 1992.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Overview of Artificial Intelligence**	**(7 Hours)**
1.1	Artificial Intelligence, Agents- Environments and its types, AI Application areas	1
1.2	Problems, Problem space, Problem characteristics	1
1.3	Production systems	1
1.4	Search algorithm terminologies	1
1.5	Example problems – Toy and real world	1
1.6	Uninformed searches	1
1.7	Continue - Uninformed searches and comparison	1
2	**Informed Search**	**(7 Hours)**
2.1	Informed Search, Generate and Test, Best First Search	1
2.2	Heuristics Search, A*	1

2.3	Problem reduction, AO*	1
2.4	Constraint Satisfaction problems	1
2.5	Hill climbing its types	1
2.6	Simulated annealing, Min-max search	1
2.7	Alpha beta cut-offs	1
3	**Knowledge Representation**	**(7 Hours)**
3.1	Knowledge Representation, Types of Knowledge, Knowledge based system and reasoning	1
3.2	Frames, and semantic nets	1
3.3	Propositional logic (PL)	1
3.4	Predicate Logic (FOPL), Inference rules	1
3.5	Conversion to clausal form	1
3.6	Unification, Forward & backward Chaining	1
3.7	Resolution refutation proof for PL and FOPL	1
4	**Learning and Reasoning**	**(7 Hours)**
4.1	Rote learning, Learning by Taking Advice	1
4.2	Learning in Problem-solving, Learning from example: induction	1
4.3	Explanation-based learning	1
4.4	Inductive Learning, Winston learning program, Version space	1
.4.5	Candidate elimination algorithm	1
4.6	Decision tree	1
4.7	Probabilistic reasoning, Bayes theorem.	1
5	**Neural Network and Expert System (ES)**	**(7 Hours)**
5.1	Basics of Neural Network, Applications of Neural Networks	1
5.2	Back Propagation	1
5.3	Natural Language Processing	1
5.4	Expert system, Components of Expert System, Expert System Technology	1
5.5	Stages in the development of an Expert System	1
5.6	Expert System Tool	1
5.7	Benefits and Application of Expert Systems.	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT433	OBJECT ORIENTED MODELLING AND DESIGN	PEC	2	1	0	3

Preamble: This course is intended to make the students capable of

1. To model the requirements with use cases and describe the dynamic behaviour and structure of the design.
2. To use the concept of design patterns and apply it where suitable.

Prerequisite: ITT202 Principles of Object Oriented Techniques

Course Outcomes: After completion of the course the student will be able to:

CO No.	Course Outcome (CO)	Bloom's Category Level
CO1	Identify various object oriented approaches to analyse problems and design software solutions.	Level 2: Understand
CO2	Use UML static modelling concepts and notations in Object Oriented design.	Level 3: Apply
CO3	Sketch UML interaction modelling and state modeling to solve real world problems.	Level 3: Apply
CO4	Explain system design on performance estimation, resource allocation, architectural styles and use of metrics for object oriented system model.	Level 2: Understand
CO5	Describe how design problems can be solved by design patterns efficiently and effectively.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	-	–	-	-	-	-	-	-	-
CO 2	3	3	3	-	1	-	-	-	2	2	-	2
CO 3	3	3	3	-	1	-	-	-	2	2	-	2
CO 4	3	3	3	-	-	-	-	-	2	2	-	2
CO 5	3	3	3	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	20	30	50
Level 3: Apply	20	10	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Syllabus

Module 1: Introduction (7 Hours)

Introduction-Two views of software Developments: SSAD and OOAD.
Object Oriented Systems Development Life Cycle: Object Oriented Systems Development: A Use-Case Approach , Object Oriented Methodologies: Rumbaugh Object Modelling Technique, The Booch methodology, The Jacobson Methodology , The Unified Approach Rational Unified Process, Four Major phases: Inception, Elaboration, Construction, Transition.

Module 2: Structural Modeling (7 Hours)

Introduction to UML-Building blocks of the UML-Rules of the UML, Common Mechanism in the UML, Architecture.
Class modelling -Objects and class concepts, link and Association Concepts, Generalization and Inheritance, A Sample Class model, Advanced Object and class concepts, N-ary Associations, Aggregation, Packages. Component diagram, Deployment diagram.

Module 3: Behavioral Modeling (7 Hours)

Interaction Modeling: Use Case Models, Sequence models, Activity Models. Advanced Interaction Modeling: Use Case Relationships, Procedural Sequence Models, Special Constructs for Activity Models. State modeling: Events, States, Transition and conditions, state diagrams, state diagram behaviour. Collaboration diagram.

Module 4: -System Design (8 Hours)

System Conception: Devising a system concept, Elaborating a concept, Preparing a problem statement. System Design: Overview of System Design, Estimating performance, Making a reuse plan, Breaking system into subsystems, Identifying concurrency, Allocation of subsystems, Management of data storage, Handling Global resources ,Choosing a software control strategy · Handling boundary condition· Common Architectural style·
Metrics for the Object Oriented Design Model, Class - Oriented Metrics , Operation Oriented Metrics.

Module 5: Design Patterns (6 Hours)

Introduction to design patterns - elements, catalog of design patterns, organizing the catalog, how design patterns solve design problems, how to select a design pattern, how to use a design pattern.

Note: UML diagrams can be drawn using any software tool. It can be given as an assignment. **Text Books**

1. Ali Bahrami, Object Oriented System Development, McGraw Hill, 1999. (Module 1)
2. Grady Booch , James Rumbaugh , Ivar Jacobson , The Unified Modeling Language User Guide, Addison Wesley, First Edition, 1998. (Module 2,Module 3)
3. Michael R Blaha,James R Rumbaugh , Object-Oriented Modeling and Design with UML, Pearson,Second Edition,2005.(Module 2,Module 3, Module 4)
4. Roger S. Pressman,Software Engineering A Practitioner's Approach, McGraw Hill, Fifth edition ,2001.(Module 4)
5. Erich Gamma,Richard Helm,Ralph Johnson,John Vlissi des,Design Patterns Elements of Reusable Object-Oriented Software ,Addison Wesley, 2009.(Module 5)

Reference Books

1. Barclay K.,J. Savage, Object Oiented Design with UML and Java,Elsevier,2004.
2. James Rumbaugh, Unified Modeling Language Reference Manual, Addison-Wesley Professional, 2005.
3. Arpita Gopal and Netra Patil, Magnifying Object Oriented Analysis and Design, PHI Publication, 2010.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Describe a unified process. Write down the four major phases of unified process.
2. Explain a unified approach? Why is it needed?
3. Explain in detail about Rumbaugh and Jacobson methodologies.
4. Illustrate the steps of Micro development process of Booch Methodology.
5. List any four differences between SSAD and OOAD approaches.

Course Outcome 2 (CO 2):

1. List and explain various relationships and visibility concepts used in UML class diagram.
2. Define package. Explain visibility and importing and exporting of package.
3. Write short notes on component diagram and deployment diagram.
4. Compare association and generalization with suitable examples.
5. Draw the class diagram for a bank management system.

Course Outcome 3 (CO 3):

1. Draw the activity diagram for the reserve ticket use case for online railways reservation system.
2. Draw the sequence diagram for the use case order item for online shopping system.
3. Define State Diagrams. Explain Sample State diagram for dialling a telephone.
4. Describe the notations of UML use case diagram. Draw the use case diagram for a mobile recharging application.

Course Outcome 4 (CO 4):

1. Describe the steps involved in batch transformation and continuous transformation?
2. Explain how the subsystems can be allocated to hardware units. What are the types of relationships between subsystems?
3. Discuss about operation oriented metrics.
4. Compare the advantages of using procedure driven control and event driven control.
5. Discuss how we can identify inherent concurrency?

Course Outcome 5 (CO 5):

1. Define design pattern? Explain four essential elements of design pattern?
2. Explain how to select a design pattern?
3. List a few design problems and explain how design patterns solve them.
4. Differentiate between the important categories of design patterns.

Model Question Paper

Course Code: ITT433

Course Name: OBJECT ORIENTED MODELLING AND DESIGN

Duration: 3 hours **Max Marks:100**

Part A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. Define reusability.
2. Give the reasons why three layered approaches are required for software development.
3. Differentiate aggregation and composition.
4. Explain the different extensibility mechanisms in UML.
5. List the different kinds of events.
6. Explain the use of include and extend relationships in use cases with an example.
7. List a few global resources used in system design.
8. Explain the different factors used in the MOOD metrics suite.
9. Explain the term delegation.
10. Differentiate pattern and framework.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. Describe the two views- SSAD and OOAD – of software development in detail. 14

OR

12. Explain the different Object Oriented Methodologies. 14
13. Explain the building blocks of UML. 14

OR

14. Draw the class diagram for a library management system. 14
15. List the basic elements of state diagram. Draw the state diagram for online order system . 14

OR

16. Prepare a sequence diagram and activity diagram for computing restaurant bills. There should be a charge for each delivered item. The total amount should be subject to tax and a service charge of 18% for groups of three or more. 14
17. Describe nine distinct and measurable characteristics of an Object Oriented design.(14)

OR

18. Explain the common architectural styles used in system design 14
19. Describe the elements and catalog of design patterns. 14

OR

20. Explain how to select and use design patterns. 14

Course Contents and Lecture Schedule

(The total hours to be allocated for a subject : 3 credits- 35 hours, 4 credits- 45 hours)

No.	Topic	No. of Lectures
1	**Introduction**	**7 Hours**
1.1	Introduction-Two views of software Developments: SSAD and OOAD	1
1.2	Object Oriented Systems Development Life Cycle: Object Oriented Systems Development: A Use-Case Approach	1
1.3	Object Oriented Methodologies: Rumbaugh Object Modelling Technique, The Booch methodology	1
1.4	The Jacobson Methodology	1
1.5	The Unified Approach	2
1.6	Rational Unified Process, Four Major phases:- Inception , Elaboration, Construction, Transition.	1
2	**Structural Modeling**	**7 Hours**
2.1	Introduction to UML-Building blocks of the UML	1
2.2	Rules of the UML, Common Mechanism in the UML	1
2.3	Architecture	1
2.4	Class modeling- Objects and class concepts, link and Association Concepts	2
2.5	Aggregation, Packages	1
2.6	Component diagram, Deployment diagram	1
3	**Behavioral Modeling**	**7 Hours**
3.1	Interaction Modeling : Use Case Models	1
3.2	Sequence models, Activity Models.	1
3.3	Advanced Interaction Modeling: Use Case Relationships, Procedural Sequence Models,Special Constructs for Activity Models.	2

3.4	State modeling: Events, states, Transition and conditions	1
3.5	State diagrams, State diagram Behavior	1
3.6	Collaboration diagram.	1
4	**System Design**	**8 Hours**
4.1	System Conception: Devising a system concept , Elaborating a concept, Preparing a problem statement.	1
4.2	System Design: Overview of System Design, Estimating performance, Making a reuse plan	1
4.3	Breaking system into subsystems, Identifying concurrency, Allocation of subsystems	1
4.4	Management of data storage, Handling Global resources ,Choosing a software control strategy	1
4.5	Handling boundary condition· Common Architectural style	1
4.6	Metrics for the Object Oriented Design Model , Class - Oriented Metrics	2
4.7	Operation Oriented Metrics	1
5	**Design Patterns**	**6 Hours**
5.1	Introduction to design patterns - elements, catalog of design patterns,	2
5.2	Organizing the catalog	1
5.3	How design patterns solve design problems	1
5.4	How to select a design pattern	1
5.5	How to use a design pattern.	1

CODE	COURSE	CATEGORY	L	T	P	CREDIT
ITT443	ADVANCED DATABASE MANAGEMENT SYSTEMS	PEC	2	1	0	3

Preamble: This course will address the advanced issues in modern database systems and applications. Students will get an introduction to different Databases like Distributed Database, Active Database, Spatial Database, Temporal Database, Biological Database etc. This course also covers different indexing and optimization techniques used in Database.

Prerequisite: ITT206 Database Management Systems

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe the basics of distributed database systems.	Level 2: Understand
CO 2	Demonstrate the features of indexing in database applications and Heuristic optimization of query trees.	Level 3: Apply
CO 3	Make use of concepts and techniques of Data Mining and data warehousing.	Level 3: Apply
CO 4	Summarize the concepts in Active Databases, Temporal Databases, Spatial Databases, Multimedia Databases and Deductive Databases.	Level 2: Understand
CO 5	Describe the challenges posed by GIS and Biological Databases and to explain how blockchain databases differ from the traditional databases.	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	3	1	-	-	-	-	-	-	-	1
CO 2	3	1	2	-	-	-	-	-	-	-	-	1
CO 3	3	2	3	-	-	-	-	-	-	-	-	1
CO 4	2	3	2	-	-	-	-	-	-	-	-	1
CO 5	1	2	3	-	-	-	-	-	-	-	-	1

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember		5	10
Understand	30	35	60
Apply	20	10	30
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. State the advantages of keeping the data in a distributed database?
2. Explain different steps involved in distributed query processing.
3. Summarize the different data fragmentation techniques used in distributed databases? Give an example for each technique.

Course Outcome 2 (CO2):

1. Illustrate the structure of internal nodes and leaf nodes of a B^+ -tree.

2. Show how multilevel indexing improves the efficiency of searching an index with t levels.

3. Demonstrate heuristic query optimization with an example.

Course Outcome 3 (CO3):

1. List the pre-programmed functionalities that are available in a data warehouse transactional environment.
2. Differentiate clustering and classification.
3. Describe an association rule among hierarchies with examples.

Course Outcome 4 (CO4):

1. Demonstrate the implementation of insert, delete and update commands on a valid time relation.
2. With an example, illustrate how active rules can be specified.
3. Define the clausal form of formulas and Horn clauses.

Course Outcome 5 (CO5)

1. Explain any three constraints in GIS.
2. Explain the benefits and potential risks of sharding?
3. Explain the characteristics of Biological data?

Model Question paper

Course Code: ITT443

Course Name: ADVANCED DATABASE MANAGEMENT SYSTEMS

Max. Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. List the advantages and disadvantages of DDBMS.
2. When are voting and elections used in distributed databases?
3. What are the applications that can be developed using information in genomic and protomic databases?
4. Discuss briefly some of the general GIS applications?

5. How do spatial databases differ from regular databases?

6. What are deductive databases?

7. What is entropy and how is it used in building decision trees?

8. What is a data warehouse? How does it differ from a Database?

9. How is clustering index different from primary index?

10. Show *two non-canonical query trees* for the following relational algebra expression:

ROLLNO, CID (COURSE ⋈ ENROLL ⋈ STUDENT))

COURSE.CID=ENROLL.CNO

EROLL.ROLL#=STUDENT.ROLLNO

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. a. Compare the primary site method with the primary copy method for distributed concurrency control. How does the use of backup sites affect each? 14

OR

12. a. What is a fragment of a relation in a Distributed Database? What are the main types of fragments? 8

b. Why is fragmentation a useful concept in distributed database design? 6

13. a. Consider an EMPLOYEE file with 10000 records where each record is of size 80 bytes. The file is sorted on employee number (15 bytes long), which is the primary key. Assuming un-spanned organization, block size of 512 bytes and block pointer size of 5 bytes, compute the number of block accesses needed for retrieving an employee record based on employee number if 10

(i) No index is used.

(ii) (ii)Multi-level primary index is used.

b. How does multilevel indexing improve the efficiency of searching an index file? 4

OR

14	Consider three tables COURSE(CNO,CNAME,CREDITS),ıSTUDENT (ROLLNO,NAME,ADDRESS,SEM) and ENROLLMENT (CNO, ROLL NO,GRADE). Foreign keys have the *same* name as primary keys. Identify one initial canonical query tree for the following SQL expression and show the steps to optimize it using heuristics. Assume that CNAME is a candidate key. SELECT S.NAME, S.ADDRESS, E.GRADE FROM COURSE C, STUDENT S, ENROLLMENT E WHERE S.ROLLNO =E.ROLLNO AND C.CNO = E.CNO AND CNAME='ADBMS'.	14

15.	Define data mining? How apriori algorithm used in data mining?	14

OR

16.	Explain the steps involved in constructing a data warehouse.	14
17. .	Explain Spatial database and its data types.	14

OR

18. .	Explain ECA model used in Active Databases?	14
19.	What are the characteristics of Biological data?	14

OR

20.	a. Explain the distinction between a public and a permissioned blockchain and when each would be more desirable?	7
	b. Explain the components in a GIS system?	7

Syllabus

Module 1: Introduction to distributed Databases. (7 Hours)

Distributed database concepts, Types of Distributed Database systems, Distributed Database Architectures, Data fragmentation, replication and allocation techniques for distributed database design, query processing and optimization in distributed databases, overview of transaction management in distributed databases, overview of concurrency control and recovery in distributed databases, distributed catalogue management.

Module 2: Database file indexing techniques. Query optimization (7 Hours)

Database file indexing techniques – types of single level ordered indexes, multilevel indexes, Dynamic multilevel indexes using B – Trees and B^+ - trees.

Heuristic Query optimization**.**

Module 3: Data Mining and Data warehousing. (7 Hours)

Data Mining – concepts, association rules, classification, clustering,applications

Data warehousing – Introduction, characteristics, modelling and building Data warehouse.

Module4: Advanced Database Models and Applications. (7 Hours)

Active database concepts and triggers, temporal database concepts, spatial Database concepts, multimedia database concepts, Introduction to Deductive Databases.

Module 5: Emerging Database Technologies and Applications. (7 Hours)

Geographic Information Systems (GIS), Biological and Genomic Databases and Emerging applications. Blockchain Databases.

Text Books

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, 6e,2013.
2. Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 7/e, McGraw Hill, 2019.

Reference Books

1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, McGrawHill Education, 3rd Edition, 2003.
2. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to distributed Databases**	**7 hours**
1.1	Distributed database concepts, Types of Distributed Database systems.	1
1.2	Distributed Database Architectures.	1
1.3	Data fragmentation, replication and allocation techniques for distributed database design.	2
1.4	query processing and optimization in distributed databases	1
1.5	Overview of transaction management in distributed databases,	1
1.6	Overview of concurrency control and recovery in distributed databases, Distributed catalog management.	1
2	**Database files indexing techniques. Query optimization**	**7 hours**
2.1	Types of single level ordered indexes.	2
2.2	Multilevel indexes (sample problems required).	1

2.3	Dynamic multilevel indexes using B – Trees and B^+ - trees(Structure only, Algorithms not required).	2
2.4	Heuristic Query optimization (sample Problems to optimize query required).	2
3	**Data Mining and Data warehousing.**	**7 hours**
3.1	Data Mining – concepts, association rules -Market-Basket model, Suppot and Confidence.	1
3.2	Apriori Algorithm, Sampling Algorithm.	1
3.3	Frequent-pattern tree Algorithm.	1
3.4	Classification.	1
3.5	Clustering (K- Means Clustering Algorithm), Applications of Data Mining.	1
3.6	Data warehousing – Introduction, Characteristics, Modelling and building Data warehouse.	2
4	**Advanced Database Models and Applications.**	**7 hours**
4.1	Active database concepts and triggers-generalized model, Design and implementation issues, Applications.	1
4.2	Temporal Database concepts- Time representations, Calenders, and Time Dimensions, Tuple versioning, Attribute versioning, Time series data.	2
4.3	Spatial Database Concepts- Introduction, Data types and models, Operators, Spatial data indexing, Spatial data mining, Applications of spatial data.	1
4.4	Multimedia Database Concepts- Automatic analysis of images, Object recognition in images, Semantic tagging, Analysis of audio data sources.	1
4.5	Introduction to Deductive Databases- Overview of deductive Databases, Prolog/Datalog notation, Clausal form and Horn Clauses, Interpretation of Rules, Datalog programs, Use of relational operations, Evaluation of Non recursive Datalog Queries	2
5	**Emerging Database Technologies and Applications.**	**7 hours**
5.1	Block chain Databases – Overview-, Block chain properties, Achieving Block chain properties via cryptographic hash functions.	1
	Consensus, Data management in a Block chain, Smart contracts.	1
	Performance enhancement, Applications.	1
5.2	Geographic Information Systems (GIS) – Components of GIS, Characteristics of Data in GIS, conceptual data models, GIS applications and software.	2
5.3	Biological and Genomic Databases and Emerging applications – Characteristics of Biological Data, Biological Databases, Applications.	2

CODE	COURSE	CATEGORY	L	T	P	CREDIT
ITT453	MACHINE LEARNING	PEC	2	1	0	3

Preamble: The course introduces fundamental concepts of Machine Learning. The course includes basics of artificial neural networks, decision trees, HMM, SVM and other supervised and unsupervised learning methods.

Prerequisite: The students are expected to have basic knowledge of mathematical concepts.

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Identify machine learning applications such as learning associations, classification, regression, supervised, unsupervised learning and reinforcement Learning.	Level 2: Understand
CO 2	Explain supervised learning method such as classification, use Naive Bayes classifier and discuss classifier performance measures.	Level 3: Apply
CO 3	Use theoretical foundations of decision trees as well as describe the basics of neural networks.	Level 3: Apply
CO 4	Describe the fundamental concepts of SVM and HMM and explain how to combine multiple learners.	Level 2: Understand
CO 5	Illustrate clustering algorithms like k-means clustering, hierarchical clustering and discuss density based clustering.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	-	-	-	-	-	-	-	-
CO 2	3	2	2	2	-	-	-	-	-	-	-	1
CO 3	3	2	2	2	-	-	-	-	-	-	-	1
CO 4	3	2	2	-	-	-	-	-	-	-	-	-
CO 5	3	2	2	2	1	-	-	-	-	-	-	1

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	10
Level 2: Understand	30	30	60
Level 3: Apply	10	10	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Compare supervised and unsupervised learning techniques.
2. List any three examples of machine learning applications.
3. Explain unsupervised learning with an example.

Course Outcome 2 (CO 2):

1. Describe how to measure the performance of a classifier.
2. Explain Naïve Bayes algorithm for classification.
3. State Bayes theorem and illustrate it with an example.

Course Outcome 3 (CO 3):

1. Demonstrate the use of decision tree for classification.
2. With the help of a neat diagram, explain the Perceptron model.
3. Describe any three activation functions used in neural networks.

Course Outcome 4 (CO 4):

1. Define linear separability with respect to two-class dataset.
2. Explain support vector machine for a two-class dataset.
3. Give an example for a discrete Markov process.

Course Outcome 5 (CO 5):

1. Discuss the similarity measures used for clustering.
2. Explain k-means algorithm with an example.
3. Demonstrate agglomerative hierarchical clustering.

Model Question Paper

Course Code: ITT453

Course Name: MACHINE LEARNING

Max.Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. List out any three applications of machine learning.
2. Illustrate learning association with an example
3. With the help of a neat diagram explain ROC Curves.
4. Explain learning a class from examples.
5. List the different types of decision trees.
6. Describe a perceptron model with a neat diagram.
7. Define Hidden Markov Model. What is meant by the evaluation problem and how is this solved?
8. State the significance of optimal separating hyperplane in SVM.
9. Discuss the similarity measures used for clustering.
10. Compare and contrast clustering and classification.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11 a. Differentiate between supervised and unsupervised training. Explain with suitable examples. 7

b. Distinguish between classification and regression with an example. 7

OR

12 a. Explain any two examples of machine learning applications in detail. 7

b. Differentiate between unsupervised learning and reinforcement learning. 7

13a. Define the terms Precision and Recall for a classification problem. 7

b. With the help of an example, illustrate classification using Naïve Bayes classifier. 7

OR

14a. A patient takes a lab test and the result comes back positive. It is known that the test returns a correct positive result in only 98% of the cases and a correct negative result in only 97% of the cases. Furthermore, only 0.008 of the entire population has this disease. What is the probability that this patient has cancer? What is the probability that he does not have cancer? What is the diagnosis? 7

b. Compare the different measures used for evaluating the performance of classifiers. 7

15a. What is a Perceptron? Explain the working of a perceptron with a neat diagram. 7

b. For the following set of training samples, find which attribute can be chosen as the root for decision tree classification. 7

Instance	Classification	a 1	a 2
1	+	T	T
2	+	T	T
3	-	T	F
4	+	F	F
5	-	F	T
6	-	F	T

OR

16a. State the issues involved in decision tree learning. 7

b. Discuss the steps involved in training a Back propagation neural network. 7

17a. Describe the terms Voting, Bagging and Boosting. 7

b. Illustrate the concept of linearly separable data. 7

OR

18a. Explain the basic problems associated with hidden Markov model. 7

b. Explain two class classification using SVM. 7

19a. Explain K means clustering algorithm. 7

b. Suppose that the data mining task is to cluster the following eight points into three clusters. 7
A1 (2, 10), A2 (2, 5), A3 (8, 4), B1 (5,8),B2(7,5),B3(6,4),C1
(1, 2), C2 (4, 9). (x, y) representing location. The distance function is Euclidean distance. Suppose initially we assign A1, B1 and C1 as the center of each cluster, respectively. Use k-means algorithm to find the three cluster centers after the first round of execution.

OR

20a. Explain agglomerative hierarchical clustering method. 7

b. Illustrate hierarchical clustering with a suitable example. 7

Syllabus

Module 1: Overview of Machine Learning (6 Hours)

Introduction to machine learning, Examples of machine learning applications - Learning associations, Classification, Regression, Supervised learning, Unsupervised learning, Reinforcement learning, Dimensionality reduction - Principle Component Analysis (Brief introduction)

Module 2: Supervised learning - Classification (7 Hours) Classification - Learning a class from examples, Learning multiple classes. Bayes theorem,
Bayesian classifier - Naive Bayes algorithm. Measuring classifier performance - Precision, Recall, ROC curves.

Module 3: Classification using decision tree and neural networks (8 Hours)

Decision tree - Example, Types of decision trees (Brief introduction). Feature selection measures - Entropy, Information gain. ID3 algorithm, Issues in decision tree learning.
Neural networks - Perceptron, Activation functions, Training feed forward network by Back Propagation (Algorithm only).

Module 4: Classification using SVM and HMM (7 Hours)

Linearly separable data, Support vector machine - Optimal separating hyper plane
Discrete Markov process, Hidden Markov models, Three basic problems of HMMs - Evaluation problem, Finding state sequence, Learning model parameters.
Combining multiple learners, Model combination schemes - Voting, Bagging, Boosting

Module 5: Unsupervised learning (7 Hours)

Unsupervised learning - Clustering methods - K means, Similarity measures for clustering. Hierarchical clustering - Agglomerative hierarchical clustering. Density based clustering (Brief introduction)

Textbook

1. EthemAlpaydin, Introduction to Machine Learning, The MIT Press, Cambridge, Massachusetts, 2nd Edition, 2004.

Reference Books

1. Mitchell T., Machine Learning, McGraw Hill, 1st Edition, 1997.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, 2nd Edition, Springer, 2006.

3. Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Pearson, 1st Edition, 2006.

4. Ryszard S. Michalski, Jaime G. Carbonell, and Tom M. Mitchell, Machine Learning: An Artificial Intelligence Approach, Elsevier science, 1st Edition, 1983

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Overview of Machine Learning**	**6 Hours**
1.1	Introduction to Machine Learning	1
1.2	Examples of Machine Learning Applications - Learning Associations	1
1.3	Classification	1
1.4	Regression	1
1.5	Supervised Learning, Unsupervised Learning, Reinforcement Learning	1
1.6	Dimensionality Reduction - Principle Component Analysis (Brief introduction)	1
2	**Supervised learning**	**7 Hours**
2.1	Classification - Learning a Class from Examples	1
2.2	Learning Multiple Classes	1
2.3	Bayes Theorem	1
2.4	Bayesian Classifier - Naive Bayes algorithm	2
2.5	Measuring Classifier Performance - Precision, Recall	1
2.6	ROC Curves	1
3	**Classification using decision tree**	**8 Hours**
3.1	Decision tree – Example, Types of Decision trees (brief introduction)	1
3.2	Feature Selection measures - Entropy, Information Gain	1
3.3	ID3 algorithm Issues in Decision Tree Learning	2
3.5	Neural Networks - Perceptron	1
3.6	Activation Functions	1
3.7	Training Feed Forward Network by Back Propagation (Algorithm only)	2
4	**Classification using SVM and HMM**	**7 Hours**
4.1	Linearly separable data	1
4.2	Support Vector Machine - Optimal Separating Hyper Plane	2
4.3	Discrete Markov Processes	1
4.4	Hidden Markov Models	1
4.5	Three Basic Problems of HMMs - Evaluation problem, Finding state sequence, Learning model parameters	1
4.6	Combining Multiple Learners, Model Combination Schemes - Voting, Bagging, Boosting	1
5	**Unsupervised learning**	**7 Hours**

5.1	Unsupervised Learning	1
5.2	Clustering Methods - K means	2
5.3	Similarity Measures for Clustering	1
5.4	Hierarchical clustering - Agglomerative hierarchical clustering.	2
5.5	Density based clustering (brief introduction)	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT463	OPTIMIZATION AND METAHEURISTICS	PEC	2	1	0	3

Preamble: The objective of the course is to introduce the basic concepts of optimization and various metaheuristic algorithms used for solving optimization problems. It provides a background that enables students to design and implement metaheuristics to solve complex optimization problems.

Prerequisite: MAT101 Linear Algebra and Calculus
ITT304 Analysis and Design of Algorithms

Course Outcomes: After the completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category
CO 1	Describe the main concepts of optimization problem and its solution method	Level 2: Understand
CO 2	Classify metaheuristics and focus on the design concepts of single-solution based metaheuristics	Level 2: Understand
CO 3	Explain the design and implementation of evolutionary algorithms on optimization problems	Level 3: Apply
CO 4	Solve complex optimization problems using swarm intelligence-based metaheuristics	Level 3: Apply
CO 5	Summarize the basic concepts of hybrid metaheuristics and parallel metaheuristics	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	1	-	-	-	-	-	-	-	-	2
CO 2	3	2	2	2	-	-	-	-	-	-	-	2
CO 3	3	3	2	2	-	-	-	-	-	-	-	2
CO 4	3	3	3	2	2	-	-	-	-	-	-	2
CO 5	2	2	2	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	10
Level 2: Understand	30	20	60
Level 3: Apply	10	20	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub–divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define global optimum.
2. Explain the various representations of solutions handled by optimization algorithms.
3. Describe two different strategies for the parameter tuning of optimization algorithms.

Course Outcome 2 (CO2):

1. Illustrate the main principles of single-solution based metaheuristics.
2. List the three strategies that can be applied in the selection of a better neighbour.

3. Explain the two mechanisms employed in tabu search to deal with intensification and diversification of the search.

Course Outcome 3 (CO3):

1. Explain the rank-based selection method in evolutionary algorithms.
2. List the two replacement strategies employed in evolutionary algorithms.
3. Minimize the value of the function, f(x)= ((a+2b+3c+4d)-30) using a genetic algorithm.

Course Outcome 4 (CO4):

1. Explain the various phases involved in artificial bee colony algorithm.
2. Find the minimum points of the function, $f(x, y) = 100(x^2 - y)^2 + (1-x)^2$; $-2.047 \leq a, b \leq 2.048$ using particle swarm optimization.
3. Explain the three components to be determined while designing an ant colony optimization in addition to common search components of metaheuristics.

Course Outcome 5 (CO5):

1. Describe global and partial hybrids.
2. Explain the two solution-level parallel models for metaheuristics.
3. Discuss four design questions involved by the parallel algorithmic-level model for metaheuristics.

Model Question paper

Course Code: ITT463

Course Name: OPTIMIZATION AND METAHEURISTICS

Max.Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. Explain the objective function of an optimization problem.
2. Define neighbourhood. Give an example of a neighbourhood for a permutation problem of size 3.
3. Explain the three different memories used to control the search process in tabu search algorithm.
4. Illustrate the principle of variable neighbourhood descent algorithm.

5. Explain the roulette wheel selection technique.

6. List the three important points to be considered while designing mutation operators.

7. Explain the three different strategies applied for pheromone update in ant colony optimization.

8. Describe three different types of bee foragers in artificial bee colony.

9. Explain the homogeneous and heterogeneous hybrid metaheuristics.

10. List the three main reasons for employing parallel metaheuristics.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11.(a) Describe two main classification of optimization algorithms with a figure 8

(b) Illustrate the direct and indirect encodings for the job-shop scheduling problem. 6

OR

12.(a) Describe any four constraint handling strategies of optimization algorithms. 8

(b) Explain the main three steps to be considered for performance analysis of optimization algorithms. 6

13.(a) Describe local search algorithm and four different approaches that can be used to avoid local optima. 8

(b) Explain the three basic elements of an iterated local search algorithm. 6

OR

14.(a) Explain the template of a simulated annealing algorithm. 7

(b) Illustrate simulated annealing by maximizing the function, $f(x)= x^3 - 60 x^2 + 900x + 100$ 7

15. (a) Explain any four crossover methods of evolutionary algorithms. 8

(b) Compare six features of genetic algorithms, evolution strategies, evolutionary programming and genetic programming. 6

OR

16.(a)	Explain the main search components for designing an evolutionary algorithm.	7
(b)	Determine the maximum of a function, $f(x)= x^2$ where x value range 7 from 0-31 using genetic algorithm.	
17.(a)	Explain the ant colony optimization algorithm.	7
(b)	Solve the travelling salesman problem using ant colony optimization.	7
	OR	
18.(a)	Explain the various phases in particle swarm optimization.	7
(b)	Maximize the function, $f(x)= 1+2x-x^2$ using particle swarm optimization.	7
19.	Describe low-level and high-level approaches under hierarchical classification of hybrid metaheuristics.	14
	OR	
20.	Explain the parallel metaheuristic and its three design levels.	14

Syllabus

Module 1: Introduction to Optimization (7 Hours)

Optimization Problem: Neighbourhood, Local and Global Optima – Classification of Optimization Algorithms: Exact Algorithms and Approximate Algorithms – Optimization Algorithm: Representation, Objective Function, Constraint Handling, Parameter Tuning and Performance Analysis of Optimization Algorithms

Module 2: Metaheuristics (8 Hours)

Classification of Metaheuristics: Single-Solution based Metaheuristics and Population-based Metaheuristics – Local Search: Neighbour Selection – Simulated Annealing: Move Acceptance and Cooling Schedule – Tabu Search – Iterated Local Search: Perturbation Method and Acceptance Criteria – Variable Neighbourhood Search: Variable Neighbourhood Descent and General Variable Neighbourhood Search

Module 3: Evolutionary Algorithms (7 Hours)

Common Concepts for Evolutionary Algorithms: Initial Population, Selection Methods, Mutation, Crossover and Replacement Strategies – Genetic Algorithm – Evolution Strategies – Evolutionary Programming – Genetic Programming

Module 4: Swarm Intelligence based Metaheuristics (7 Hours)

Characteristics of Swarm Intelligence based Metaheuristics – Ant Colony Optimization – Ant Colony Optimization for Travelling Salesman Problem – Particle Swarm Optimization – Artificial Bee Colony Algorithm

Module 5: Advanced Metaheuristics (6 Hours)

Hybrid Metaheuristics – Hybrid Metaheuristics Design Issues: Hierarchical Classification and Flat Classification – Parallel Metaheuristics – Design Levels of Parallel Metaheuristics: Algorithmic-Level, Iteration-Level and Solution-Level Parallel Models

Text Books

1. Talbi, El–Ghazali. *Metaheuristics: from design to implementation*. Vol. 74. John Wiley & Sons, 2009.
2. Luke, Sean. *Essentials of Metaheuristics*, Lulu, Second edition, 2013.

Reference Books

1. Gendreau, Michel, and Jean-Yves Potvin, eds. *Handbook of metaheuristics*. Vol. 2. New York: Springer, 2010.
2. Michalewicz, Zbigniew, and David B. Fogel. *How to solve it: modern heuristics*. Springer Science & Business Media, 2013.
3. Gonzalez, Teofilo F. *Handbook of approximation algorithms and metaheuristics*. CRC Press, 2007.
4. Mitchell, Melanie. *An introduction to genetic algorithms*. MIT press, 1998.
5. Christian Blum, Daniel Merkle. *Swarm Intelligence: Introduction and Applications*, Springer Verlag, 2008.
6. Eric Bonabeau, Marco Dorigo, Guy Theraulaz. *Swarm Intelligence: From Natural to Artificial Systems*, Oxford University Press, 2000.
7. Marco Dorigo, Thomas Stutzle. *Ant Colony Optimization*, MIT Press, 2004.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Introduction to Optimization**	**7 Hours**
1.1	Optimization Problem: Neighbourhood, Local and Global Optima	1
1.2	Classification of Optimization Algorithms: Exact Algorithms and Approximate Algorithms	1
1.3	Representation: Linear, Nonlinear, Representation-Solution Mapping, Direct and Indirect Encodings	1
1.4	Objective Function, Constraint Handling: Reject Strategies, Penalizing Strategies	1
1.5	Repairing Strategies, Decoding Strategies and Preserving Strategies	1
1.6	Parameter Tuning: Offline and Online Parameter Initialization	1
1.7	Performance Analysis of Optimization Algorithms	1
2	**Metaheuristics**	**8 Hours**
2.1	Classification of Metaheuristics: Single-Solution based Metaheuristics	1
2.2	Concepts for Population-based Metaheuristics	1

2.3	Local Search: Neighbour Selection	1
2.4	Simulated Annealing: Move Acceptance and Cooling Schedule	1
2.5	Tabu Search	1
2.6	Iterated Local Search: Perturbation Method and Acceptance Criteria	1
2.7	Variable Neighbourhood Search: Variable Neighbourhood Descent	1
2.8	General Variable Neighbourhood Search	1
3	**Evolutionary Algorithms**	**7 Hours**
3.1	Common Concepts for Evolutionary Algorithms : Initial Population	1
3.2	Selection Methods	1
3.3	Mutation	1
3.4	Crossover and Replacement Strategies	1
3.5	Genetic Algorithm	1
3.6	Fundamentals of Evolution Strategies and Evolutionary Programming	1
3.7	Genetic Programming	1
4	**Swarm Intelligence based Metaheuristics**	**7 Hours**
4.1	Swarm Intelligence based Metaheuristics: Ant Colony Optimization	2
4.2	Ant Colony Optimization for Travelling Salesman Problem	1
4.3	Particle Swarm Optimization	2
4.4	Artificial Bee Colony Algorithm	2
5	**Advanced Metaheuristics**	**6 Hours**
5.1	Hybrid Metaheuristics, Design Issues: Hierarchical Classification	1
5.2	Flat Classification	1
5.3	Parallel Metaheuristics and its Design Levels	1
5.4	Algorithmic-Level Parallel Model	1
5.5	Iteration-Level Parallel Model	1
5.6	Solution-Level Parallel Model	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT473	PROBABILISTIC AND STOCHASTIC MODELLING	PEC	2	1	0	3

Preamble: This course introduces the basic concepts of probability and stochastic processes. This course helps the learner to apply the theory and applications of probability and random process in various fields of engineering.

Prerequisite: MAT 208 Probability, Statistics and Advanced Graph Theory.

Course Outcomes: After completion of the course, the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe the basic concepts of probability theory.	Level 2: Understand
CO 2	Identify probability distributions for various situations.	Level 2: Understand
CO 3	Discuss on problems with two random variables and calculate the joint expectations and other statistical measures.	Level 2: Understand
CO 4	Explain the concepts of random processes, its classifications, statistical properties and stationary properties.	Level 2: Understand
CO 5	Interpret random processes - Poisson process and Markov Chain.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	1	1	-	-	-	-	-	-	-	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	2
CO 3	3	2	2	1	-	-	-	-	-	-	-	2
CO 4	3	2	2	1	-	-	-	-	-	-	-	2
CO 5	3	2	2	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	10	20
Level 2: Understand	40	30	65
Level 3: Apply		10	15
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. If you twice flip a balanced coin, what is the probability(/)of getting at least one head?
2. If P(A)=0.5, P(B)=0.3 and P(A∩B)=0.15. Find P(A/B).
3. In a colony, there are 60% men and 40% women. According to a survey taken, 8 men out of 100 and 10 women out of 100 have high blood pressure. A high B.P person is chosen at random. What is the probability that this person is male?

Course Outcome 2 (CO 2):

1. X is a discrete RV with the probability mass function f(x)=x/10,for x=1,2,3,4.Find a) P(X=1 or 2)

2. 3It is known that 5% of the books bound at a certain bindery have defective bindings. Find the probability that 2 of 100 books bound by this bindery will have defective bindings.

3. The weekly wages of 1000 workmen are normally distributed around a mean of Rs.500/- with a standard deviation of Rs.50/-. Estimate the number of workers, whose weekly wages will be
    a) between Rs. 400 and Rs. 600.
    b) less than Rs. 400.
    c) more than Rs. 600.

COURSE OUTCOME 3 (CO 3)

1. The fraction X of male runners and fraction Y of female runners who complete marathon races can be described by the joint density function f(x,y)={8xy ,if 0<x<1,0< y<x,otherwise Find the covariance of X and Y.

2. A random sample of size 100 is taken from a population whose mean is 80 and variance is 400. Using CLT, with what probability can we assert that the mean of the sample will not differ from μ=80 by more than 6?

Course Outcome 4 (CO 4):

1. Define and classify random processes.
   Consider a random processX(t)=Acoswt,t>=0,where A is a uniform variable over (0,1)
    a) Mean of X(t)
    b) Autocorrelation function of X(t)
    c) Auto covariance function of X(t) and
    d) Variance of X(t).
3. Consider a random process X(t) defined by X(t)=U Cost+V Sint,where U and V are independent random variables each of which assumes the values -2 and 1 with probabilities 1/3 and 2/3 respectively. Show that X(t) is wide-sense stationary.

Course Outcome 5 (CO 5):

1. Queries presented in a database are following a Poisson process of rate ?=6 queries per minute. An experiment consists of monitoring the database for m
    a. No queries in a one minute interval?
    b. Exactly 6 queries arriving in a one- minute interval?
    c. Less than 3 queries arriving in a half minute interval?
2. A message transmission system is found to be Markovian with the transition probability of current message to next message given by the matrix

   P=[0.2 0.3 0.5 0.1 0.2 0.7 0.6 0.3]

The initial probabilities of the states are $p1(0) = 0.4, p2(0) = 0.3, p3(0) = 0.3$. Find probabilities of the next message.

3. Describe a simple random walk with two reflecting barriers at the states 0 and 2 and compute the stationary distribution.

Model Question Paper

Course Code: ITT473

Course Name: PROBABILISTIC AND STOCHASTIC MODELLING

Max.Marks:100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. If A and B. are mutually exclusive events such that P(A)=1/4 and P(B)=3/5. FindP($\underline{A} \cap \underline{B}$)
2. A manufacturer of Airplane parts knows that the probability is 0.8 that an order will be ready for shipment of time, and it is 0.7 that an order will be ready for shipment and will be delivered on time. What is the probability that such an order will be delivered on time given that it was also ready for shipment on time?
3. A continuous random variable X has a probability density function f(x)=k(1+x),2<x<5.Find P(X<4).
4. If the mean and variance of a binomial variable are 12 and 4, respectively, find the distribution.
5. Find the value of k if f(x,y)=K(1-x)(1-y) for 0<x,y<1 is to be joint density function of X and Y.
6. The joint probability distribution of X and Y is given by f(x,y)=(2x+y)/27,x=0,1and Y=0,1,2 .Are X and Y independent random variables?
7. Let X(t)=A cos cos(50t+∂) where A is uniformly distributed in (-$\prod$,$\prod$). Find the mean{X(t)}
8. Let X(t) be a WSS.Then prove that $R_{xx}(0)=E[X^2(t)]$.
9. A gambler has Rs. 2/- . He bets 1 rupee at a time and wins 1 rupee with probability ½. He stops fixing if he loses Rs. 2/- or wins Rs. 4/-. Model this problem as a Markov Chain and find the transition probability matrix.
10. Find the mean of the Poisson Process and check whether it is a stationary process.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. a) Two thirds of the students in a class are boys and the rest are girls. It is known that the probability of a girl getting a first class is 0.25 and that of a boy is 0.28. Find the probability that a student chosen at random will get first class. 7

b) In a certain recruitment test, there are multiple choice questions. There are 4 possible answers to each question and of which one is correct.An intelligent student knows 90% of the answer. If the intelligent student gets the correct answer, what is the probability that he is guessing? 7

OR

12. a) A box contains 5 red and 4 white balls. Two balls are drawn successively from the box without replacement and it is noticed that the second one is white. What is the probability that the first is also white? 7

b) If A tells the truth 4 out of 5 times and B tells the truth 3 out of 4 times, What is the probability that both expressing the same fact contradict each other? 7

13. a) The length of time (in minutes) a person speaks over the phone follows an exponential distribution with mean 4. Find the probability that the person will talk for (i) more than 8 minutes (ii) between 3 and 6 minutes (iii) less than 2 minutes. 7

b) A pair of dice is thrown 5 times. If getting a doublet is considered to be a success, use Binomial distribution to find the probability of getting (i) at least 2 successes (ii) at most 2 successes (iii) exactly 2 failures. 7

OR

14. a) The marks obtained by students in an intelligence test follow normal distribution with mean 45 and standard deviation 25. Find the percentage of students who scored marks (i) more than 80 (ii) between 30 and 70 (iii) below 35. 7

b) Show that Poisson distribution is the limiting case of Binomial distribution as $n \to \infty, p \to 0$. 7

15. a) A random sample of size 200 is taken from a population whose mean is 50 and variance is 600. Using Central Limit theorem, find the probability that the mean of the sample X will not differ from mean=50 by more than 5. 7

b) The joint pdf of X,Y is given by $f(x,y)=k(x+2y), x=1,2,3; y=1,2,3$. Find (i) k(ii) marginal pdf of X,Y (iii)$P(X<3, Y\geq 2)$. 7

OR

16 a) Let $X_1, X_2, \ldots X_{75}$ are independently and identically distributed random variables following Poisson distribution with parameter $\lambda=2$. Use Central Limit Theorem to estimate $P(120 \leq S_{75} \leq 160)$, where $S_{75}=X_1+X_2+\cdots+X_{75}$. 7

b) The joint density function of two continuous random variables X,Y is given by 7
$F(x,y)=\{Ke^{-2X-2Y}, x\geq 0, y\geq 0$.
Find (i) the value of K (ii) $P(X>1)$ (iii) the marginal distributions of X,Y and (iv) check whether X,Y are independent.

17 a) $\{X(t)\}$ is a random process with mean 2 and auto correlation 7
$R(t1,t2)=5+3e^{-0.1|t1-t2|}$.Find the mean, variance and the covariance of the random variables X(4) and X(6).

b) Consider the random process X(t) defined by $X(t)=A\cos(wt+\Theta)$ 7
where A and Θ are independent and uniform random variables over (–k, k) and $(-\prod,\prod)$, respectively. Find the Mean and autocorrelation function of X(t).

OR

18 a)Let $\{X(t)=A\cos\cos wt+B\sin\sin wt, t>0\}$ be a random process where A and B are independent random variables following normal distribution with mean 0 and variance 4. Check whether $\{X(t)\}$ is WSS. 7

b) Define and classify random processes with examples 7

19 a) The tpm of a Markov Chain with states 1,2,3 is P=[0.2 0.3 0.5 0.1 0.6 0.3 0.4 0.3 0.3] and the initial distribution is $P(0)=(0.5,0.3,0.2)$. Find
(i) $P(X_2)=2$
(ii) $P(X_3=3,X_2=2,X_1=1,X_0=3)$ 7

b) Suppose that customers arrive at a bank according to a Poisson process with mean rate of 3 per minute. Find the probability that during a time interval of 2 minutes (i) exactly 4 customers arrive (ii) more than 4 customers arrive 7

OR

20 a) The tpm of a Markov Chain is P=[0.5 0.5 0.1 0.9]. Find the steady state distribution of the process. 7

b) Prove that the inter arrival time of a Poisson process with intensity λ obeys an exponential law with mean $1/\lambda$. **7**

Syllabus

Module 1: Introduction to Probability theory (6 Hours)

Sample space, Events, Probability, Conditional probabilities, Independent events, Bayes' formula.

Module 2: Random variables (8 hours)

Random variables - Discrete and continuous random variables - statistical properties. Probability distributions - Binomial, Poisson, Exponential, Uniform and Normal probability distributions.

Module 3: Two-Dimensional random variables (7 hours)

Joint distribution of random variables, Marginal and conditional distributions, Independent random variables, Expectation and Covariance, Central limit theorem.

Module 4: Random processes (7 hours)

Classification of random processes, Mean, Correlation and Covariance functions, Stationary random processes, Autocorrelation and Cross correlation functions.

Module 5: Special random processes (7 hours)

Poisson process - Properties and applications, Markov Chain, Chapman-Kolmogorov theorem, Stationary distribution of a Markov Chain.

Text Books

1. V. Sundarapandian, "Probability, Statistics and Queueing Theory", Prentice Hall India, 2009.
2. Sheldon M. Ross, "Introduction to Probability models", Academic Press, 11th edition, 2014.

Reference Books

1. J Medhi, "Stochastic Processes", New Age International Publishers, 3rd edition, 2009
2. Kishor S. Trivedi, "Probability and Statistics with Reliability, Queuing, and Computer Science Applications", Wiley, 2nd Edition, 2002.
3. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage, 8th edition, 2012.
4. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, 2005.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Introduction to Probability theory**	**6 Hours**
1.1	Sample space, Events, Probability	1
1.2	Conditional probabilities	2
1.3	Independent events	1
1.4	Bayes' formula	2

2	**Random variables**	**8 hours**
2.1	Discrete and continuous random variables and their statistical properties	1
2.2	Discrete and continuous Probability distributions	2
2.3	Binomial Random variables	1
2.4	Poisson random variables	1
2.5	Uniform random variables	1
2.6	Exponential random variables	1
2.7	Normal random variables	1
3	**Two-Dimensional random variables**	**7 hours**
3.1	Joint distribution of random variables (Discrete and Continuous)	2
3.2	Marginal and conditional distributions, Independent random variables	2
3.3	Expectation and Covariance	2
3.4	Central limit theorem	1
4	**Random processes**	**7 hours**
4.1	Definition and Classification of random processes	1
4.2	Mean, Correlation and Covariance functions	2
4.3	Stationary random processes	2
4.4	Autocorrelation and Cross correlation functions	2
5	**Special random processes**	**7 hours**
5.1	Poisson process- Definition and probability distribution (without proof)	1
5.2	Poisson process - Properties and applications	2
5.3	Markov Chain - Definition, probability distributions	1
5.4	Chapman - Kolmogorov theorem (Without proof)	1
5.5	Stationary distribution of a Markov Chain	2

SEMESTER VII

OPEN ELECTIVE

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT415	WEB DESGINING	OEC	2	1	0	3

Preamble: Web Designing course is intended to deliver the elementary concepts of aesthetic Web Design with HTML, CSS, Bootstrap, JavaScript, JQuery there by equipping them to develop responsive websites.

Prerequisite: Basics of programming

Course Outcome (CO): After completion of the course, the student will be able to

CO No.	Course Outcome	Bloom's Category
CO1	Interpret the fundamental concepts of web designing	Level 2: Understand
CO2	Summarize the basic elements of HTML	Level 2: Understand
CO3	Develop suitable web graphics for web pages	Level 3: Apply
CO4	Apply cascading style sheet to add presentation style to web Pages	Level 3: Apply
CO5	Employ JavaScript to add functionality to web pages	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes 3/2/1: High/Medium/Low

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	1	-	-	-	-	-	-	2
CO2	2	2	2	-	-	-	-	-	-	-	-	2
CO3	2	2	3	-	1	-	-	-	-	-	-	2
CO4	2	2	3	-	-	-	-	-	-	-	-	2
CO5	2	3	3	-	-	-	-	-	-	-	-	2

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	1	2	
Remember	5	5	10
Understand	35	20	50
Apply	10	25	40
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have a maximum 2 subdivisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. List User Interface and Layout tools for web designing.
2. Summarize file management and transfer tools
3. Mention the various web graphics creation tools

Course Outcome 2 (CO 2):

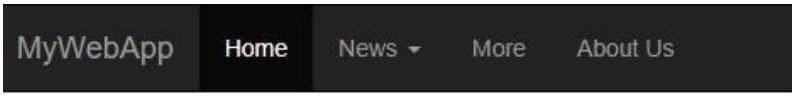
1. List out the process involved in web page design.
2. Differentiate ordered list and unordered list with example
3. Discuss Responsive image markup

Course Outcome 3 (CO 3):

1. Discuss responsive image production list.
2. Design a responsive svg image for library website
3. Create a web design for hospital management with responsive SVGs

Course Outcome 4 (CO 4):

1. Create a navigation bar in the format shown below using Cascading Stylesheet and HTML:



2. Create a web site for library management with HTML, CSS.
3. How colors and background applied in above site

Course Outcome 5 (CO 5):

1. Demonstrate insertion of new list item in an HTML page utilizing DOM methods.
2. Use Ajax & JQuery to enhance the functioning of web pages
3. Design a website make use of JQuery and Ajax

Model Question Paper

Course Code: ITT415

Course Name: WEB DESIGNING

Max Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Differentiate User Experience and User Interface Design
2. Discuss the anatomy of a web page.
3. What is the use of href? Give examples.
4. Illustrate the usage of alt attributes in an image tag.
5. Describe image asset strategy
6. Discuss SVG production tips.
7. What are Cascading Style Sheets?
8. Differentiate block and inline elements.
9. What is a Document Object Model?
10. Illustrate how JavaScript makes web pages more interactive.

PART B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. Discuss different web graphics creation tools. 14

OR

12. Describe progressive web design with examples. 14
13. Explain table tag and create the following table using table tag in HTML: 14

Branch	CGPA/Percentage		Salary
	UG	PG	
IT	105	12	500000

Others	200	225	400000

OR

14. Implement the following nested list in HTML: 14

- MAHARASHTRA
  - PUNE
    I. DIGHI
    II. MOSHI
    III. SHIVAJINAGAR
- MUMBAI
  I. SANTAKRUIZ
  II. VIKROLI
  III. MUMBRA

15. Discuss image optimization. 14

OR

16. Discuss features of SVG as XML. 14

17. Differentiate the concepts of inline, internal and external style sheets with examples. 14

OR

18. Illustrate layout and positioning elements in CSS with examples. 14

19. Explain JavaScript: Objects: Math, String, Date, and document Object with example. 14

OR

20. What are events and explain event handling with examples. 14

Syllabus

Module 1: Introduction to web designing (7 Hours)

Getting Started in Web Design: *Website creation roles:* Content wrangling - information architecture, Content strategy. All manner of Design - User Experience, interaction and User Interface Design, Visual(Graphic Design). Code Slinging - Front End Development, Back End Development, Other Roles. Gearing up for web design: Equipment, Web Production Software - Coding tools, User Interface and Layout tools, Web Graphics Creation Tools, A variety of browsers, File Management and Transfer Tools.

How the Web Works?: The internet versus the web, Serving up your information, A word about browsers, Web Page Addresses(URL), The anatomy of a web page, Putting it all together, A multitude of Devices, Sticking with the standards, Progressive Enhancement, Responsive web Design, Accessibility, Site performance.

Module 2: Html for structure (7 Hours)

Creating a simple page: A web page step by step: starting with content, Give the HTML document structure, Identifying text elements, Add an image, Change the look with a style sheet, When good page go bad, Validating your documents.

Marking up Elements: *Text:* Paragraph, Heading, Horizontal Rule, Lists, Organizing page content, Inline elements, generic elements(div and span), Character escapes, putting it all together; *Links:* href attribute, Linking to pages on web, linking within your own site, targeting a new browser window, Mail links. *Images:* image formats, img element, Adding svg elements, Responsive image markup. *Table:* how to use tables, Minimal table structure, table headers, spanning cells, Row and column groups, Wrapping up tables. *Forms:* How form works, form elements, variables and content, The great form control roundup, Form accessibility features, form layout and design. *Embedded media:* iframe, object, video and audio, canvas

Module 3: Creating web graphics (6 Hours)

Web Image Basics: Image sources, Meet the formats, Image size and resolution, image asset strategy, favicons, summing up images, saving images in web format, working with transparency, Responsive image production tips, image optimization.

SVG: Drawing with XML, Features of SVG as XML, SVG tools, SVG production tips, Responsive svgs.

Module 4: CSS for presentation (8 Hours)

Introduction to Cascading Style Sheets: The benefits of CSS, How style sheets work, The big concept, CSS units of measurement, Developer tools, moving forward with css, *Formatting text:* Basic font properties, Advanced typography with CSS3, changing text color, Selector types, text line adjustments, decorations, changing capitalization, spaced out, text shadow, changing list bullets and numbers. *Colors and backgrounds:* specifying color values, foreground color, background color, clipping the background, playing with opacity, pseudo class selectors, pseudo element selectors, attribute selectors, background images, shorthand background property, gradients, External Style sheets.

Positioning: *Thinking inside the box:* Element box, Specifying box dimensions, padding, borders, margins, assigning display types, box drop shadows; *Floating and positioning:* normal flow, floating, fancy text wrap with css shapes, positioning basics, relative positioning, Absolute positioning, fixed positioning; *CSS Layout with Flexbox and Grid:* flexible boxes with css and flexbox, CSS grid layout.

Responsive Web Design: why RWD?, The responsive recipe, choosing breakpoints, designing responsively, *Transition, Transforms and Animations:* CSS transitions, CSS transforms, Keyframe animations

Module 5: Java script for behavior (7 Hours)

Introduction to Javascript: What is javascript?, Adding javascript to a page, The anatomy of a script, The browser object, Events, Putting it all together, Meet the DOM, Polyfills, Javascript libraries

Jquery : What is jquery ?, A basic jquery example, Why use jquery ?, finding elements, jquery selection, getting element content, updating elements, changing content, inserting elements, adding new content, getting and setting attributes, getting and setting CSS properties, using .each(), events, event object, effects, animating CSS properties, using animation, traversing the DOM, working with forms, javascript libraries, jquery and Ajax

Text Books

1. Jennifer Niederst Robbins, "Learning Web Design", 5/E O'Reilly, 2018
2. Jon Duckett , "JavaScript and JQuery : Interactive Front–End Web Development", Wiley, 1st Edition 2014
3. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, "Internet and World Wide Web How To Program", 5/E, Pearson Education, 2012.

Reference Books

1. Jon Duckett , "HTML and CSS: Design and Build Websites", Wiley, 1st Edition, 2011

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	**Introduction to web designing**	**7 Hours**
1.1	**Getting Started in Web Design:** *Website creation roles:* Content wrangling - information architecture, Content strategy; All manner of Design - User Experience, interaction and User Interface Design, Visual(Graphic Design)	1
1.2	Code Slinging - Front End Development, Back End Development; Other Roles. Gearing up for web design: Equipment, Web Production Software - Coding tools, User Interface and Layout tools	1
1.3	Web Graphics Creation Tools, A variety of browsers, File Management and Transfer Tools	2
1.4	**How the Web Works?:** The internet versus the web, Serving up your information, A word about browsers, Web Page Addresses(URL),	1
1.5	The anatomy of a web page, Putting it all together, A multitude of Devices, Sticking with the standards, Progressive Enhancement, Responsive web Design, Accessibility, Site performance	2

2	**HTML for structure**	**7 Hours**
2.1	**Creating a simple page:** A web page step by step: starting with content, Give the HTML document structure, Identify text elements, Add an image	1
2.2	Change the look with a style sheet, When good page go bad, Validating your documents	1
2.3	**Marking up Elements:** *Text:* Paragraph, Heading, Horizontal Rule, Lists, Organizing page content, Inline elements, generic elements(div and span), Character escapes, putting it all together.	1
2.4	*Links:* href attribute, Linking to pages on web, linking within your own site, targeting a new browser window, Mail links.	1
2.5	*Images:* image formats, img element, Adding svg elements, Responsive image markup. *Table:* how to use tables, Minimal table structure, table headers, spanning cells, Row and column groups, Wrapping up tables.	1
2.6	*Forms:* How form works, form elements, variables and content, The great form control roundup, Form accessibility features, form layout and design; *Embedded media:* iframe, object, video and audio, canvas	2
3	**Creating Web Graphics**	**6 Hours**
3.1	**Web Image Basics:** Image sources, Meet the formats	1
3.2	Image size and resolution, image asset strategy, favicons	1
3.3	Summing up images, saving images in web format, working with transparency,	1
3.4	Responsive image production tips, image optimization	1
3.5	SVG: Drawing with XML, Features of SVG as XML, SVG tools,	1
3.6	SVG production tips, Responsive SVGs	1
4	**CSS For presentation**	**8 Hours**

4.1	**Introduction to Cascading Style Sheets:** The benefits of CSS, How style sheets work, The big concept, CSS units of measurement, Developer tools, moving forward with css	1
4.2	*Formatting text:* Basic font properties, Advanced typography with CSS3, changing text color, Selector types, text line adjustments, decorations, changing capitalization, spaced out, text shadow, changing list bullets and numbers.	2
4.3	*Colors and backgrounds:* specifying color values, foreground color, background color, clipping the background, playing with opacity, pseudo class selectors, pseudo element selectors, attribute selectors, background images, shorthand background property, gradients, External Style sheets	1
4.4	**Positioning:** *Thinking inside the box:* Element box, Specifying box dimensions, padding, borders, margins, assigning display types, box drop shadows.	1
4.5	*Floating and positioning:* normal flow, floating, fancy text wrap with css shapes, positioning basics, relative positioning	1
4.6	Absolute positioning, fixed positioning; *CSS Layout with Flexbox and Grid:* flexible boxes with css and flexbox, CSS grid layout	1
4.7	**Responsive Web Design:** why RWD?, The responsive recipe, choosing breakpoints, designing responsively, *Transition, Transforms and Animations:* CSS transitions, CSS transforms, Keyframe animations	1
5	**JavaScript for behavior**	**7 Hours**
5.1	**Introduction to Javascript:** What is javascript?, Adding javascript to a page, The anatomy of a script, The browser object	1
5.2	Events, Putting it all together, Meet the DOM, Polyfills, Javascript libraries	1
5.3	**JQuery :** What is JQuery ?, A basic JQuery example, Why use JQuery?, finding elements, JQuery selection, getting element content, updating elements, changing content, inserting elements	2
5.4	Adding new content, getting and setting attributes, getting and setting CSS properties, using .each(), events, event object, effects, animating CSS properties	2
5.5	Using animation, traversing the DOM, working with forms, JavaScript libraries, JQuery and Ajax	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT425	MULTIMEDIA TECHNIQUES	OEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn multimedia concepts and the different elements of multimedia such as text, image, sound, video and animations.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe multimedia concepts and the use of text in multimedia.	Level 2: Understand
CO 2	Demonstrate the facets of image in multimedia.	Level 2: Understand
CO 3	Choose different sound formats for multimedia applications.	Level 3: Apply
CO 4	Develop video and animations.	Level 3: Apply
CO 5	Explain stages of multimedia and future multimedia.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	1	-	-	-	-	-	-	2
CO 2	3	3	2	1	-	-	-	-	-	-	-	2
CO 3	3	3	3	2	1	-	-	-	-	-	-	2
CO 4	3	3	3	2	1	-	-	-	-	-	-	2
CO 5	2	2	2	1	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	5	5	10
Level 2: Understand	35	30	60
Level 3: Apply	10	15	30
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Describe different environments in which multimedia might be used, and different aspects of multimedia that provide a benefit over other forms of information presentation.
2. Define common multimedia terms such as multimedia, integration, interactive, HTML, and authoring and qualify various characteristics of multimedia: nonlinear versus linear content?
3. Discuss the importance of text and ways text can be leveraged in multimedia presentations.

Course Outcome 2 (CO 2):

1. Describe the use of colours and palettes in multimedia.

2. Discuss the difference between bitmap and vector graphics. Describe five different graphic elements you might use in a project, for example,the background, buttons, icons, or text. Would you use a vector tool or a bitmap tool for each element? Why?
3. Explain the image file formats.

Course Outcome 3 (CO 3):

1. Describe the components and measurements of sound.
2. Determine which audio file formats are frequently used in a multimedia project.
3. How to make digital audio files?

Course Outcome 4 (CO 4):

1. Illustrate the principles of animation.
2. How to create computer generated animations from multiple still images.
3. What defines the quality of a video signal? What factors affect, if the end result is going to be a postage-stamp-sized streaming video clip at 10 frames per second, why would quality matter?

Course Outcome 5 (CO 5):

1. Explain the four basic stages in a multimedia project.
2. What are the desirable features that should be included in a good 3d modelling tool?
3. Discuss the intangible elements needed to make good multimedia.

Model Question Paper

Course Code: ITT425

Course Name: MULTIMEDIA TECHNIQUES

Max.Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Define multimedia.
2. Describe the characteristics a block of text might have.
3. Describe the use of colors and palettes in multimedia.
4. How would you describe dithering?
5. How do you use the power of sound to make the difference between an ordinary multimedia presentation and a professionally spectacular one?
6. List the important steps and considerations in recording and editing digital audio.

7. How does the video work and is displayed?
8. Define codec and list an example of a codec.
9. What are the various authoring tools based on the method used for organizing multimedia elements and events? Give examples.
10. What is the need of OCR software while making multimedia?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11 Discuss the problems encountered using text across computer platforms and in different languages. 14

OR

12 Explain hypermedia, hypertext, links, anchors, and nodes. Discuss both the potential and limitations of hypertext and hyperlinking systems. 14

13 Differentiate among bitmap, vector, and 3-D images and describe the capabilities and limitations of all three. 14

OR

14 Explain how still images are generated in a computer. 14

15 a. Describe what MIDI is, what its benefits are, and how it is best used in a multimedia project. 10

b. Compare and contrast the use of MIDI and digitized audio in a multimedia production 4

OR

16 a. List the steps you would go through to record, edit, and process a set of sound files for inclusion on a web site. How would you digitally process the files to ensure they are consistent, have minimum file size, and sound their best? 10

b. Calculate the file size of a five-second recording sampled at 22 kHz, 16-bit if stereo two tracks are used. 4

17 a. How can create a simple animation of a man bowling, with the ball rolling down the alley and striking the pins? 10

i) Describe the sequence of motions in a storyboard.

ii) Discuss the various techniques and principles you might employ to accurately represent the motion of the man moving, the ball rolling, and the pins falling.

b. i) List the steps involved in capturing video, compressing the video, and preparing it for DVD and discuss the decisions you need to make with each step regarding compromises on image quality and other limiting factors. 4

OR

18 a. Discuss the physical and psychological principles as to why animation works, as well as how it is usually presented. 4

b. Answer the following questions. 10

i) Discuss the consideration aspects while shooting and editing video for multimedia.

ii) What techniques would you use to produce the best possible video at a reasonable cost?

iii) Which of these techniques apply to all videos?

iv) Which applies specifically to multimedia?

19 a. Describe the memory and storage devices used in making multimedia. 8

b. Explain the features in image editing applications which are desirable to multimedia developers. 6

OR

20 a. How can we choose an authoring tool suitable for our needs? Explain the various features to be considered. 10

b. Explain the various hardware connection methodologies helpful in making multimedia. 4

Syllabus

Module 1: Introduction to multimedia (7 Hours)

Multimedia-Introduction, Definition, Use, Delivering.

Text-Power of meaning-Fonts and Faces, Text in multimedia, computers and texts, font editing and design tools, Hyper media and hyper texts

Module 2: Images and colours in multimedia (6 hours)

Images-Still Images-Bitmap images, vector drawing, 3D drawing and rendering. Color–

Understand natural light and color- Computerized color- Color palette-File formats.

Module 3: Sound in multimedia (6 hours)

Sound-Power of sounds-Digital Audio-MIDI-multimedia system sounds-Audio file formats-Vaughan’s Law of multimedia minimums, Adding sounds to your project.

Module 4: Video and animation (8 hours)

Animation-The power of motion-principle of animation- animation by computer-making animations -creating an animated scene.

Video- How video works and is displayed-Digital video containers-obtaining video clips-shooting and editing

Module 5: Making multimedia (8 hours)

Making Multimedia-The stages of a multimedia project-What you need-Intangibles, hardware, software, authoring systems. -Future multimedia

Text Books

1. Tay Vaughan, Multimedia: Making It Work, Ninth Edition, McGraw-Hill, 2014

Reference Books

1. Ashok Banerjee, Anand Mohan Ghosh, Multimedia Technologies, McGraw-Hill, 2009
2. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of multimedia, Springer, 2/e.
3. Chopra Raiv, Computer graphics with an introduction to multimedia, S Chand and company Ltd, 2017 4/e.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Introduction to multimedia**	**7 Hours**
1.1	Multimedia- Introduction, definition.	1
1.2	Use, delivering.	1
1.3	Text-Power of meaning-Fonts and Faces.	1
1.4	Text in multimedia.	1
1.5	Computers and texts.	1
1.6	Font editing and design tools	1
1.7	Hyper media and hyper texts.	1
2.	**Images and colours in multimedia**	**6 Hours**
2.1	Images-Still images-Bitmap images, vector drawing.	2
2.2	3D drawing and rendering.	1

2.3	Color –understand natural light and color	1
2.4	Computerized color	1
2.5	Color palette-file formats.	1
3	Sound in multimedia	6 Hours
3.1	Sound-Power of sounds-Digital Audio	1
3.2	MIDI	1
3.3	Multimedia system sounds-Audio file formats	1
3.4	Vaughan's Law of multimedia minimums, Adding sounds to your project-Space consideration, Audio recording.	2
3.5	Adding sounds to your project- Keeping track of your sounds, Audio CDs, Sound for your mobile, Sound for the internet.	1
4	**Video and animation**	**8 Hours**
4.1	Animation-The power of motion-Principle of animation	1
4.2	Animation by computer	1
4.3	Making animations - examples, Creating an animated scene.	1
4.4	Video- How video works and is displayed	2
4.5	Digital video containers	1
4.6	Obtaining video clips-shooting and editing	2
5	**Making multimedia**	**8 Hours**
5.1	Making Multimedia-The stages of a multimedia project-What you need-Intangibles.	1
5.2	What you need - Hardware	2
5.3	What you need-software	2
5.4	What you need-authoring systems	2
5.5	Future multimedia	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT435	FREE AND OPEN SOURCE SOFTWARE	OEC	2	1	0	3

Preamble: To provide the concepts of free open source software and enable the students to learn Linux OS environment and Python programming

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Outline the basic concepts of FOSS & its development	Level 2: Understand
CO 2	Explain and summarize the salient features of the Linux operating system.	Level 2: Understand
CO 3	Demonstrate basics Shell programming.	Level 2: Understand
CO 4	Outline basic concepts of version control.	Level 2: Understand
CO 5	Develop programs using the open source programming language Python.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	-	-	1	-	-	-	-	-	-	1
CO 2	2		-	-	1	-	-	-	-	-	-	1
CO 3	2	2	2	-	2	-	-	-	-	-	-	1
CO 4	2			-	1	-	-	-	-	-	-	-
CO 5	3	3	3	1	3	-	-	-	-	-	-	1

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	10	5	10
Level 2: Understand	40	30	70
Level 3: Apply		15	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Define FOSS.
2. What is the difference between free software and open software ?
3. Describe how to start a FOSS project.

Course Outcome 2 (CO 2):

1. Illustrate the layout of a Linux file system.
2. Explain different type of process in Linux
3. Compare data partition with swap partition.

Course Outcome 3 (CO 3):

1. How to define functions in shell programming ?
2. Describe with an example the I/O redirection in shell programming.

3. How to initialize Variables in Shell Scripting?

Course Outcome 4 (CO 4):

1. Define version control.
2. How does the distributed nature of gits help to improve the working environment of developers in projects?.
3. Describe the branching in Gits.

Course Outcome 5 (CO 5):

1. Develop a Python program to check whether a given number is an Armstrong number
2. Write a Python program to find the factorial of a number. Use function to calculate the factorial.
3. Demonstrate the data type conversion in Python.

Model Question Paper

Course Code: ITT435

Course Name: FREE AND OPEN SOURCE SOFTWARE

Max.Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. In security aspects, FOSS systems are superior to proprietary systems. Justify.
2. List the shortcomings of FOSS.
3. How does an interactive process differ from an automated process?
4. Describe boot process.
5. What is backtick in shell programming ?
6. Compare modified and staged state of file in Git.
7. Write syntax of conditional expression in Python.
8. Differentiate between x/y and x//y .
9. Describe dictionary operations.
10. How to select an element from a list?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11 a. Explain technical infrastructure needed for FOSS. 9

b. Describe (i)candidate release (ii) security release. 5

OR

12	a.	Compare Free Software Foundation(FSF) philosophy and the Open Source Initiative(OSI)philosophy.	6
	b.	Explain major release numbering conventions.	8
13	a.	What is the purpose of partitioning the Linux file system ?	9
	b.	Compare absolute path and relative path in file system.	5

OR

14	a.	List and explain any five commands related to the process.	10
	b.	Describe filters in Linux ?	4
15	a.	Write a shell program to find the largest of three numbers.	6
	b.	Illustrate basic branching and merging of Git.	8

OR

16	a.	Write a shell program to find the factorial of a number using function.	7
	b.	Explain Git Repository.	7
17	a.	What is recursion ?Write a Python program to generate n terms of Fibonacci sequences using recursion.	8
	b.	Let fruit =’apples’ be a string. What will be the output of the following expressions: i)len(s1) ii) s1[0:4] iii) s1[6] iv) s1[-4]	6

OR

18	a.	Write a Python program to find sum of digits of a number.	6
	b.	Differentiate between break and continue statement with proper examples?	8
19	a.	Write a Python program to input a list of ‘n’ numbers. Calculate and display the average of numbers. Also display the cube of each value in the list.	8
	b.	Explain class and object with an example.	6

OR

20	a	Write a Python program to create a dictionary of roll numbers and names of 5 students. Display the contents of the dictionary in alphabetical order of names.	8
	b.	Compare List and Tuple with suitable examples?	6

Syllabus

Module 1: Introduction to FOSS(5 Hours)

The FOSS philosophy- The FOSS development method, Why FOSS, benefits of FOSS, shortcomings of FOSS, Intellectual Property Rights and Licensing, Localization and Internationalization, Starting open source project, Technical infrastructure for FOSS, Packaging and releasing of FOSS.

Module 2: Open Source Operating System (LINUX) (7 Hours)

Introduction, user interface, properties, Linux Flavours, Linux file system, Process, Linux I/O redirection, Text editors in Linux, Installing new software.

Module 3: Introduction to shell programming and version control (7 Hours)

Shell, Shell scripting, creating and executing shell script,variables,basic operators ,control statement ,I/O redirection **,**shell functions**.**

Introduction to Version Control Systems, introduction to gits, git branching, distributed git, github.

Module 4: Python Programming -Part 1 (8 Hours)

Introduction, values and variables, expression and arithmetic operators, conditional execution, iteration, functions.

Module 5: Python Programming Part 2 (8 Hours)

Strings and Lists, tuples, dictionaries – operations and examples. files, exceptions. Introduction to classes and objects.

Text Books

1. Karl Fogel,Producing Open Source Software How to Run a Successful Free Software Project, Producingoss,2018 ,
2. Machtelt Garrels, Introduction to Linux A Hands on Guide, Linux Documentation Project collection ,2014.
3. Richard Blum ,Linux Command Line and Shell Scripting Bible, Wiley Publishing, Third Edition,2015.
4. Richard L. Halterman, Fundamentals of Python Programming, Southern Adventist University,2018 .
5. Scott Chacon and Ben Straub , Pro Git book, Apress(Version 2.1.225, 2020-05-13).

Reference Books

1. Kenneth Wong, Phet Sayo, Free/open source software : a general introduction,United Nations Development Programme's Asia-Pacific Development Information Programme, 2010
2. Richard Petersen,"Linux complete reference "Tata McGraw-Hill Education ,Sixth Edition 2010.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Introduction to FOSS -(**Refer textbook No.1 **"**Producing Open Source Software How to Run a Successful Free Software Project")	**5 Hours**
1.1	The FOSS philosophy**,**The FOSS development method.	1
1.2	Why FOSS, benefits of FOSS, shortcomings of FOSS, Intellectual Property Rights and Licensing.	1
1.3	Localization and Internationalization.	1
1.4	Starting open source project, Technical infrastructure for FOSS .	1
1.5	Packaging and releasing of FOSS .	1
2	**Open Source Operating System (LINUX) –(**Refer textbook No.2 **"**Introduction to Linux A Hands on Guide")	**7 Hours**
2.1	Introduction, user interface, properties, Linux Flavours.	1
2.2	Linux file system.	1
2.3	Process.	2
2.4	Linux I/O redirection.	2
2.5	Text editors in Linux, Installing new software.	1
3	**Introduction to shell programming and version control (**Refer textbook No 3,Linux Command Line and Shell Scripting Bible, Text No 5 Pro Git book)	**7 Hours**
3.1	Introduction Shell, Shell scripting, creating and executing shell script.	1
3.2	Variables,basic operators .	1
3.3	Control statement ,I/O redirection.	1
3.4	Shell functions **.**	1
3.5	Introduction to Version Control Systems, introduction to gits.	1
3.6	git branching,	1
3.7	Distributed git, github.	1
4	**Python Programming (**Refer text book No **.**4 Fundamentals of Python Programming)	**8 Hours**
4.1	Introduction, values and variables.	1
4.2	Expression and arithmetic operators.	1
4.3	Conditional execution.	2
4.4	Iteration.	2
4.5	Functions.	2
5	**Python Programming (**Refer text book No**.**4 Fundamentals of Python Programming)	**8 Hours**

5.1	Strings and Lists.	1
5.2	Tuples.	1
5.3	Dictionaries – operations and examples.	1
5.4	Files.	2
5.5	Introduction to classes and objects.	1
5.6	Exceptions.	2

****

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT445	MOBILE APPLICATION DEVELOPMENT	OEC	2	1	0	3

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in mobile applications for real world applications. A person should have knowledge about the basic concepts about how an application is developed for a mobile phone, thereby they will be equipped to work in the industry.

Prerequisite: NIL

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basic concepts of mobile networks, architecture and operating systems	Level 2: Understand
CO 2	Explain different android app architectures and Android Studio	Level 2: Understand
CO 3	Describe the basics of Kotlin and familiarize basic Hello World App	Level 2: Understand
CO 4	Discuss about the Android Architecture and databases	Level 2: Understand
CO 5	Explain the basic concepts of cross platform development and Flutter	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	-	1	-		-	-	-	-	-	-	
CO2	2	-	1	-	2	-	-	-	-	-	-	2
CO3	2	-	1	-	2	-	-	-	-	-	-	2
CO4	2	-	1	-	2	-	-	-	-	-	-	2
CO5	2	-	1	-	2	-	-	-	-	-	-	2

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	30	30	80
Apply			
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Compare the platform architecture of iOS and Android.

2. What are the advantages of ARM architecture?

3. Differentiate between Base sensor and Composite Sensor

Course Outcome 2 (CO2)

1. Compare between MVC, MVP and MVVM architectures.

2. Give a brief description of components in Android Application Architecture.

3. Give examples of an Activity.

Course Outcome 3 (CO3):

1 How is variable declaration in Kotlin different from Java?

2. What kind of applications can be built on Kotlin?

3. Is Kotlin a statically typed programming language. Justify your

answer. 4.What are the steps involved in creating a project in Kotlin?

Course Outcome 4 (CO4):

1. Describe the Lifecyle of a View model.

2. Describe the advantages of using LiveData.

3. What are the advantages of Room database over SQLite?

Course Outcome 5 (CO5):

1. What is the importance of widget in Flutter?

2. Describe the advantages of using Flutter for cross platform development

3. Give an overview about the architectural layers of Flutter.

Model Question paper

Course Code: ITT445

Course Name: MOBILE APPLICATION DEVELOPMENT

Max Marks :100 **Duration: 3 Hrs**

PART A

Answer all questions. Each question carries three marks(10*3=30 marks)

1	Describe features of Swift Language	3
2	Describe the characteristics of Composite Sensors with an example	3
3	What is an App Component? What is its importance?	3

4		Describe the advantages of MVP architecture.	3
5		How do you declare variables in Kotlin? How does the declaration differ from the Java counterpart?	3
6		Give the basic structure of a function in Kotlin with an example	3
7		What are the differences between SQLite and Room database?	3
8		Describe the advantages of using Live Data.	3
9		List out the features for Flutter.	3
10		What are the existing solutions for cross platform development?	3

PART B

Answer all questions. Each question carries 14 marks (5*14=70 marks)

11	a	Describe any three different type of composite sensors	10.5
	b	What are the features of Swift programming language that makes it unique?	3.5

OR

12		Draw the architecture of iOS and explain each of its components	14
13	a	Compare the different mobile application architectures by giving the advantages and disadvantages of each of them	6
	b	What is a Project and Module in Android Studio? Describe the distinct types of module offered by Android studio?	8

OR

14		Write short notes on four different types of app components	14
15	a	What are functions in Kotlin? Write a function in Kotlin to find sum of two numbers	6
	b	What are the features of Kotlin that makes it unique?	8

OR

16	a	Illustrate with an example the use of when expression	7
	b	Illustrate the concept of Properties in Kotlin with an example	7
17		What are the advantages of using Live Data? What are the steps to work with Live Data objects?	14

OR

18		What are the major components in a Room database? Explain each one briefly. List out the benefits of Room database	14
19	a	What do you mean by cross platform development? What are the available cross platform development solutions? Why is Flutter considered to be one of the best solutions	7
	b	What is a widget? Give the differences between a stateful widget and a stateless widget	7

OR

20	a	With a figure explain each layer in the architecture of Flutter architecture	7
	b	Summarize the features of user interfaces of Flutter	7

Syllabus

Module 1: Device Hardware, Peripheral and Platform Architecture (7 hours):

Device hardware - ARM processors. Sensors - Base sensors, Composite Sensors, Peripherals - Audio and Custom Accessories. Mobile Operating systems (no details required). Platform Architecture: iOS and Android. Development languages: Swift for iOS, Kotlin for Android.

Module 2 : Mobile Application Architecture and Introduction to Android(7 hours)

Mobile application architectures - MVC, MVP, MVVM. Introduction to Android Studio IDE-Project structure, User interface, Gradle build system, Project overview – Modules, Project files, Project Structure settings. Android App Components - Activities, Services, Notifications, Broadcast Receivers, Content Providers.

Module 3:Introduction to Kotlin (7 hours)

Basic elements – Basic types ,Functions and Variables, Classes and Properties, Conditions and Loops. Familiarization of basic apps using Kotlin by a Hello World Project

Module 4 :Android Architecture Components and Database(7 hours)

Android Architecture Components – ViewModel - Overview, Implementation, Lifecycle, Sharing Data with fragments, Replacing Loaders with View Model, LiveData-Overview, Advantages, Work with LiveData Objects Database – SQLite-Defining a schema, Create a database, Insertion, Deletion and Updation of Data, Room- Overview, Primary components, Sample Implementation

Module 5 : Cross Platform Development (7 hours)

Introduction to Flutter, Why Flutter, Other options , Native Solutions, Flutter App Architecture Layer, Reactive User Interfaces, Widgets, Rendering model

Textbooks

1. Lyla B Das, Embedded Systems an Integrated Approach, Pearson,2013 (page number 335 -344)
2. Varun Nagpal, Android Sensor Programming By Example -PACKT Publishing, 1st edition ,2016 (Chapter 1)
3. Dmitry Jemerov and Svetlana Isakova , Kotlin in Action ,Hanning, MEAP Edition, February 2017 (Part 2)
4. Bill Philips, Android Programming: The Big Nerd Ranch Guide ,3rd Edition,2017 (Chapter 14)
5. Josh Skeen, Kotlin Programming: The Big Nerd Ranch Guide (Big Nerd Ranch Guides) 1st Edition,2018 (Chapter 1- Your first Kotlin Application)
6. Rap Pyne," Beginning App Development with Flutter: Create Cross-Platform Mobile Apps",APress,2019 (Chapter 1)

References

1. Ian Darwin, "Android Cookbook", O'Reilly, 2nd edition, 2017.
2. Micheal Burton,"Android Application Development For Dummies",October 2012
3. Dawn Griffiths, David Griffiths, "Head First Kotlin", O'Reilly Media, Inc., February 2019
4. Marco L. Napoli,"Beginning Flutter: A Hands on Guide for App Development",Wiley, October 2019.

Web Resources

- Android Sensors and Peripheral: https://source.android.com/devices/sensors/sensor-types
- Mobile OS list: https://www.g2.com/articles/mobile-operating-systems
- iOS Platform Architecture: https://cs4720.cs.virginia.edu/slides/CS4720-MAD-iOSArchitecture.pdf
- Android Platform Architecture: https://developer.android.com/guide/platform
- Swift: https://docs.swift.org/swift-book/
- Kotlin for Android: https://developer.android.com/kotlin/first
- Architectures: https://blog.mindorks.com/mvc-mvp-mvvm-architecture-in-android
- Android Studio : https://developer.android.com/studio/intro
- Android Project Overview: https://developer.android.com/studio/projects

- Android App Components:https://developer.android.com/guide/components/fundamentals
- Kotlin basics: https://kotlinlang.org/docs/reference/basic-syntax.html
- Kotlin basic types: https://kotlinlang.org/docs/basic-types.html
- Kotlin condition and loops: https://kotlinlang.org/docs/control-flow.html
- Google Codelabs for app development: https://codelabs.developers.google.com/android-kotlin-fundamentals/
- Android Architecture Components: https://developer.android.com/topic/libraries/architecture
- Live Data: https://developer.android.com/topic/libraries/architecture/livedata
- View Model: https://developer.android.com/topic/libraries/architecture/viewmodel
- Location tracking: https://developer.android.com/training/location
- SQLite-https://developer.android.com/training/data-storage/sqlite
- Room Database: https://developer.android.com/topic/libraries/architecture/room
- Flutter architecture: https://flutter.dev/docs/resources/technical-overview
- Flutter codelab: https://flutter.dev/docs/codelabs
- Flutter Tutorials: https://flutter.dev/docs/reference/tutorials

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**7 hours**
1.1	ARM Processor	1
1.2	Sensors, Peripherals	2
1.3	Mobile Operating Systems	1
1.4	Platform Architecture -iOS and Android	2
1.5	Developmental Languages- Swift,Kotlin	1
2	**Android**	**7 hours**
2.1	Mobile Application Architectures-MVC,MVP,MVVM	1
2.2	Introduction to Android studio	2
2.3	Project Overview	2
2.4	Android app components	2
3	**Kotlin**	**7 hours**
3.1	Introduction to Kotlin, Basic elements-Type	2
3.2	Basic elements -Functions and Variables	1
3.3	Classes and Properties	1
3.4	Conditional expressions and Loop	1
3.5	Hello World Project	2
4	**Architecture Components and Database**	**7 hours**
4.1	Android Architecture Components-View model	2
4.2	Android Architecture Components-Live data	2
4.3	SQLite data base	2
4.4	Room	1

5	**Cross Platform Development**	**7 hours**
5.1	Introduction to Flutter,Why Flutter, Native solutions	1
5.2	Flutter architecture	1
5.3	Reactive user interface	1
5.4	Widgets	2
5.5	Rendering model	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MCN401	INDUSTRIAL SAFETY ENGINERING	MCN	2	1	0	--

Preamble: The course is intended to give knowledge of various safety management principles, various safety systems, various machine guarding devices, hazard identification techniques, energy sources, systems & applications and the need in the present context. Learners will be able to compare different hazard identification tools and choose the most appropriate based on the nature of industry. It aims to equip students in working with projects and to take up research work in connected areas

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	Describe the theories of accident causation and preventive measures of industrial accidents. (Cognitive Knowledge level: **Understand**)
CO2	Explain about personal protective equipment, its selection, safety performance & indicators and importance of housekeeping. (Cognitive Knowledge level: **Understand**)
CO3	Explain different issues in construction industries. (Cognitive Knowledge level: **Understand**)
CO4	Describe various hazards associated with different machines and mechanical material handling. (Cognitive Knowledge level: **Understand**)
CO5	Utilise different hazard identification tools in different industries with the knowledge of different types of chemical hazards. (Cognitive Knowledge level: **Apply**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2				2	2	2				1
CO2	2	1	2		1	1	1	1				1
CO3	2	2	2		1	1	1	1	1	1		1
CO4	2	2	2		1	1	1	1	1	1		1
CO5	2	2	2	1	1	1	1	1	1	1		1

The COs and CO-PO map shall be considered as suggestive only.

Abstract POs defined by National Board of Accreditation			
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment - Test : 25 marks

Continuous Assessment - Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

MCN401- Industrial Safety Engineering (35 hrs)

Module I (safety introduction- 5 hrs)

Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.

Module II (Personal protection in work environment- 7 hrs)

Personal protection in the work environment, Types of PPEs, Personal protective equipment-respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

Module III (safety issues in construction- 7 hrs)

Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space – Temporary Structures. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety. Relevance of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.

Module IV (safety hazards in machines- 8 hrs)

Machinery safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices. Safety in turning, and grinding. Welding and Cutting-Safety Precautions of Gas

welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks, clamps. Hearing Conservation Program in Production industries.

Module V (hazard identification and analysis- 8 hrs)

Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion hazard rating of process plants - The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operability study (HAZOP)) – methodology, criticality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardous properties of chemicals, Material Safety Data Sheets (MSDS).

Text Books:

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
3. Krishnan, N.V. (1997). *Safety management in Industry*. Jaico Publishing House, New Delhi.
4. John V. Grimaldi and Rollin H.Simonds. (1989) *Safety management*. All India Traveller Book Seller, Delhi.
5. Ronald P. Blake. (1973). *Industrial safety.* Prentice Hall, New Delhi.
6. Alan Waring. (1996). *Safety management system*. Chapman & Hall, England.
7. Vaid, K.N., (1988). Construction safety management. National Institute of Construction Management and Research, Mumbai.

8. AIChE/CCPS. (1992). *Guidelines for Hazard Evaluation Proce*dures. (second edition). Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Which are the various accident causation theories? Explain.
2. Define terms: Accident, Reportable accident, Dangerous occurrence.

Course Outcome 2 (CO2):

1. Discuss different types of personal protective equipment

2. Discuss about how to compare the safety performance of two industries.

3. Discuss the significance of work permit system in accident prevention.

Course Outcome 3 (CO3):

1. Distinguish ladders and scaffolds along with their safety features**.**
2. Discuss the safety requirement for a confined space entry.
3. Explain the important provision in the National Building Code.

Course Outcome 4 (CO4):

1. Explain the various principles used in machine guarding.
2. Explain the issues in mechanical material handling.

Course Outcome 5 (CO5):

1. Selection of different types of fire extinguishers accordance to type of fire.
2. Conduct a HAZOP study for a batch rector of your choice.
3. Determine different types of Chemical hazards associated with industries

MODEL QUESTION PAPER

VII SEMESTER B. TECH DEGREE EXAMINATION

MCN401- INDUSTRIAL SAFETY ENGINEERING

Maximum: 100 Marks **Duration: 3 hours**

PART A

Answer all questions, each question carries 3 marks

1. Differentiate Unsafe act and Unsafe conditions with suitable examples
2. Discuss the significance of a safety committee in improving the safety performance of an industry
3. Which are the different types of permit? Highlight its suitability.
4. Which are five 'S' used in housekeeping?
5. List the various safety features of ladders.
6. How safety of the workers can be ensured during a demolition operations.
7. Which are the hazards associated with manual material handling?
8. Discuss the safety issues of Gas welding operations.
9. Differentiate Hazard and Risk.
10. Why MSDS is mandatory for chemical products.

(10 X 3 = 30 Marks)

PART B

Answer one full question from each module

Module 1

11. List the various accident causation theories and explain any one in details. (14 Marks)
12. a) Discuss the significance of safety policy in reducing the accidents. (4 Marks)

    b) Safety and productivity are the two sides of a coin'. Are you agreeing with this statement? Explain with your arguments. (10 Marks)

Module 2

13. a) Classify the personal protective equipment. List the suitability of at least fifteen types of PPEs. (10 Marks)

b) How will you calculate the frequency rate? Explain with an example. (4 Marks)

14. a) How will you compare the safety performance of two industries? Explain with suitable example. (10 Marks)

    b) Which are the steps to be followed in confined space entry to protect the life a worker. (4 Marks)

Module 3

15. Discuss the safety and fire protection facilities required for a high rise building as per National building code. (14 Marks)
16. a) Identify the various hazards during the different stages of building construction. (7 Marks)

    b) Discuss the important types of ergonomic hazards associated with industries.(7 Marks)

Module 4

17. Which are the various types of machine guarding devices used industries. Discuss the suitability of each machine guarding devices. (14 Marks)
18. With suitable sketches briefly explain seven defects of wire ropes. (14 Marks)

Module 5

19. What is Hazard and Operability Analysis? How do you conduct a HAZOP analysis? (14 Marks)
20. Discuss about different types of chemical hazards. (14 Marks)

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures/ Tutorials L-T
1	**Introduction to Industrial safety Engineering**	
1.1	Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence. Reportable accidents	1
1.2	Theories of accident causation. Safety organization.	2
1.3	Role of management, supervisors, workmen, unions, government and voluntary agencies in safety.	3
1.4	Safety Officer-responsibilities, authority.	4
1.5	Safety committee-need, types, advantages.	5
2	**Personal protection in the work environment**	
2.1	Types of PPEs, respiratory and non-respiratory equipment.	6
2.2	Standards related to PPEs	7
2.3	Monitoring Safety Performance: Frequency rate, severity rate	8,
2.4	Monitoring Safety Performance: incidence rate, activity rate.	9
2.5	Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping.	10
2.6	Work permit system- objectives, hot work and cold work permits.	11
2.7	Typical industrial models and methodology. Entry into confined spaces.	12
3	**Introduction to construction industry and safety**	
3.1	Excavation and filling – Under-water works – Under-pinning & Shoring	13
3.2	Ladders & Scaffolds – Tunneling	14
3.3	Blasting –Demolition – Confined space	15
3.4	Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety.	16
3.5	Relevance of ergonomics in construction safety.	17
3.6	Ergonomics Hazards	18
3.7	Musculoskeletal Disorders and Cumulative Trauma Disorders.	19
4	**Machinery safeguard**	

4.1	Point-of-Operation, Principle of machine guarding -	20
4.2	Types of guards and devices.	21
4.3	Safety in Power Presses, primary & secondary operations - shearing -bending - rolling – drawing.	22
4.4	Safety in turning, boring, milling, planning and grinding.	23
4.5	Welding and Cutting-Safety Precautions of Gas welding and Arc Welding,	24
4.6	Cutting and Finishing.	25
4.7	Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking.	26
4.8	Material Handling equipment-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks, clamps	27
5	**Hazard identification**	
5.1	Hazard and risk, Types of hazards – Classification of Fire	28
5.2	Types of Fire extinguishers fire, explosion and toxic gas release.	29
5.3	Inventory analysis, Fire and explosion hazard rating of process plants -	30
5.4	The Dow Fire and Explosion Hazard Index.	31
5.5	Preliminary hazard analysis, Hazard and Operability study (HAZOP)	32
5.6	Chemical hazard- Classifications, Control of Chemical Hazards.	33
5.7	Hazardous properties of chemicals	34
5.8	Material Safety Data Sheets (MSDS).	35

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL411	DATA ANALYTICS LAB	PCC	0	0	3	2

Preamble: Data analytics lab is a practical course to supplement the Data analytics theory course. The implementation of machine learning algorithms using R and experimenting with the dynamic, interactive visualization techniques using Tableau will equip the students to pursue careers in the data analytics domain. A familiarization of the popular analytic tools like Hadoop can help in academic projects or to carry out data analysis in new application areas.

Prerequisites:

- ITT201 - Data Structures
- ITT 206 - Database Management Systems
- MAT 208 - Probability, Statistics and Advanced Graph theory
- ITT 306 - Data Science

Course Outcomes: After the completion of the course the student will be able to:

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Solve simple problems of statistical analysis of data using Microsoft Excel	Level 3: Apply
CO 2	Analyze the textual dataand time series data with the data visualization techniques in R	Level 3: Analyze
CO 3	Implement the basic statistical techniques and machine learning algorithms using R	Level 3: Apply
CO 4	Execute HDFS commands and apply Map Reduce technologies associated with big data analytics using HADOOP	Level 3: Apply
CO 5	Analyzereal world data by applying the suitable visualization techniques in Tableau	Level 4: Analyze

Mapping of Course Outcomes with Program Outcomes

	PO	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	3	-	-	-	-	-	-	2
CO 2	3	3	3	3	3	2	2	2	2	2	-	2
CO 3	3	3	3	2	3	-	-	-	-	-	-	2
CO 4	3	3	3	2	3	-	-	-	-	-	-	2
CO 5	3	3	3	3	3	2	2	2	2	2	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

(a) Preliminary work : 15 Marks
(b) Implementing the work/Conducting the experiment : 10 Marks
(c) Performance, result and inference (usage of equipments and troubleshooting) : 25 Marks
(d) Viva voce : 20 marks
(e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Sample Course Level Assessment

Questions Course Outcome 1 (CO1):

1. Use Excel's Descriptive Statistics data analysis tool to show the descriptive statistics for the two samples.

Sample 1	Sample 2
28	14
19	18
56	9
23	2
24	26
35	32
99	100
10	62
4	53

2.The given data shows the age of individuals and their average medical expenses per month. Apply linear regression in Excel to draw the regression line and predict the average medical expenses of specific individuals.

Age(X)	Avg amt spend on medical expenses per month in rupees
15	100
20	135
25	135
37	150
40	250
45	270
48	290

3. Consider the waiting time of the customer at the cash counter of the SBI bank branch during peak hours, which was observed by the cashier. Create a histogram in Excel based on the below data.

Customer Waiting time in minutes
2.30
5.00
3.55
2.50
5.10
4.21
3.33
4.10
2.55

Course Outcome 2 (CO2):

1. Write an R program to perform sentiment analysis using the movie review dataset. (Reference Dataset: https://ai.stanford.edu/~amaas/data/sentiment/)
2. Write an R program to create a corpus of documents and preprocess them in R using stemming, stop word removal, whitespace removal, convert them to lowercase and remove punctuations.
3. Write an R program to create a term document matrix for a corpus in R.
4. Write an R program to find the frequent terms in a document and remove sparse terms in R.
5. Plot a distance versus time scatter plot.
6. Implement the analysis of single variable and multi variable data using histogram, boxplot,whisker plot, barplot and scatter plot (Use the default mtcars dataset in R).
7. Collect data related to user's preferences for products and implement a product recommender system.

Course Outcome 3 (CO3):

1. Given the following data about average rainfall in every month in the year of 2017.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rainfall (mm)	10	10	10	10	10	560	640	520	320	90	20	10

Calculate Arithmetic, Geometric, Harmonic mean, Median and Mode, First quartile, 56thpercentile for the above data using R.

2. Interpret the data in Anscombe dataset in R with linear regression.
3. Use logistic regression to find the best predictor variables for customer churn prediction.

4. Using decision trees, predict whether to play golf given factors such as weather outlook, temperature, humidity, and wind.
5. Group 620 high school seniors based on their grades in three subject areas: English, mathematics, and science with K-means clustering method.

Course Outcome 4 (CO4):

1. Write a map reduce program to count the words.
   (https://www.kaggle.com/rtatman/english-word-frequency)
2. Write a map reduce program to mine weather data (Data available at https://github.com/tomwhite/hadoop-book/tree/master/input/ncdc/all)
3. Write a map reduce program to analyze web log files (https://www.microsoft.com/en-in/download/details.aspx?id=37003)
4. Write HDFS commands to:
   - Create a directory on HDFS in home directory.
   - Create two directories in a single command in home directory.
   - List the directories created in HDFS.
   - Create a sample text file in any of the directories created above.
   - Copy file/files from local file system to one of the directories created on HDFS.
   - Verify the file upload.
   - Copy a file from HDFS to local file system
   - Copy the file from one directory to another directory in HDFS.
   - Move the file from one directory to another directory in HDFS.
   - Copy a file from/To Local file system to HDFS.
   - Display last few lines from the file in HDFS.
   - Display the size of the file in KB and MB in the HDFS.
   - Append a file from Local File system to file in HDFS
   - Merge two file contents (in HDFS) in to one file (in Local file system)
   - Copy one directory structure to another.
   - Set the replication to the file created to 4
   - Remove a file from the directory in HDFS.
   - Remove a directory in HDFS.

Course Outcome 5 (CO5):

1. Using visualization with Tableau , analyze a Superstore data to identify prospective regions for its expansion.
2. There Are Three Customer Segments in the Superstore Dataset. What Percent of the Total Profits Are Associated with the Corporate Segment? Visualize using Tableau
3. Calculate the “average delay to ship using Tableau.”The data set considered should have information regarding order date and ship date for four different regions.

LIST OF EXPERIMENTS

Data Analysis using EXCEL

1. Descriptive Statistics*
2. Linear Regression*
3. Histogram*

R programming

1. Basic Concepts of R - Data structures , Control flow , Functions, Packages*
2 Data reshaping and merging using R *
3. Text Data Analysis using appropriate datasets.*
4. Data Visualisation in R (Scatter plot, Histogram, Box and Whisker, Dot plots,ggplot package).*
4. Exercises to implement Time series Analysis using R.
6. Exercises to create Dashboard, analytics report for a dataset.
7. Recommender systems like product recommendation or movie recommendation

Machine Learning algorithms using R

1. Statistics using R – Mean, Mode, median*
2. Linear Regression and logistic regression*
3. Decision Tree based Classification*
4. K-Means Clustering*
5. SVM classification
6. Neural Network based classification
7. Principal Component Analysis

Big Data Tools and Techniques

1. Installation and configuration of Hadoop*
2. Manipulation of HDFS files using commands*
3. Implementation of Map Reduce programs *
4. Interactive Data Visualization with Tableau Public*
5. Installing and configuring Hive and implementing partitioning and bucketing in Hive
6. Exercises to implement map reduce in MongoDB

*(Note: * marked experiments are mandatory.)*

References

1. Joseph Schmuller. Statistical Analysis with Excel For Dummies (4th. edn.)2016.

2. https://cran.r-project.org/manuals.html

3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. Wiley Publishing.(1st. ed.). 2015.

4. https://bradleyboehmke.github.io/HOML/index.html

5. https://hadoop.apache.org/

6. https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html

7. https://hive.apache.org/

8. https://docs.mongodb.com/manual/installation/

9. https://www.tableau.com/community/academic

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITQ413	SEMINAR	PWS	0	0	3	2

Preamble: The course 'Seminar' is intended to enable a B.Tech graduate to read, understand, present and prepare report about an academic document. The learner shall search in the literature including peer reviewed journals, conference, books, project reports etc., and identify an appropriate paper/thesis/report in her/his area of interest, in consultation with her/his seminar guide. This course can help the learner to experience how a presentation can be made about a selected academic document and also empower her/him to prepare a technical report.

Course Objectives:

- To do literature survey in a selected area of study.
- To understand an academic document from the literate and to give a presentation about it.
- To prepare a technical report.

Course Outcomes [COs] : After successful completion of the course, the students will be able to:

CO1 Identify academic documents from the literature which are related to her/his areas of interest (Cognitive knowledge level: **Apply**).

CO2 Read and apprehend an academic document from the literature which is related to her/ his areas of interest (Cognitive knowledge level: **Analyze**).

CO3 Prepare a presentation about an academic document (Cognitive knowledge level: **Create**).

CO4 Give a presentation about an academic document (Cognitive knowledge level: **Apply**).

CO5 Prepare a technical report (Cognitive knowledge level: **Create**).

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1		2	1					3
CO2	3	3	2	3		2	1					3
CO3	3	2			3			1		2		3
CO4	3				2			1		3		3
CO5	3	3	3	3	2	2		2		3		3

The COs and CO-PO map shall be considered as suggestive only.

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

General Guidelines

- The Department shall form an Internal Evaluation Committee (IEC) for the seminar with academic coordinator for that program as the Chairperson/Chairman and seminar coordinator & seminar guide as members. During the seminar presentation of a student, all members of IEC shall be present.
- Formation of IEC and guide allotment shall be completed within a week after the University examination (or last working day) of the previous semester.
- Guide shall provide required input to their students regarding the selection of topic/ paper.
- Choosing a seminar topic: The topic for a UG seminar should be current and broad based rather than a very specific research work. It's advisable to choose a topic for the Seminar to be closely linked to the final year project area. Every member of the project team could choose or be assigned Seminar topics that covers various aspects linked to the Project area.
- A topic/paper relevant to the discipline shall be selected by the student during the semester break.
- Topic/Paper shall be finalized in the first week of the semester and shall be submitted to the IEC.
- The IEC shall approve the selected topic/paper by the second week of the semester.
- Accurate references from genuine peer reviewed published material to be given in the report and to be verified.

Evaluation pattern

Total marks: 100, only CIE, minimum required to pass 50

Seminar Guide: 20 marks (Background Knowledge – 10 (The guide shall give deserving marks for a candidate based on the candidate's background knowledge about the topic selected), Relevance of the paper/topic selected – 10).

Seminar Coordinator: 20 marks (Seminar Diary – 10 (Each student shall maintain a seminar diary and the guide shall monitor the progress of the seminar work on a weekly basis and shall approve the entries in the seminar diary during the weekly meeting with the student), Attendance – 10).

Presentation: 40 marks to be awarded by the IEC (Clarity of presentation – 10, Interactions – 10 (to be based on the candidate's ability to answer questions during the interactive session of her/his presentation), Overall participation – 10 (to be given based on her/his involvement during interactive sessions of presentations by other students), Quality of the slides – 10).

Report: 20 marks to be awarded by the IEC (check for technical content, overall quality, templates followed, adequacy of references etc.).

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITD415	PROJECT PHASE I	PWS	0	0	6	2

Preamble: The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Course Objectives

- To apply engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.

Course Outcomes [COs] : After successful completion of the course, the students will be able to:

CO1 Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: **Apply**).

CO2 Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: **Apply**).

CO3 Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: **Apply**).

CO4 Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: **Apply**).

CO5 Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: **Analyze**).

CO6 Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: **Apply**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	2	1	1	1	1	2
CO2	2	2	2		1	3	3	1	1		1	1
CO3									3	2	2	1
CO4					2			3	2	2	3	2
CO5	2	3	3	1	2							1
CO6					2			2	2	3	1	1

The COs and CO-PO map shall be considered as suggestive only.

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

PROJECT PHASE I

Phase 1 Target

- Literature study/survey of published literature on the assigned topic
- Formulation of objectives
- Formulation of hypothesis/ design/ methodology
- Formulation of work plan and task allocation.
- Block level design documentation
- Seeking project funds from various agencies
- Preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility study
- Preparation of Phase 1 report

Evaluation Guidelines & Rubrics

Total: 100 marks (Minimum required to pass: 50 marks).

- Project progress evaluation by guide: 30 Marks.
- Interim evaluation by the Evaluation Committee: 20 Marks.
- Final Evaluation by the Evaluation Committee: 30 Marks.
- Project Phase - I Report (By Evaluation Committee): 20 Marks.

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor).

Evaluation by the Guide

The guide/supervisor shall monitor the progress being carried out by the project groups on a regular basis. In case it is found that progress is unsatisfactory it shall be reported to the Department Evaluation Committee for necessary action. The presence of each student in the group and their involvement in all stages of execution of the project shall be ensured by the guide. Project evaluation by the guide: 30 Marks. This mark shall be awarded to the students in his/her group by considering the following aspects:

Topic Selection: innovativeness, social relevance etc. (2)

Problem definition: Identification of the social, environmental and ethical issues of the project problem. (2)

Purpose and need of the project: Detailed and extensive explanation of the purpose and need of the project. (3)

Project Objectives: All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified. (2)

Project Scheduling & Distribution of Work among Team members: Detailed and extensive Scheduling with timelines provided for each phase of project. Work breakdown structure well defined. (3)

Literature survey: Outstanding investigation in all aspects. (4)

Student's Diary/ Daily Log: The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily/weekly activity diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily/weekly activity diary shall be signed after every day/week by the guide. (7) **Individual Contribution:** The contribution of each student at various stages. (7)

EVALUATION RUBRICS for PROJECT Phase I: Interim Evaluation

.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
1-a	Topic identification, selection, formulation of objectives and/or literature survey. (Group assessment) [CO1]	10	The team has failed to come with a relevant topic in time. Needed full assistance to find a topic from the guide. They do not respond to suggestions from the evaluation committee and/or the guide. No literature review was conducted. The team tried to gather easy information without verifying the authenticity. No objectives formed yet.	The team has identified a topic. The originally selected topic lacks substance and needs to be revised. There were suggestions given to improve the relevance and quality of the project topic. Only a few relevant references were consulted/ studied and there is no clear evidence to show the team's understanding on the same. Some objectives identified, but not clear enough.	Good evidence of the group thinking and brainstorming on what they are going to build. The results of the brainstorming are documented and the selection of topic is relevant. The review of related references was good, but there is scope of improvement. Objectives formed with good clarity, however some objectives are not realistic enough.	The group has brainstormed in an excellent manner on what they were going to build. The topic selected is highly relevant, real world problem and is potentially innovative. The group shows extreme interest in the topic and has conducted extensive literature survey in connection with the topic. The team has come up with clear objectives which are feasible.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
1-b	Project Planning, Scheduling and Resource/ Tasks Identification and allocation. (Group assessment) [CO4]	10	No evidence of planning or scheduling of the project. The students did not plan what they were going to build or plan on what materials / resources to use in the project. The students do not have any idea on the budget required. The team has not yet decided on who does what. No project journal kept.	Some evidence of a primary plan. There were some ideas on the materials /resources required, but not really thought out. The students have some idea on the finances required, but they have not formalized a budget plan. Schedules were not prepared. The project journal has no details. Some evidence on task allocation among the team members.	Good evidence of planning done. Materials were listed and thought out, but the plan wasn't quite complete. Schedules were prepared, but not detailed, and needs improvement. Project journal is presented but it is not complete in all respect / detailed. There is better task allocation and individual members understand about their tasks. There is room for improvement.	Excellent evidence of enterprising and extensive project planning. Gantt charts were used to depict detailed project scheduling. A project management/version control tool is used to track the project, which shows familiarity with modern tools. All materials / resources were identified and listed and anticipation of procuring time is done. Detailed budgeting is done. All tasks were identified and incorporated in the schedule. A well-kept project journal shows evidence for all the above, in addition to the interaction with the project guide. Each member knows well about their individual tasks.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
	Phase 1 Interim Evaluation Total		**Marks: 20**			

EVALUATION RUBRICS for PROJECT Phase I: Final Evaluation

Sl. No.	Parameters	Marks	Poor	Fair	Very Good	Outstanding
1-c	Formulation of Design and/or Methodology and Progress. (Group assessment) [CO1]	5	None of the team members show any evidence of knowledge about the design and the methodology adopted till now/ to be adopted in the later stages. The team has not progressed from the previous stage of evaluation.	The students have some knowledge on the design procedure to be adopted, and the methodologies. However, the team has not made much progress in the design, and yet to catch up with the project plan.	The students are comfortable with design methods adopted, and they have made some progress as per the plan. The methodologies are understood to a large extent.	Shows clear evidence of having a well- defined design methodology and adherence to it. Excellent knowledge in design procedure and its adaptation. Adherence to project plan is commendable.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
1-d	Individual and Teamwork Leadership (Individual assessment) [CO3]	10	The student does not show any interest in the project activities, and is a passive member.	The student show some interest and participates in some of the activities. However, the activities are mostly easy and superficial in nature.	The student shows very good interest in project, and takes up tasks and attempts to complete them. Shows excellent responsibility and team skills. Supports the other members well.	The student takes a leadership position and supports the other team members and leads the project. Shows clear evidence of leadership.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
1-e	Preliminary Analysis/ Modeling / Simulation/ Experiment / Design/ Feasibility study [CO1]	10	The team has not done any preliminary work with respect to the analysis/modeling/ simulation/experiment/desig n/feasibility study/ algorithm development.	The team has started doing some preliminary work with respect to the project. The students however are not prepared enough for the work and they need to improve a lot.	There is some evidence to show that the team has done good amount of preliminary investigation and design/ analysis/ modeling etc. They can improve further.	Strong evidence for excellent progress in the project. The team has completed the required preliminary work already and are poised to finish the phase I in an excellent manner. They have shown results to prove their progress.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)

						The project stages are extensively
1	f	Documentation and presentation. (Individual & group assessment). [CO6]	5	The team did not document the work at all. The project journal/diary is not presented. The presentation was shallow in content and dull in appearance. The individual student has no idea on the presentation of his/her part.	Some documentation is done, but not extensive. Interaction with the guide is minimal. Presentation include some points of interest, but overall quality needs to be improved. Individual performance to be improved.	Most of the project details were documented well enough. There is scope for improvement. The presentation is satisfactory. Individual performance is good.	documented in the report. Professional documentation tools like LaTeX were used to document the progress of the project along with the project journal. The documentation structure is well-planned and can easily grow into the project report. The presentation is done professionally and with great clarity. The individual's performance is excellent.
				(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
	Total		**30**	**Phase - I Final Evaluation Marks: 30**			

EVALUATION RUBRICS for PROJECT Phase I: Report Evaluation						
Sl. No.	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
1-g	Report [CO6]	20	The prepared report is shallow and not as per standard format. It does not follow proper organization. Contains mostly Unacknowledged content. Lack of effort in preparation is evident.	Project report follows the standard format to some extent. However, its organization is not very good. Language needs to be few issues improved. All references are the not cited properly in the of report.	Project report shows evidence of systematic documentation. Report is following the standard format and there are only a s. Organization of equations report is good. Most references are cited properly.	The report is exceptionally good. Neatly organized. All references cited properly. Diagrams/Figures, Tables and ns are properly numbered, and listed and clearly shown. Language is excellent and follows standard styles.
			(0 - 7 Marks)	(8 - 12 Marks)	(13 - 19 Marks)	(20 Marks)
Phase - I Project Report Marks: 20						

SEMESTER VII

MINOR

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITD481	MINIPROJECT	PWS	0	0	3	2

Preamble: This course is designed for enabling the students to apply the knowledge to address the real-world situations/problems and find solutions. The course is also intended to estimate the ability of the students in transforming theoretical knowledge studied as part of the curriculum so far in to a working model of a software system. The students are expected to design and develop a software/hardware project to innovatively solve a real-world problem.

Prerequisites: Subjects studied up to sixth semester.

Course Outcomes: After the completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Make use of acquired knowledge within the selected area of technology for project development.	Level 3: Apply
CO 2	Identify, discuss and justify the technical aspects and design aspects of the project with a systematic approach.	Level 3: Apply
CO 3	Interpret, improve and refine technical aspects for engineering projects.	Level 3: Apply
CO 4	Associate with a team as an effective team player for the development of technical projects.	Level 3: Apply
CO 5	Report effectively the project related activities and findings.	Level 2: Understand

Mapping of course outcomes with program outcomes

POs / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	3	3	3	3	-	-	-	3
CO 2	3	3	3	3	3	-	2	3	-	3	2	3
CO 3	3	3	3	3	3	2	3	3	-	2	3	3
CO 4	3	3	2	2	-	-	-	3	3	3	3	3
CO 5	3	-	-	-	2	-	-	3	2	3	2	3

3/2/1: high/medium/low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

The End Semester Evaluation (ESE) will be conducted as an internal evaluation based on the product, the report and a viva- voce examination, conducted by a 3-member committee appointed by Head of the Department comprising HoD or a senior faculty member, academic coordinator for that program and project guide/coordinator. The Committee will be evaluating the level of completion and demonstration of functionality/specifications, presentation, oral examination, working knowledge and involvement.

The Continuous Internal Evaluation (CIE) is conducted by evaluating the progress of the mini project through minimum of TWO reviews. At the time of the 1st review, students are supposed to propose a new system/design/idea, after completing a thorough literature study of the existing systms under their chosen area. In the 2nd review students are expected to highlight the implementation details of the proposed solution. The review committee should assess the extent to which the implementation reflects the proposed design. A well coded, assembled and completely functional product is the expected output at this stage. The final CIE mark is the average of 1st and 2nd review marks.

A zeroth review may be conducted before the beginning of the project to give a chance for the students to present their area of interest or problem domain or conduct open brain storming sessions for innovative ideas. Zeroth review will not be a part of the CIE evaluation process.

Marks Distribution

Total Marks	CIE	ESE
150	75	75

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Marks awarded by Guide : 15 marks
Project Report : 10 marks
Evaluation by the Committee : 40 Marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks.

(a) Demonstration : 50 Marks
(b) Project report : 10 Marks
(d) Viva voce: 15marks

Course Plan

In this course, each group consisting of three/four members is expected to design and develop a moderately complex software/hardware system with practical applications. This should be a working model. The basic concept of product design may be taken into consideration.

Students should identify a topic of interest in consultation with Faculty-in-charge of miniproject/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design/fabrication or develop codes/programs to achieve the objectives. Demonstrate the novelty of the project through the results and outputs. The progress of the mini project is evaluated based on a minimum of two reviews**.**

The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The product has to be demonstrated for its full design specifications. Innovative design concepts, reliability considerations, aesthetics/ergonomic aspects taken care of in the project shall be given due weight.

SEMESTER VII

HONOURS

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT495	ENTERPRISE NETWORKS	VAC	3	1	0	4

Preamble: This course aims to provide a basic idea about the design and management of data center networks.

Prerequisites: ITT292 Mathematical Foundation For Networking, ITT393 Wireless Communication, ITT394 Design And Analysis Of Networks

Course Outcomes: After the completion of the course the student will be able to

CO#	Course Outcomes	Bloom's Category
CO 1	Identify the various cloud computing models and services and understand the basic concepts about cloud data centers and networking.	Level 2: Understand
CO 2	Describe the various cloud data center networking topologies.	Level 2: Understand
CO 3	Explain the Data center networking standards and concepts of server virtualization.	Level 2 : Understand
CO 4	Experiment with network virtualization in various data center environments and understand the working of Storage Networks.	Level 3: Apply
CO 5	Describe the concept of Software Defined Networking and its role in Cloud data center management.	Level 2: Understand

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	-	-	-	-	-	-	-	-	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	2
CO 3	3	2	2	-	-	-	-	-	-	-	-	2
CO 4	3	2	3	1	-	-	-	-	-	-	-	2
CO 5	3	2	2	-	-	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	5	15
Understand	40	35	70
Apply	0	10	15
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have a maximum of 2 subdivisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe the various Cloud Computing models.
2. Advances in virtualization technology have resulted in improvement in data center networking also. Justify.
3. Explain the evolution of data centers from early mainframes.

Course Outcome 2 (CO2)

1. What is the difference between ToR and EoR switches? What are the topologies used for both?
2. How does the use of fabric extenders reduce cabling costs?
3. Describe the role of Network function virtualization in data centers.

Course Outcome 3 (CO3):

1. How has the data center bridging networking standard helped in avoiding the high latency variations?
2. Explain the process of virtual switching.
3. Equal cost multipath routing provides improved bandwidth when compared to the Spanning tree approach. Justify.

Course Outcome 4 (CO4):

1. Compare and contrast the traditional networking tunneling protocols with VXLAN and NVGRE.
2. Explain how innovations in storage technologies have affected data center networking.
3. How is storage in cloud data centers different from traditional enterprise data centers?

Course Outcome 5 (CO5):

1. How is Software Defined Networking implemented in data centers?
2. Explain the use of Ethernet Fabric as an alternative to a traditional switch network.
3. Differentiate between Open SDN and overlays.

Model Question Paper

Course Code:ITT495
Course Name: ENTERPRISE NETWORKS

Max.Marks :100 **Duration: 3 Hrs**

PART A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. Differentiate between public and private clouds.
2. Ethernet technology has helped in the development of data centers. Justify.
3. What is a virtual switch?
4. Describe the 2 methods to interconnect microserver modules?
5. Briefly explain the following fields in the VLAN tag indicate?
    a. Priority Code Point
    b. Drop Eligible Indicator

c. VLAN Identifier

6. How does Virtual machine device queues improve the server and VM performance levels?

7. What is meant by network attached storage?

8. Why do cloud data centers implement erasure coding to provide data protection for their storage systems?

9. Describe the networking components of OpenStack?

10. How is SDN implemented at the network edge?

PART B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. Describe SONET/SDH and Asynchronous Transfer Mode. 14

OR

12. a) Explain the evolution of data centers. 8

b) Differentiate between enterprise data center networks and cloud data center networks. 6

13. With the help of a diagram explain the architecture of traditional multitiered enterprise data center networks. What are the cost factors and performance factors associated with them? 14

OR

14. a) Explain the traffic flow in a flat data center network. 8

b) What are the differences between ToR switches and Core switches? 6

15. Discuss the methods of improving network bandwidth. 14

OR

16. Explain the single root IO virtualization (SR-IOV) and multi root IO virtualization (MR-IOV) standards in PCI Express. 14

17. How is load balancing implemented in networks using Hash-based algorithms and Equal cost multipath routing? 14

OR

18. Explain the following storage communication protocols: 14

a. SCSI
b. SATA
c. SAS
d. Fibre channel

19. Explain the Open flow architecture. 14

OR

20. How can the current limitation of traditional networks be overcomed using SDN? 14

Syllabus

Module 1: Introduction To Cloud Computing & Cloud Datacentres (9 hours)

Cloud computing-Definition, Public, Private and Hybrid Clouds. Cloud Service Models-Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS).

Cloud Data Center, Cloud Networking, Characteristics of Cloud Networking - Ethernet usage, Virtualization, Convergence, Scalability, Software.

The Data Center Evolution, Computer Networks, Ethernet, Enterprise versus Cloud Data Centers, Movement to the Cloud.

Module 2: Cloud Data Center Networking Topologies (8 hours)

Traditional Multitiered Enterprise Networks - Cost Factors, Performance Factors. Data Center Network Switch Types - Virtual switch, ToR Switch, EoR Switch, Fabric Extenders, Aggregation and core switches.

Flat Data Center Networks - Data Center Traffic Patterns, ToR Switch Features, Core Switch Features. Rack Scale Architectures - Disaggregation of Resources, Microservers. Network Function Virtualization.

Module 3: Data Center Networking Standards And Server Virtualization (10 hours)

Data Center Networking Standards - Ethernet Data Rate Standards, Virtual Local Area Networks, Data Center Bridging, Improving Network Bandwidth, Remote Direct Memory Access.

Server Virtualization and Networking - VM Overview, Virtual Switching, PCI Express, Edge Virtual Bridging, VM Migration.

Module 4: Network Virtualization & Storage Networks (10 hours)

Network Virtualization- Multi-tenant Environments, Traditional Network Tunneling Protocols, VXLAN, NVGRE, Tunnel Locations, Load Balancing.

Storage Networks - Storage Background, Advanced Storage Technologies, Storage Communication Protocols, Network Convergence, Software-Defined Storage, Storage in Cloud Data Centers.

Module 5: SDN In Data Centers (8 hours)

Software-Defined Networking- Data Center Software Background, OpenStack, OpenFlow, Network Function Virtualization, SDN Deployment.

SDN Use Cases in the Data Center, Ethernet Fabrics in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations.

Text Books

1. Gary Lee, "Cloud Networking - Understanding Cloud-based Data Center Networks", Elsevier, 2014

References

1. Kai Hwang , Geoffrey C Fox, Jack J Dongarra : "Distributed and Cloud Computing – From Parallel Processing to the Internet of Things" , Morgan Kaufmann Publishers – 2012.
2. Paul Göransson Chuck Black, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufman.
3. William von Hagen, Professional Xen Virtualization, Wrox Publications, January, 2008
4. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006
5. Kumar Reddy, Victor Moreno, "Network virtualization", Cisco Press, July, 2006

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1: Introduction To Cloud Computing & Cloud Datacentres**	**9 hours**
1.1	Cloud computing- Definition, Public, Private and Hybrid Clouds	1 Hr
1.2	Cloud Service Models - Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS)	1 Hr
1.3	Cloud Data Center, Cloud Networking, Characteristics of Cloud Networking	2 Hrs
1.4	The Data Center Evolution	1 Hr
1.5	Computer Networks, Ethernet	2 Hrs
1.6	Enterprise versus Cloud Data Centers, Movement to the Cloud	2 Hrs
2	**Module 2: Cloud Data Center Networking Topologies**	**8 hours**
2.1	Traditional Multitiered Enterprise Networks - Cost Factors, Performance Factors	1 Hr
2.2	Data Center Network Switch Types - Virtual switch, ToR Switch, EoR Switch	2 Hrs
2.3	Fabric Extenders, Aggregation and core switches	1 Hr
2.4	Flat Data Center Networks - Data Center Traffic Patterns, ToR Switch Features, Core Switch Features	2 Hrs
2.5	Rack Scale Architectures - Disaggregation of Resources, Microservers	1 Hr
2.6	Network Function Virtualization	1 Hr

3	**Module 3: Data Center Networking Standards And Server Virtualization** INFORMATION	**10 hours**
3.1	Data Center Networking Standards - Ethernet Data Rate Standards, Virtual Local Area Networks	2 Hrs
3.2	Data Center Bridging	1 Hr
3.3	Improving Network Bandwidth, Remote Direct Memory Access	2 Hrs
3.4	Server Virtualization and Networking - VM Overview, Virtual Switching	2 Hrs
3.5	PCI Express, Edge Virtual Bridging	2 Hrs
3.6	VM Migration	1 Hr
4	**Module 4: Network Virtualization & Storage Networks**	**10 hours**
4.1	Network Virtualization- Multi-tenant Environments, Traditional Network Tunneling Protocols, VXLAN, NVGRE	2 Hrs
4.2	Tunnel Locations, Load Balancing	2 Hrs
4.3	Storage Networks - Storage Background, Advanced Storage Technologies	2 Hrs
4.4	Storage Communication Protocols, Network Convergence	2 Hrs
4.5	Software-Defined Storage, Storage in Cloud Data Centers	2 Hrs
5	**Module 5: SDN In Data Centers**	**8 hours**
5.1	Software-Defined Networking- Data Center Software Background, OpenStack	2 Hrs
5.2	OpenFlow	1 Hr
5.3	Network Function Virtualization, SDN Deployment	2 Hrs
5.4	SDN Use Cases in the Data Center	1 Hr
5.5	Ethernet Fabrics in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations	2 Hrs

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT497	WEB SECURITY	VAC	3	1	0	4

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in Web Security, and to familiarise mechanisms for handling Web security threats.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Discuss the basic concepts of Web Security	Level 2: Understand
CO 2	Summarise the basics of Web Application Hacking	Level 2: Understand
CO 3	Apply penetration testing and Ethical Hacking Principles	Level 3: Apply
CO 4	Summarise malware analysis and protection mechanisms	Level 2: Understand
CO 5	Differentiate methods for protecting web applications	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	2	-	-	-	-	-	-	2
CO 2	3	2	2	2	3	-	-	-	-	-	-	2
CO 3	3	3	3	3	3	-	-	-	-	-	-	3
CO 4	3	2	2	2	2	-	-	-	-	-	-	2
CO 5	3	2	2	2	2	-	-	-	-	-	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	30	30	70
Apply	10	10	20
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. Explain the key challenges related to modern day web security.
2. Discuss the structure of modern day web applications.
3. Differentiate Modern and Legacy Web Applications
4. Mention dictionary attacks.

Course Outcome 2 (CO 2):

1. Explain Distributed DoS attack.
2. Define DOM-Based XSS attack.
3. Differentiate between Stored XSS and reflected XSS.
4. Explain regex DoS.

Course Outcome 3 (CO 3):

1. Describe the tools and steps you would use if you have to check for vulnerability in a network.
2. Differentiate various Reconnaissance tools in Kali Linux
3. Describe the method for Remote password cracking.
4. Discuss port scanning for finding vulnerabilities.

Course Outcome 4 (CO 4):

1. Describe the goals of malware analysis.
2. Differentiate packed and obfuscated malwares.
3. Discuss the steps involved in packet sniffing with wireshark.
4. Explain the step for viewing the process with process explorer.

Course Outcome 5 (CO 5):

1. What are the steps involved in comprehensive code review?
2. Define Secure coding anti patterns.
3. List out different ways of securing modern web applications
4. Define Archetypical vulnerabilities.

Model Question Paper

Course Code: ITT497

Course Name: WEB SECURITY

Max.Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. Discuss browser's built in network analysis tools.
2. Explain Web application mapping with examples.
3. Explain Query parameter tampering with examples
4. Differentiate Direct XXE and Indirect XXE
5. Discuss the three way handshake protocol.
6. Explain reconnaissance using Google Directives.
7. List out different types of malwares
8. Describe the working of credential stealers.
9. Differentiate Archetypical Vulnerabilities and Custom Logic Bugs
10. Explain the importance of reviewing code for security.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11.	List structure and various new features of modern web applications.	14
	OR	
12.	a. List the methods for web application reconnaissance	5
	b. Discuss various methods for finding subdomains as part of reconnaissance.	9
13.	Illustrate various Cross Site Scripting attacks.	14
	OR	
14.	Differentiate various Injection attacks with examples.	14
15.	List Out the different phases of penetration testing with examples.	14
	OR	
16.	a. Discuss different reconnaissance tools for penetration testing.	9
	b. Discuss the method of extracting information from DNS	5
17.	List different malware analysis techniques with examples.	14
	OR	
18.	Discuss basic dynamic analysis for malwares.	14
19.	a. Explain Secure Socket Layer and Transport Layer Security	8
	b. Discuss various methods for vulnerability management in a web application.	6
	OR	
20.	Explain different ways for securing modern web applications with examples.	14

Syllabus

Module 1: Basics of Web Application Security (9 Hours)

Web Application Security Basics:- Introduction to Web Application Reconnaissance- Information Gathering, Web Application Mapping. The Structure of a Modern Web Application- Modern vs Legacy Web Applications, REST API, Javascript Object Notation, SPA Framework, Authentication and authorization Systems, Client side Data stores. Finding SubDomains- Browser's built in network analysis tools, Taking advantage of public records, Search Engine Caches, Social Snapshots, Zone transfer attacks, Brute forcing sub domains, Dictionary Attacks.

Module 2: Hacking Web Applications (10 Hours)

Introduction to Hacking Web Applications:- The Hacker's mindset, Cross Site Scripting - Stored XSS, Reflected XSS, DOM-Based XSS, Mutation Based XSS. Cross-Site Request Forgery (CSRF) - Query Parameter Tampering, Alternate Get Payloads, CSRF against POST Endpoints. XML External Entity (XXE) - Direct XXE, Indirect XXE. Injection - SQL Injection, Code Injection, Command Injection. Denial of Service(DoS) - regex DoS (ReDoS), Logical DoS Vulnerabilities, Distributed DoS.

Module 3: Penetration Testing (10 Hours)

Penetration Testing:- What is penetration Testing?, Introduction to Kali tools, Phases of Penetration testing. Reconnaissance- HTTRACK, Google Directives, The harvester, whois, netcraft, Extracting information from DNS. Scanning- Pings and Ping Sweeps, Port Scanning, The three way handshake, vulnerability scanning. Exploitation- Medusa, Metasploit, Remote Password cracking

Module 4: Malware Forensics (8 Hours)

Malware Analysis:- The goals of malware analysis, Malware analysis techniques, Types of malware, Basic static techniques - antivirus scanning, hashing, Finding strings, Packed and obfuscated malwares. Basic dynamic analysis- sandboxes, running malware, viewing process with process explorer, packet sniffing with wireshark. Malware Behavior - backdoors, credential stealers, Privilege escalation.

Module 5: Securing Web Applications (8 Hours)

Securing Modern Web Applications:- Defensive Software Architecture, Comprehensive Code Reviews, Vulnerability Discovery, Vulnerability analysis, Vulnerability Management, Regression Testing, Mitigation Strategies

Secure Application Architecture:- Analyzing Feature Requirements, Authentication and Authorization: Secure Sockets Layer and Transport Layer Security, Secure Credentials, Hashing Credentials, PBKDF2, PII and Financial Data.

Reviewing Code For Security:- How to start a code review?, Archetypical Vulnerabilities Versus Custom Logic Bugs, Where to Start a Security Review, Secure-Coding Anti-Patterns.

Text Books

1. Andrew Hoffman, "Web Application Security: ExploitationINFORMATIONandCountermeasuresTECHNOLOGYfor Modern Web Applications", O'reilly 1st Edition, March 2020
2. Patrik Engebretson, "The basics of Hacking and Penetration Testing", Syngress, 1st Edition, 2011
3. Michael Sikorski, Andrew Honig, "Practical Malware Analysis", No Starch Press 1st Edition, 2012

Reference Books

1. Justin Clarke, "SQL Injection Attacks and Defense", Syngress Publication, 1st Edition, 2009
2. Stuart McClure Joel, ScambRay, George Kurtz, "Hacking Exposed 7: Network Security Secrets & Solutions",The McGraw-Hill Companies Seventh Edition, 2012

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Module 1: Basics of Web Application Security**	**9 Hours**
1.1	Web Application Security Basics:- Introduction to Web Application Reconnaissance-Information Gathering	1
1.2	Web Application Mapping, The Structure of a Modern Web Application- Modern vs Legacy Web Applications	1
1.3	REST API, Javascript Object Notation, SPA Framework	1
1.4	Authentication and authorization Systems, Client side Data stores	1
1.5	Finding SubDomains- Browser's built in network analysis tools	1
1.6	Taking advantage of public records, Search Engine Caches	1
1.7	Social Snapshots	1
1.8	Zone transfer attacks	1
1.9	Brute forcing sub domains, Dictionary Attacks.	1
2	**Hacking Web Applications**	**10 Hours**
2.1	Introduction to Hacking Web Applications:- The Hacker's mindset	1
2.2	Cross Site Scripting - Stored XSS, Reflected XSS	1
2.3	DOM-Based XSS, Mutation Based XSS	1
2.4	Cross-Site Request Forgery (CSRF) - Query Parameter Tampering	1
2.5	Alternate Get Payloads, CSRF against POST Endpoints	1
2.6	XML External Entity (XXE) - Direct XXE	1
2.7	Indirect XXE. Injection - SQL Injection, Code Injection	1
2.8	Command Injection. Denial of Service(DoS) - regex DoS (ReDoS)	1

2.9	Logical DoS Vulnerabilities	1
2.10	Distributed DoS.	1
3	**Penetration Testing**	**10 Hours**
3.1	Penetration Testing:- What is penetration Testing?	1
3.2	Introduction to Kali tools	1
3.3	Phases of Penetration testing	1
3.4	Reconnaissance- HTTRACK, Google Directives, The harvester	1
3.5	whois, netcraft, Extracting information from DNS.	1
3.6	Scanning- Pings and Ping Sweeps	1
3.7	Port Scanning, The three way handshake	1
3.8	vulnerability scanning	1
3.9	Exploitation- Medusa, Metasploit	1
3.10	Remote Password cracking	1
4	**Malware Forensics**	**8 Hours**
4.1	Malware Analysis:- The goals of malware analysis	1
4.2	Malware analysis techniques, Types of malware	1
4.3	Basic static techniques - antivirus scanning, hashing, Finding strings,	1
4.4	Packed and obfuscated malwares.	1
4.5	Basic dynamic analysis- sandboxes, running malware	1
4.6	viewing process with process explorer, packet sniffing with wireshark	1
4.7	Malware Behavior - backdoors	1
4.8	credential stealers, Privilege escalation.	1
5	**Securing Web Applications**	**8 Hours**
5.1	Securing Modern Web Applications:- Defensive Software Architecture,	1
5.2	Comprehensive Code Reviews, Vulnerability Discovery, Vulnerability analysis	1
5.3	Vulnerability Management, Regression Testing, Mitigation Strategies	1
5.4	Secure Application Architecture:- Analyzing Feature Requirements,	1
5.5	Authentication and Authorization: Secure Sockets Layer and Transport Layer Security, Secure Credentials	1
5.6	Hashing Credentials, PBKDF2, PII and Financial Data.	1
5.7	Reviewing Code For Security:- How to start a code review?, Archetypical Vulnerabilities Versus Custom Logic Bugs	1
5.8	Where to Start a Security Review, Secure-Coding Anti-Patterns.	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT499	ROBOTICS AND AUTOMATION	VAC	3	1	0	4

Preamble: This course aims at imparting knowledge about robotics as well as automation. This will include basics of robot technology as well as robot programming and Robot Wireless sensor Networks.

Prerequisite: ITT398 Embedded Systems

Course Outcomes: After completion of the course the student will be able to

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Describe the fundamentals of robot sensors, actuators, technology and application.	Level 2: Understand
CO 2	Demonstrate the facets of Robot Technology.	Level 2: Understand
CO 3	Acquire proficiency in Robot programming.	Level 3: Apply
CO 4	Explain AI and Fuzzy logic for robotics.	Level 2: Understand
CO 5	Outline Robot process automation, RWSN and future of Robots.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

	PO	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	2	-	-	-	-	2	-	2
CO 2	3	3	2	1	2	-	-	-	-	2	-	2
CO 3	3	3	3	3	3	1	-	-	-	2	-	2
CO 4	3	3	3	2	3	1	-	-	-	2	-	2
CO 5	3	3	3	3	3	1	1	-	-	2	-	2

3/2/1: High/Medium/Low

The COs and CO-PO map shall be considered as suggestive only.

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
Level 1: Remember	5	5	10
Level 2: Understand	35	35	70
Level 3: Apply	10	10	20
Level 4: Analyse			
Level 5: Evaluate			
Level 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer *all* questions. Part B contains 2 questions from each module of which student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. What is a Robot?
2. Define ' the laws of Robots'
3. Discuss different applications of Industrial robots?
4. Explain the different internal and external sensors that can be used in designing a robot arm

Course Outcome 2 (CO 2):

1. Define forward and inverse kinematics.
2. How to model and control a Single Joined Robot?
3. Explain the common kinematic arrangements of robots based on various coordinate Systems.

Course Outcome 3 (CO 3):

1. Describe the features of generation of Robot languages.
2. Write a Python program which might be able to determine if one object is on top of another. Assume you are given the location of two objects in the form of list(x,y,z) for each object. Assume that if x and y are equal for both parts and z is greater for one than the other, that one is on the top. Use CAR and CDR to get the individual x,y,z values and then perform comparison.
3. Why task-level programming is difficult?
4. Explain advanced machine learning and artificial intelligence applications in service robot

Course Outcome 4 (CO 4):

1. Illustrate any two search techniques.
2. How to create various type of knowledge which may require representation.
3. Explain the Fuzzy Logic-Neural Computing for robotics.

Course Outcome 5 (CO 5):

1. What are the effects of the implementation of Robotic Process Automation in companies?
2. What are the types of processors that are suitable for Robotic Process Automation?
3. Discuss the Robotic Wireless Sensor Network components.

Model Question Paper

Course Code: ITT499

Course Name: ROBOTICS AND AUTOMATION

Max. Marks :100 **Duration: 3 Hrs**

Part A

Answer all questions. Each question carries 3 marks (10 * 3 = 30 Marks)

1. What do you mean by the term Degree of Freedom(DOF) in robot motion ?
2. Give the requirements of an actuator for robotic application.
3. Explain different types of controller.
4. Draw the block diagram that corresponds to the spring-mass-damper system represented by Ms2 Y(s) + Kas Y(s) + Ks Y(s) = Ks X(s)
5. What are the advantages and disadvantages of online programming?
6. Explain advanced machine learning concept of a service robot.
7. What are Frames? Set up frames for the following
   i. Dogs
   ii. Cars
   iii. Professors
8. Explain Evolutionary Computation based algorithms for the control of robots.
9. What are the benefits of Robotic Process Automation?
10. Illustrate a Robotic wireless sensor.

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11 . You are required to design a robot that can pick up an object of arbitrary shapes from a table and place it inside a box. 14

   i. What is the minimum number of degree of freedom it should have?
   ii. List all the possible arm configurations.
   iii. Draw their corresponding work volumes.

OR

12 . Differentiate External and Internal sensors with example .Why the term internal and external used to classify sensors? Is there any advantage of external sensors over internal type? Explain any two velocity sensors. 14

13 . A stepping motor is to be used to actuate one joint of a robot arm in a light duty pick-up—place application. The step angle of the motor is 10^0. For each pulse received from pulse train source and motor rotates through a distance of one step angle. 14

i. What is the resolution of the stepping motor?
ii. Rate this value to the definition of control resolution, spatial resolution and accuracy.

OR

14 . What is a Jacobian of a robot systems? Calculate the Jacobian of two link planar arm when $\Theta_1=45^0$ and $\Theta_2=20^0$. 14

15 a. Explain the structure of robot programming language 6

b. Artificial Intelligence in robotics deals with the connection between the 8 three primitives of sense, plan and act. In each of the given application, Explain how you would connect the primitives to design a controller.

i. A mobile robot has to wander around and explore its environment without hitting obstacles
ii. A mobile robot has to reach a goal point in the shortest time and also avoid hitting obstacles.

OR

16 . Explain a self driving car's program model and algorithm. 14

17 . Explain advanced techniques for representing knowledge. 14

OR

18. Explain the Neural Computing and Evolutionary Computation based algorithms for the control of robots 14

19. What are the effects of the implementation of Robotic Process Automation and the impact on the job design of involved within large companies?. 14

OR

20. Explain localization in RWSN and describe an unified system architecture for RWSN with help of a diagram? 14

Syllabus

Module 1: Basic Concept (10 hours)

Fundamentals of Robotics- Classification, Automation, Robot Anatomy.

Sensors in Robotics-Sensor Classification, Internal sensors, External sensors, Vision, Sensor selection.

Actuators and Grippers- Electric, Hydraulic, Pneumatic, selection of motors, grippers.

Robot Applications- medical, mining, space, defence, security, domestic, entertainment, Industrial Applications-Material handling, welding, Spray painting, Machining.

(T1:Chapter 1,2,,6,7 R1: Chapter 1,2,3,4)

Module 2: Robot Technology (10 hours)

The robot and its peripherals- Control Systems and components -models-Mathematical model, Transfer functions, Block diagrams, Characteristics Equations, Controllers.

Modelling and control of a Single joint robot.

Manipulator Kinematics- Position Representations, Forward and reverse transformation of 2-Degree of Freedom Arm, adding Orientation, A 3- Degree of Freedom Arm in Two Dimensions, A 4-Degree of freedom Manipulator in Three Dimensions. Jacobian Computation.

(T1:Chapter 3,4 R1:Chapter 6)

Module 3: Robot Programming (10 hours)

Robot Languages-different languages, Generation, Structure, Requirements, Problems.

Robot Programming-Online Programming, Offline Programming, VAL Programming-commands for movement, speed control, End-effectors, Sensor commands, Robot oriented programming, Task level programming.

Robot Programming with Python and C.

ROS (Robotic Operating System basics only).

Advanced Machine learning and Artificial intelligence applications in service robot.

Integrated deep learning for self-driving robotic car.

(T1: Chapter 8,9 R1:Chapter 13 R2: Chapter 10 R3:Chapter 7,8)

Module 4: Artificial Intelligence for Robotics (6 hours)

Artificial Intelligence and Robotics - Robotics Paradigms ,Goals of AI Research, AI Technique- Knowledge Representation, Problem Representation and Problem solving, Search Techniques in problem solving. Ethics and risks of artificial intelligence in robotics.

Fuzzy Logic-Neural Computing and Evolutionary Computation based algorithms for the control of robots.

(T1:Chapter 10 ,R8)

Module 5: Robotic Wireless Sensors Networks (9 hours)

Robot Process Automation (RPA) and Its Future-Properties-RPA Applied to the Digital Process.

Robotic Wireless sensor networks-RWSN-System Components- Localization-RWSN Network Stack Layer Analysis- Unified System Architecture.

Robot and Drone Localization in GPS - Denied Areas, Robot and Drones, Visual Localization and Navigation, Mobile robot navigation.

Multi Robot Systems-MRS Middleware-Design Goal – Applications.
Future of Robots –AI, Autonomy, Humanoids, Haptic Intelligence in Robot.
(T2:Part VI R5- chapter 21)

Text Books

1. M.P Groover, Mitchel weiss, Roger N Nagel,Nicholoas G Odrey,Ashish Dutta " Industrial Robotics-Technology, Programming and Applications" 2e , McGraw-Hill ISBN-13: 978-1-25-900621-0, ISBN-10: 1-25-900621-2
2. Habib M.Ammari "Mission-Oriented Sensor Networks and Systems: Art and Science" Volume 2: Advances, Springer ISSN 2198-4182 ISBN 978-3-319-9238-3

References

1. S K Saha "Introduction to Robotics" Second Edition McGraw-Hill ISBN-13: 978-93-329-0280-0, ISBN-10: 93-329-0280-1
2. Dr. Jisu Elsa Jacob and Manjunath N, "Robotics Simplified" ,BPB Publishers, 2022.
3. https://www.sciencedirect.com/book/9780323854986/artificial-intelligence-for-future-generation-robotics
4. Introduction to Mobile Robot Control; S.G. Tzafestas; Elsevier; ISBN:0124170498, 9780124170490
5. Robot Process Automation (RPA) and Its Future https://www.researchgate.net/publication/338302068,2nd Edition, John Wiley & sons, Inc, 2007.
6. Stuart Russell, Peter Norvig, "Artificial Intelligence: A modern approch", Pearson Education,India2003.
7. David Jefferis, "Artificial Intelligence: Robotics and Machine Evolution", Crabtree PublishingCompany, 1992.
8. Fuzzy Logic Combined With Neural Algorithm to control Industrial Robot https://www.researchgate.net/publication/265164491
9. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005
10. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education,. 2009.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Basic Concept**	**10 Hours**
1.1	Fundamentals of Robotics- Classification Automation, Robot Anatomy	2
1.2	Sensors in Robotics- sensor classification	1
1.3	Internal sensors, External sensors	1
1.4	Vision	1
1.5	Sensor Selection	1
1.6	Actuators - Electric, Hydraulic, Pneumatic, selection of motors	1
1.7	Grippers	1
1.8	Robot Applications- medical, mining, space, defence, security, domestic, entertainment, Industrial Applications-Material handling, welding, Spray painting, Machining.	2
2.	**Robot Technology**	**10 Hours**
2.1	The robot and its peripherals- Control Systems and components	1
2.2	Models- Mathematical model- Transfer functions- Block diagrams- Characteristics Equations	2
2.3	Controllers	1
2.4	Modelling and control of a Single joint robot.	2
2.5	Manipulator Kinematics- Position Representations, Forward and reverse transformation of 2-Degree of Freedom Arm	1
2.6	Adding Orientation- A 3- Degree of Freedom Arm in Two Dimensions, A 4-Degree of freedom Manipulator in Three Dimensions.	1

2.7	Jacobian Computation	2
3	Robot Programming	10 Hours
3.1	Robot Languages-different languages, Generation, Structure, Requirements, Problems.	2
3.2	Robot Programming-Online Programming, Offline Programming.	2
3.3	Robot oriented programming, Task level programming.	1
3.4	ROS (Robotic Operating System)- Basics only	1
3.5	Advanced Machine learning and Artificial intelligence applications in service robot.	2
3.7	LISP Programming fundamentals.	2
4	**Artificial Intelligence for Robotics**	**6 Hours**
4.1	Artificial Intelligence and Robotics - Robotics Paradigms	1
4.2	Goals of AI Research, AI Technique- Knowledge Representation	1
4.3	Problem Representation and Problem solving	1
4.4	Search Techniques in problem solving	1
4.5	Ethics and risks of artificial intelligence in robotics.	1
4.6	Fuzzy Logic-Neural Computing and Evolutionary Computation based algorithms for the control of robots	1
5	**Robotic Wireless Sensors Networks**	**9 Hours**
5.1	Robot Process Automation (RPA) and Its Future-Properties-RPA Applied to the Digital Process.	1
5.2	Robotic Wireless sensor networks-RWSN-System Components	1
5.3	Localization-RWSN Network Stack Layer Analysis	1
5.4	Unified System Architecture	1

5.5	Robot and Drone Localization in GPS- Denied Areas, Robot and Drones, Visual Localization and Navigation, Mobile robot navigation	2
5.6	Multi Robot Systems-MRS Middleware-Design Goal – Applications.	1
5.7	Future of Robots –AI, Autonomy, Humanoids, Haptic Intelligence in Robot.	2