UNIVERSITY OF KERALA

Syllabus For B.Tech INFORMATION TECHNOLOGY

2020 SCHEME

SEMESTER VI

SEMESTER VI

SLOT	Course No.	COURSES	L-T-P	Hours	Credit
A	ITT302	INTERNETWORKING WITH TCP/IP	3-1-0	4	4
B	ITT304	ALGORITHM ANALYSIS AND DESIGN	3-1-0	4	4
C	ITT306	DATA SCIENCE	3-1-0	4	4
D	ITTXXX	PROGRAM ELECTIVE – I	2-1-0	3	3
E	HUT300	INDUSTRIAL ECONOMICS & FOREIGN TRADE	3-0-0	3	3
F	ITT308	COMPREHENSIVE COURSE WORK	1-0-0	1	1
S	ITL332	COMPUTER NETWORKS LAB	0-0-3	3	2
T	ITD334	MINIPROJECT	0-0-3	3	2
R\M/H	VAC	REMEDIAL/MINOR/HONORS COURSE	3-1-0	4*	4
	TOTAL			**29**	**23/27**

PROGRAM ELECTIVE I

SLOT	Course No.	COURSES	L-T-P	Hours	Credit
D	ITT312	USER INTERFACE AND USER EXPERIENCE DESIGN	2-1-0	3	3
	ITT322	COMPILER DESIGN	2-1-0		
	ITT332	SOFT COMPUTING	2-1-0		
	ITT342	MICROPROCESSORS	2-1-0		
	ITT352	DISTRIBUTED SYSTEMS	2-1-0		
	ITT362	DIGITAL IMAGE PROCESSING	2-1-0		
	ITT372	SEMANTIC WEB	2-1-0		

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT302	INTERNETWORKING WITH TCP/IP	PCC	3	1	0	4

Preamble: This subject is about the TCP/IP protocol suite and how it is used on the internet. It begins with a review of the underlying communications technologies needed for the internet. The course provides a detailed examination of IP routing, UDP, TCP, network virtualization, and label switching. Finally, internet applications and Software defined networking are discussed.

Prerequisite: ITT 305 Data Communication and Networking

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

CO No.	Course Outcomes (CO)	Bloom's Category Level
CO 1	Discuss internetworking concepts and internet address resolution.	Level2: Understand
CO 2	Illustrate the functions of IPv4, IPv6, and ICMP protocols	Level 3: Apply
CO 3	Explain internet routing architecture and internet multicasting	Level2: Understand
CO 4	Solve the design issues and protocols in transport layer	Level 3: Apply
CO 5	Explain application layer protocols, network virtualization and software defined networking	Level2: 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	2	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	2	-	-	-	-	-	-	-	-	2
CO 3	3	2	-	-	2	-	-	-	-	-	-	2
CO 4	3	2	2	-	-	-	-	-	-	-	-	2
CO 5	3	2	-	-	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	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember			
Understand	40	40	80
Apply	10	10	20

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 ARP
2. Explain different layers in TCP/IP reference model.

Course Outcome 2 (CO2)

1. Explain IP datagram fragmentation and reassembly. Also explain different header fields affected in these cases.
2. Describe the functions of ICMP

Course Outcome 3(CO3):

1. Explain characteristics and message formats in BGP.
2. Explain RIP in detail. What is slow convergence problem and how it is solved?

Course Outcome 4 (CO4):

1. Draw and explain TCP finite state machine.

2. What is label switching?

Course Outcome 5 (CO5):

1. Explain the difference between persistent and non-persistent HTTP.
2. Explain DNS.

Model Question Paper

Course Code: ITT302
Course Name: INTERNETWORKING WITH TCP/IP

Max. Marks: 100 Duration: 3 Hours

PART A

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

1. What is internetworking?
2. Explain the role of routers in Networks.
3. Explain the header fields in IP that are used for datagram fragmentation and reassembly
4. Explain the importance of ICMP
5. What is an autonomous system?
6. Explain about IPv6 multicast address.
7. What is VPN?
8. What is the purpose of including pseudo header while computing UDP header checksum
9. What is a cookie?
10. What is persistent HTTP?

Part B

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

11 List and explain the main features of all the seven layers of the ISO/OSI reference model and compare it with TCP/IP Model.

OR

12 Explain in detail about ARP.

13 Explain the format of IPv4 and IPv6 datagram.

OR

14 Explain in detail about ICMP.

15 What is BGP? Explain the characteristics and message formats of BGP.

OR

16 What is slow convergence problem? How can it be solved?

17 Explain in detail about TCP segment format.

OR

18 What is congestion? Explain in detail about TCP congestion control.

19 Explain the working of DNS.

OR

20 Explain in detail about FTP.

Syllabus

Module 1: Introduction to Internetworking (8 Hours)
Introduction & Overview – Motivation for internetworking, TCP/IP internet, Internet Services. Internetworking Concept and Architectural Model – Introduction, Application-Level Interconnection, Network-Level Interconnection, Properties Of The Internet, Internet Architecture, Interconnection Of Multiple Networks With IP Routers. **Protocol Layering-** Introduction, The Need For Multiple Protocols, The Conceptual Layers Of Protocol Software, Functionality Of The Layers, ISO 7-Layer Reference Model, The TCP/IP 5-Layer Reference Model, Mapping Internet Addresses To Physical Addresses (ARP)
Module 2: Network Layer (8Hours)
Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) – Introduction, Connectionless Delivery System Characteristics, Purpose And Importance Of The Internet Protocol, The IP Datagram, Datagram Type Of Service And Differentiated Services, Datagram Encapsulation, Datagram Size, Network MTU and Fragmentation, Datagram Reassembly, Header Fields Used For Datagram Reassembly, Time To Live (IPv4) And Hop

Limit (IPv6), Optional IP Items, Options Processing During Fragmentation.

Internet Protocol: Error And Control Messages (ICMP) – Introduction, The Internet Control Message Protocol, Error Reporting Vs. Error Correction, ICMP Message Delivery, 5 Conceptual Layering, ICMP Message Format

Module 3: Routing (9 Hours)

Routing Architecture – Cores, Peers and Algorithms, Routing among Autonomous system – BGP - The Scope Of A Routing Update Protocol, Determining A Practical Limit On Group Size, Autonomous System Concept, Exterior Gateway Protocols And Reachability, BGP Characteristics, BGP Functionality And Message Types, Routing Within An Autonomous System (RIP, RIPng, OSPF, IS-IS)- Introduction, Static Vs. Dynamic Interior Routes, Routing Information Protocol (RIP), Slow Convergence Problem, Solving The Slow Convergence Problem, The Disadvantage Of Using Hop Counts, Delay Metric (HELLO), Delay Metrics, Oscillation, And Route Flapping, The Open SPF Protocol (OSPF).

Internet Multicasting – Introduction, Hardware Broadcast, Hardware Multicast, Ethernet Multicast, The Conceptual Building Blocks Of Internet Multicast, The IP Multicast Scheme, IPv4 And IPv6 Multicast Addresses, Multicast Address Semantics, Mapping IP Multicast To Ethernet Multicast, Hosts And Multicast Delivery, Multicast Scope, Multicast Routing.

Module 4: Transport Layer (10 Hours)

Transport Layer - Transport Service, The services provided to upper layers, Transport Service primitives, UDP- Segment Structure, Remote Procedure Call, RTP, and RTCP.TCP – Service model, TCP Protocol, TCP Segment Header, Connection establishment and Release, TCP finite state machine, TCP Sliding Window, TCP timer management, Congestion Control. Label switching, flows and MPLS. Network Virtualization: VPNs, NATs, And Overlays

Module 5: Application Layer (10Hours)

Application Layer- HTTP- Overview, Persistent and non-persistent Connections, Message formats, Concept of Cookies and Web Cache -FTP - Electronic Mail– SMTP, Mail message formats, POP3, IMAP – DNS- Services provided by DNS, Overview of how DNS works, DNS Caching, Message format, DHCP.Software Defined Networking (SDN, OpenFlow)

Text Books

1. Douglas E Comer, "Internetworking with TCP/IP Principles, Protocol, and Architecture" , VolumeI, 6th Edition, Pearson Education, 2013
2. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall, 5th Edition
3. James F Kurose, Keith W Ross, Computer Networking: A top Down Approach featuring the Internet, Pearson Education, 3rd Edition

Reference Books

1. Behrouz A Forouzan, TCP/IP Protocol Suite, Fourth Edition

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to Internetworking**	**8 Hours**
1.1	Introduction & Overview – Motivation for internetworking, TCP/IP internet, Internet Services. Internetworking Concept And Architectural Model – Introduction, Application-Level Interconnection, Network-Level Interconnection, Properties Of The Internet, Internet Architecture, Interconnection Of Multiple Networks With IP Routers.	2Hours
1.2	Protocol Layering- Introduction, The Need For Multiple Protocols, The Conceptual Layers Of Protocol Software, Functionality Of The Layers, ISO 7-Layer Reference Model.	2Hours
1.3	The TCP/IP 5-Layer Reference Model	2Hours
1.4	Mapping Internet Addresses To Physical Addresses (ARP)	2 Hours
2	**Network Layer**	**8 Hours**
2.1	Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) – Introduction, Connectionless Delivery System Characteristics, Purpose And Importance Of The Internet Protocol, The IP Datagram, Datagram Type Of Service And Differentiated Services, Datagram Encapsulation, Datagram Size, Network MTU and Fragmentation, Datagram Reassembly, Header Fields Used For Datagram Reassembly, Time To Live (IPv4) And Hop Limit (IPv6), Optional IP Items, Options Processing During Fragmentation.	5Hours
2.2	**Internet Protocol: Error And Control Messages (ICMP) –** Introduction, The Internet Control Message Protocol, Error Reporting Vs. Error Correction, ICMP Message Delivery, 5 Conceptual Layering, ICMP Message Format	3 Hours
3	**Routing**	**9 Hours**
3.1	Routing Architecture – Cores, Peers and Algorithms, Routing among Autonomous system – BGP - The Scope Of A Routing Update Protocol, Determining A Practical Limit On Group Size, Autonomous System Concept, Exterior Gateway Protocols And Reachability, BGP Characteristics, BGP Functionality And Message Types	2 Hours
3.2	Routing Within An Autonomous System (RIP, RIPng, OSPF, IS-IS)- Introduction, Static Vs. Dynamic Interior Routes, Routing Information Protocol (RIP), Slow Convergence Problem, Solving The Slow Convergence Problem, The Disadvantage Of Using Hop Counts, Delay Metric (HELLO), Delay Metrics, Oscillation, And Route Flapping, The Open SPF Protocol (OSPF).	5Hours
3.3	Internet Multicasting – Introduction, Hardware Broadcast, Hardware Multicast, Ethernet Multicast, The Conceptual Building Blocks Of Internet Multicast, The IP Multicast Scheme, IPv4 And IPv6 Multicast Addresses, Multicast Address Semantics, Mapping	2 Hours

	IP Multicast To Ethernet Multicast, Hosts And Multicast Delivery, Multicast Scope, Multicast Routing.	
4	**Transport Layer**	**10 Hours**
4.1	Transport Layer - Transport Service, The services provided to upper layers, Transport Service primitives, UDP- Segment Structure, Remote Procedure Call, RTP, and RTCP.	2 Hours
4.2	TCP – Service model, TCP Protocol, TCP Segment Header, Connection establishment and Release, TCP finite state machine, TCP Sliding Window, TCP timer management, Congestion Control.	4 Hours
4.3	Label switching, flows and MPLS. Network Virtualization: VPNs, NATs, And Overlays	4 Hours
5	**Application Layer**	**10 Hours**
5.1	Application Layer: - HTTP- Overview, Persistent and non persistent Connections, Message formats, Concept of Cookies and Web Cache	1 Hour
5.2	FTP - Electronic Mail– SMTP, Mail message formats, POP3, IMAP	2 Hours
5.3	DNS- Services provided by DNS, Overview of how DNS works, DNS Caching, Message format	2 Hours
5.4	DHCP	1 Hour
5.5	Software Defined Networking (SDN, Openflow)	4 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT304	ALGORITHM ANALYSIS AND DESIGN	PCC	3	1	0	4

Preamble: The syllabus is prepared with a view to equip the Engineering Graduatesto learn basic concepts in algorithms, and to instil the confidence to solve non-conventional problems using different problem solving strategies.

Prerequisite:

- ITT201 Data Structures

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

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Explain asymptotic notations used in the performance analysis of algorithms and to solve recurrence equations	Level 2: Understand
CO 2	Apply divide and conquer strategy to solve practical problems efficiently	Level 3: Apply
CO 3	Apply greedy and dynamic programming techniques in algorithm design	Level 3: Apply
CO 4	Apply backtracking and branch and bound techniques in algorithm design	Level 3: Apply
CO 5	Interpret sophisticated algorithms such as string matching and approximation algorithms	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	-	-	-	-	-	-	-	-	-	-	2
CO 2	3	3	3	-	3	-	-	-	-	-	-	2
CO 3	3	3	3	-	3	-	-	-	-	-	-	2
CO 4	3	3	3	-	3	-	-	-	-	-	-	2
CO 5	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	Continuous Assessment Tests		End Semester Examination
	Test 1 (Marks)	Test 2 (Marks)	Marks
Remember			
Understand	30	30	60
Apply	20	20	40
Analyze			
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. What is an asymptotic notation? Give the different notations used to represent the complexity of algorithms.
2. Write the recurrence equation for your algorithm and solve it to estimate the time complexity of the algorithm.

Course Outcome 2 (CO 2):

1. Give the divide and conquer solution for binary search and analyse its complexity.

2. What is the notion behind the divide and conquer method? Apply divide and conquer strategy to perform merge sort on an array of integers.

Course Outcome 3 (CO 3):

1. Why Kruskal's minimum cost spanning tree construction method is considered as a Greedy method for problem solving?
2. State fractional knapsack problem. Give an algorithm for solving the fractional knapsack problem using greedy strategy.

Course Outcome 4 (CO 4):

1. Draw the state space tree corresponding to 4-Queens problem.

Course Outcome 5 (CO 5):

1. Write an algorithm based on Rabin Karp method to find all the occurrences of pattern P[0..m-1] from a given string str[0. ... n-1], where n>m. Compare the time complexity of this algorithm with the naive approach.
2. Suggest an algorithm for finding the vertex cover of a graph.

Model Question Paper

Course Code: ITT304

Course Name: Algorithm Analysis and Design

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

Part A

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

1. What are the properties of a good algorithm?
2. Write down the control abstraction of divide and conquer.
3. List and explain the characteristic properties associated with a problem that can be solved using dynamic programming.
4. What is backtracking? Give one problem that can be solved by backtracking.
5. Differentiate Fixed Tuple and Variable Tuple formulation.
6. Define Least Common Sequence Problem.
7. What is principle of optimality?
8. Write an algorithm for matrix multiplication using Divide and conquer method.

9. What are approximation algorithms?

10. Differentiate between deterministic and nondeterministic algorithm.

Part B

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

11. (a) Compare asymptotic notations with examples (6 marks)

(b) What is amortized analysis? Explain any one method to perform amortized analysis with an example. (8 marks)

OR

12. (a) Compare the growth of time complexity for the following set of functions.

(6 marks)

(i) 2n and n^2
ii) $\sqrt{}$log n and log log n
iii) n$\sqrt{}$n and n log n

(b) Solve the recurrence equation using recursive tree method: T(n)= 2T(n/2)+c

(8 marks)

13. (a) How we can prove that Strassen's matrix multiplication is advantageous over ordinary matrix multiplication? (8 marks)

(b) Explain why worst case complexity of Quick sort is $O(n^2)$ and average case complexity is O(n log n) (6 marks)

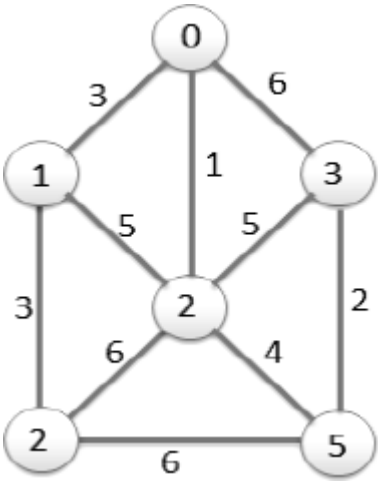
OR

14. (a) Write a recursive algorithm for implementing Binary Search. Illustrate the divide and conquer approach through this algorithm. (7 marks)

(b) Design a recursive algorithm to find the maximum and minimum from a set of *n* numbers .Illustrate with an example. (7 marks)

15. (a) Explain Kruskal's algorithm. Find the minimum cost spanning tree of the graph whose vertices are v1,v2,v3,v4,v5,v6 and v7. Cost of graph edges are (v1,v2)= 28, (v1,v6)=10, (v6,v5)=25, (v5,v4)=22, (v7,v2)=14, (v2,v3)=16, (v3,v4)=12, (v4,v7)=18 (8 marks)

(b) Draw and explain each stages of execution of Prim's algorithm in the following graph. (6 marks)



OR

16. (a) Find an optimal solution to the fractional knapsack problem for an instance with number of items 7, Capacity of the sack W=15, profit associated with the items (p1,p2,…,p7) = (10,5,15,7,6,18,3) and weight associated with each item (w1,w2,…,w7)= (2,3,5,7,1,4,1). (5 marks)
(b) Define Travelling Salesman Problem (TSP). Explain the basic steps that are to be followed to solve TSP using branch and bound. Illustrate with an example. (9 marks)

17. (a) Define the following tree organization for representing solution spaces.

(i) Problem state (ii) State space (iii) Solution state (6 marks)

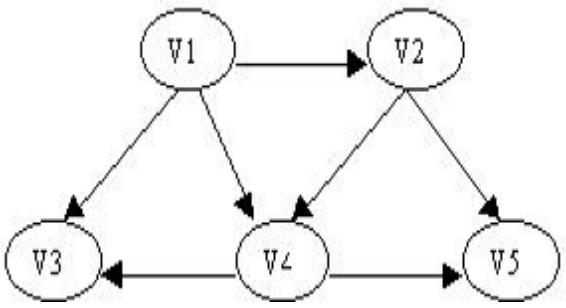
(b) Describe Branch and Bound technique. Demonstrate a problem that can be solved by branch and bound method. (8 marks)

OR

18. (a) What is 15-puzzle problem? How can it be solved? (8 marks)

(b) What is the relevance of Least cost search? Give the control abstraction for Least Cost Search. (6 marks)

19. (a) Perform Topological sorting on the given graph. (5 marks)



(b) Explain vertex cover problem using an example. Suggest an algorithm for finding vertex cover of a graph. (9 marks)

OR

20. (a) Write an algorithm based on Rabin Karp method to find all the occurrences of the pattern P[0..m-1] from a given string str[0....n-1], where n>m. Analyse and Compare the time complexity of this algorithm with the naive approach. (10 marks)

(b) Give an approximate algorithm for graph coloring problem. (4 marks)

Syllabus

Module 1: Introduction to Algorithms (9 Hours)
Properties of a good Algorithm, Development of an Algorithm, Pseudo-code Conventions, Recursive Algorithms Performance Analysis - Space and Time Complexity, Running Time Comparison - Worst, Best and Average Case Complexity, Asymptotic Notations, Common Complexity Functions Recurrence Relations – Solving Recurrences using substitution and recurrence trees Amortized Complexity – aggregate analysis, cost-accounting and potential methods
Module 2: Divide and Conquer (8 Hours)
Divide and Conquer - Control Abstraction, Finding Maximum and Minimum, Binary Search, Strassen's Matrix Multiplication, Quick Sort, Merge Sort
Module 3: Greedy Strategy and Dynamic Programming (9 Hours)
Greedy Strategy- Control Abstraction, Fractional Knapsack Problem, Minimum Cost Spanning Trees – Prim's and Kruskal's Algorithm, Job sequencing with deadlines Dynamic Programming- Principle of Optimality, DP solution for traveling salesman and 0/1 Knapsack problems, Least Common Subsequence problem
Module 4: Backtracking & Branch and Bound (10 Hours)
Backtracking– State Space Tree, Fixed Tuple and Variable Tuple Formulation - Control Abstraction, Monte Carlo Method – N-Queens Problem, Sum of Subsets Branch and Bound Techniques– FIFO, LIFO, and LC Branch and Bound, Control Abstraction, 15-puzzle problem
Module 5: Sophisticated Algorithms (9 Hours)
Topological sort, string matching: KMP algorithm, Rabin-Karp algorithm, Introduction to Computational Complexity – complexity classes, Determinism and Non-determinismm, Approximation Algorithms – Planar Graph Colouring, Vertex cover

Text Books

1. Introduction to Algorithms – Cormen, Leiserson, Rivest, Stein – 3/e, PHI
2. Fundamentals of Computer Algorithms – Horowitz and Sahni, 2/e, Universities Press

Reference Books

1. Computer Algorithms – Introduction to Design and Analysis – Sara Baase& Allen Van Gelder, 3/e, Pearson Education
2. Introduction to the Design and Analysis of Algorithms – Anany Levitin, 3/e, Pearson
3. Foundations of Algorithms – Richard Neapolitan, 5/e, Jones and Barlett Learning

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	**Introduction to Algorithms**	**9 Hours**
1.1	Properties of a good Algorithm, Development of an Algorithm, Pseudo-code Conventions, Recursive Algorithms	3 Hours
1.2	Performance Analysis - Space and Time Complexity, Running Time Comparison - Worst, Best and Average Case Complexity, Asymptotic Notations, Common Complexity Functions	3 Hours
1.3	Recurrence Relations – Solving Recurrences using substitution and recurrence trees Amortized Complexity – aggregate analysis, cost-accounting and potential methods	3 Hours
2	**Divide and Conquer**	**8 Hours**
2.1	Divide and Conquer - Control Abstraction, Finding Maximum and Minimum	2 Hours
2.2	Binary Search, Strassen's Matrix Multiplication	3 Hours
2.3	Quick Sort, Merge Sort	3 Hours
3	**Greedy Strategy and Dynamic Programming**	**9 Hours**
3.1	Greedy Strategy- Control Abstraction, Fractional Knapsack Problem	2 Hours
3.2	Minimum Cost Spanning Trees – Prim's and Kruskal's Algorithm, Job sequencing with deadlines	2 Hours
3.3	Dynamic Programming- Principle of Optimality	2 Hours
3.4	DP solution for traveling salesman and 0/1 Knapsack problems, Least Common Subsequence problem	3 Hours
4	**Backtracking & Branch and Bound**	**10 Hours**
4.1	Backtracking– State Space Tree, Fixed Tuple and Variable Tuple	3 Hours

	Formulation - Control Abstraction	
4.2	Monte Carlo Method – N-Queens Problem, Sum of Subsets	2 Hours
4.3	Branch and Bound Techniques– FIFO and LIFO	2 Hours
4.4	LC Branch and Bound, Control Abstraction, 15-puzzle problem	3 Hours
5	**Sophisticated Algorithms**	**9 Hours**
5.1	Topological sort, string matching: KMP algorithm	3 Hours
5.2	Rabin-Karp algorithm, Introduction to Computational Complexity – complexity classes, Determinism and Non-determinismm	3 Hours
5.3	Approximation Algorithms – Planar Graph Colouring, Vertex cover	3 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT306	DATA SCIENCE	PCC	3	1	0	4

Preamble: This course is designed to provide learners with working knowledge of the theoretical background of various aspects of Data Science and enable them to incorporate and apply the principles of statistics and machine learning to solve real-world problems for large-scale data analysis.

Prerequisites:

- MAT 101 Linear Algebra and Calculus
- MAT 208 Probability and Statistics and Advanced Graph Theory
- ITT 205 Problem Solving Using Python
- ITT 201 Data Structures
- ITT 206 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	Explain the fundamental concepts and various aspects of data science	Level 2: Understand
CO 2	Choose data validation techniques suitable for statistical analysis and present results using data visualization techniques.	Level 2: Understand
CO 3	Identify different statistical learning algorithm for solving a Problem	Level 3: Apply
CO 4	Use statistical analysis to characterize and interpret data sets	Level 3: Apply
CO 5	Compare the pros/cons of various models and algorithms used for data analysis and data mining	Level 2: Understand
CO 6	Develop the ability to perform basic data analysis in Python and understand the fundamentals of deep learning.	Level 3: Apply

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	1	1	1	1	2	-	-	-	-	-	-	-
CO 2	3	2	1	1	3	-	-	-	-	2	-	-
CO 3	3	2	1	1	3	-	-	-	1	2	-	-
CO 4	3	3	2	1	3	-	-	-	1	2	-	-

CO 5	2	3	1	1	3	-	-	-	1	2	-	-
CO 6	3	2	1	1	3	-	-	-	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 Marks**
	Test1 (Marks)	**Test2 (Marks)**	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	30
Analyse			
Evaluate			
Create			

Marks 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 anyone. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. What is data science? What are the different models for data science?
2. Explain data science process with a neat diagram.
3. Explain different types of Data Sets in Data Science

Course Outcome 2 (CO 2):

1. List any four two tools for data visualisation?

2. What is data visualization and what are the different techniques used for visualizing data?
3. Discuss methods of evaluating models in data science?

Course Outcome 3(CO 3):

1. Explain random forest ensemble method with an example.
2. What is data cleaning? What are the different operations in data cleaning?
3. Is regression a supervised learning technique? Justify your answer. Compare it with classification giving examples.
4. What are ensemble methods? Explain the bagging technique
5. Discuss Linear discriminant analysis.
6. What is decision tree? Explain the working of decision tree with information gain algorithm.

Course Outcome 4 (CO 4):

1. Differentiate between supervised and unsupervised learning techniques.
2. Classify different types of clustering. What are the practical issues in clustering?
3. Summarise different kernel tricks in SVM.
4. Illustrate with examples different Resampling methods.
5. Suppose that our task is to cluster data points into two clusters. Let the data points are {2, 4, 10, 12, 3, 20, 30, 11, 25}. Let 2 and 4 are initial cluster centroids. Apply Two rounds of k-means algorithm and find a set of clusters. Use Euclidean distance as the measure.

Course Outcome 5 (CO 5):

1. Compare Apriori and FP Growth algorithm. What are the advantages of FP Growth over Apriori algorithm?
2. How will you relate constraint-based mining with frequent pattern mining?

3. A database has five transactions. Let min_sup=60% and min_conf=80%. With the following transaction, list all the strong association rules.

T100 {M, O, N K, E, Y}

T200 {D, O, N, K, E, Y}

T300 {M, A, K, E}

T400 {M, U, C, K, Y}

T500 {C, O, O, K, I, E}

Course Outcome 6 (CO 6):

1. Write an example of multiplying three dimensional matrices in NumPy.
2. Identify the essential libraries in Python.
3. Is Jupyter notebook IDE?How can you relate IPython and Jupyter?
4. What are the ways to store text data in pandas?

Course Code: ITT306

Course Name: Data Science

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

Part A

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

1. What is data science? What are the different models for data science?

2. What is data visualization and what are the different techniques used for visualizing data?

3. Is regression a supervised learning technique? Justify your answer. Compare it with classification giving examples.

4. Explain random forest ensemble method with an example.

5. Explain different types of clustering. What are the practical issues in clustering?

6. What is Support Vector Machine? How classification is done using SVM?

7. Explain the concept of constraint-based mining.

8. Compare Apriori and FP Growth algorithm. What are the advantages of FP Growth over Apriori algorithm?

9. Briefly explain the essential libraries in Python.

10. What makes deep learning deep? What are the different deep learning techniques?

Part B

Each question set carries 14 marks (5 * 14 = 70 Marks)

11. Explain data science process with a neat diagram.
12. Describe data science classification with a neat diagram.

OR

13. What is data cleaning? What are the different operations in data cleaning?
14. Explain different types of Data Sets in Data Science.

15. What is decision tree? Explain the working of decision tree with information gain algorithm.
16. What are ensemble methods? Explain the bagging technique.

OR

17. Differentiate supervised and unsupervised learning techniques with examples.
18. Discuss Linear discriminant analysis.

19. Explain different types of Resampling methods.
20. What is SVM? Explain Different kernel tricks in SVM.

OR

21. Write a short note on Maximal Margin Hyperplanes. (MMH).
22. Suppose that our task is to cluster data points into two clusters. Let the data points are {2, 4, 10, 12, 3, 20, 30, 11, 25}. Let 2 and 4 are initial cluster centroids. Apply Two rounds of k-means algorithm and find a set of clusters. Use Euclidean distance as the measure.

23. Consider the transaction database given below. Set minimum support count as 2 and minimum confidence threshold as 70%.
    a) Find the frequent item-set using FP Growth Algorithm.
    b) Generate strong association rules.

Transaction ID	List of Item_Ids
T100	I1,I2,I5
T200	I2,I4
T300	I2,I3
T400	I1,I2,I4
T500	I1,I3
T600	I2,I3
T700	I1,I3
T800	I1,I2,I3,I5
T900	I1,I2,I3

24. Explain Multi-level and multi-dimensional pattern mining.

OR

25. What is data mining? Explain the process of Knowledge discovery from database.
26. A database has five transactions. Let min_sup=60% and min_conf=80%. With the following transaction, list all the strong association rules.

    T100 {M, O, N K, E, Y}

    T200 {D, O, N, K, E, Y}

    T300 {M, A, K, E}

    T400 {M, U, C, K, Y}

    T500 {C, O, O, K, I, E}

27. What are the basic universal functions in Numpy?
28. What are the applications of deep learning?

OR

29. Write an example of multiplying three dimensional matrices in NumPy.

30. What are the ways to store text data in pandas?

Module 1: Foundations Data Science, process, and tools (9 Hours)
Introduction to data science, properties of data, asking interesting questions, classification of data science, data science process, collecting, cleaning and visualizing data, languages, and models for data science
Module 2: Statistical machine learning: introduction, regression, and classification, decision tress, random forests (11 Hours)
Introduction to statistical machine learning, parametric and non-parametric methods, supervised vs. unsupervised learning, regression and classification, linear discriminant analysis, decision trees, random forests, and bagging
Module 3: Unsupervised learning, support vector machines and resampling (9 Hours)
Principal Component Analysis, clustering algorithms, practical issues in clustering, support vector classifiers and support vector machines, resampling methods: cross-validation and bootstrapping
Module 4: Data mining, pattern mining and association rule mining (9 Hours)
Data and pattern mining, types, issues, mining frequent patterns and associations, apriori and FP growth algorithms, multi-level association mining, constraint-based mining, pruning pattern space and data space
Module 5: Python for Data Analysis, Deep learning (7Hours)
Using Python for data analysis, essential python libraries, IPython, Jupyter notebook, NumPy basics, working with pandas, deep learning methods.

Textbooks

1. Kotu, V., & Deshpande, B. (2019). Data science: Concepts and practice., Morgan Kaufmann.
2. Skiena, S. S. (2017). The data science design manual., Springer.
3. James, G., Witten, D., Hastie, T., Tibshirani, R. (2017). An Introduction to Statistical Learning: with Applications in R., Springer.
4. Han, J., Kamber, M. & Pei, J. (2012). Data mining concepts and techniques, Morgan Kaufmann.

5. McKinney, W. (2017). Python for Data analysis! Data wrangling with pandas NumPy, and IPython. Beijing: O'Reilly.

Reference Books

1. Montgomery, D. C., Runger, G. C. (2017). Applied Statistics and Probability for Engineers. John Wiley and Sons.

2. Provost, F., Fawcett, T. (2013). Data Science for Business. Beijing: O'Reilly

3. Igual, L., Seguí, S. (2017). Introduction to Data Science - A Python Approach to Concepts, Techniques and Applications. Springer.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Foundations Data Science, process, and tools**	**9 Hours**
1.1	What is Data Science, relation with AI and machine learning (1.1, 1.2 of Kotu, V., & Deshpande, B. (2019). *Data science: Concepts and practice*., Morgan Kaufmann.)	1 Hour
1.2	Case for Data Science, Data science classification (1.3, 1.4 of Kotu, V., & Deshpande, B. (2019). *Data science: Concepts and practice*., Morgan Kaufmann.)	1 Hour
1.3	Properties of data, asking interesting questions (1.1, 1.2 and 1.3 of Skiena, S. S. (2017). *The data science design manual*., Springer.)	1 Hour
1.4	Data Science process: preparation, modelling, and application (2.1, 2.2, 2.3 and 2.4 of Kotu, V., & Deshpande, B. (2019). *Data science: Concepts and practice*., Morgan Kaufmann.)	2Hours
1.5	Collecting and cleaning data (3.2 and 3.3 of Skiena, S. S. (2017). *The data science design manual*., Springer.)	1 Hour
1.6	Visualizing data (6.1, 6.2 and 6.3 of Skiena, S. S. (2017). *The data science design manual*., Springer.)	1Hour
1.7	Languages and models for Data Science, evaluating models (3.1, 7.2, 7.3 and 7.4 of Skiena, S. S. (2017). *The data science design manual*., Springer.)	2 Hours
2	**Statistical machine learning: introduction, regression, and classification, decision tress, random forests** **(Reference Textbook for all topics:** James, G., Witten, D., Hastie, T., Tibshirani, R. (2017). *An Introduction to Statistical Learning: with Applications in R.*, Springer.)	**11 Hours**
2.1	What is statistical learning, parametric and non-parametric methods (2.1)	1 Hour
2.2	Supervised vs. unsupervised learning, Classification vs. regression (2.1)	1 Hour
2.3	Simple linear regression, assessing model accuracy (3.1)	1Hour
2.4	Multiple linear regression, some important concerns (3.2)	1 Hour

2.5	Extensions of the linear model (3.3.2)	1 Hour
2.6	Classification (4.1)	1 Hour
2.7	Logistic regression: model, estimating coefficients, predicting (4.3.1, 4.3.2, 4.3.3)	2 Hours
2.8	Linear discriminant analysis, using Bayes' theorem for classification, case when p=1 (4.4.1, 4.4.2, 4.4.3)	1 Hour
2.9	Decision tress, regression and classification trees, tress vs. linear models, advantages, and disadvantages (8.1)	1 Hour
2.10	Bagging, random forests (8.2.1, 8.2.2)	1 Hour
3	**Unsupervised learning, support vector machines and resampling** **(Reference Textbook for all topics:** James, G., Witten, D., Hastie, T., Tibshirani, R. (2017). *An Introduction to Statistical Learning: with Applications in R*., Springer.)	**9Hours**
3.1	Challenge of unsupervised learning, principal component analysis (10.1, 10.2.1)	1 Hour
3.2	Clustering techniques: k-means, hierarchical (10.3.1, 10.3.2)	1Hour
3.3	Practical issues in clustering (10.3.3)	1 Hour
3.4	Overview of the support vector classifier, hyperplane, maximal margin classifier (9.1.1, 9.1.2, 9.1.3)	2 Hours
3.5	Support vector classifiers: overview and details (9.2.1, 9.2.2)	1 Hour
3.6	Support vector machines: Classification with non-linear decision boundaries (9.3.1, 9.3.2)	1 Hour
3.7	Resampling: cross-validation and bootstrapping (5.1 and 5.2)	2 Hours
4	**Data mining, pattern mining and association rule mining(Reference Textbook for all topics:** Han, J., Kamber, M. & Pei, J. (2012). Data mining concepts and techniques, Morgan Kaufmann.)	**9 Hours**
4.1	Data mining, kinds of data that can be mined (1.2, 1.3,)	1 Hour
4.2	Pattern mining: class description, mining frequent patterns and associations, classification, and regression for predictive analysis (1.4.1, 1.4.2, 1.4.3)	1 Hour
4.3	Cluster analysis, outlier analysis (1.4.4, 1.4.5), measures of pattern interestingness (1.4.6), Issues in data mining (1.7)	1 Hour
4.4	Mining frequent patterns: market basket analysis, frequent and closed item sets, association rules (6.1.1, 6.1.2)	1 Hour
4.4	Apriori algorithm, generating rules, improving efficiency (6.2.1, 6.2.2, 6.2.3)	1 Hour
4.5	FP growth algorithm (6.2.4)	1 Hour
4.6	Multi-level and multi-dimensional pattern mining (7.2.1, 7.2.2)	1 Hour
4.7	Mining quantitative association rules (7.2.3) mining rare and negative patterns (7.2.4)	1 Hour
4.8	Constraint-based mining: meta-rule guided mining (7.3.1) pattern generation, pruning pattern space and data space (7.3.2)	1Hour

5	**Python for Data Analysis, Deep learning**	7 Hours
5.1	Why Python for data analysis? Essential libraries (1.2 and 1.3 of McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. Beijing: O'Reilly.)	1 Hour
5.2	IPython basics and Jupyter notebook (2.2 of McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. Beijing: O'Reilly.), demo of appropriate Examples	1 Hour
5.3	NumPy basics, universal functions, array-oriented programming, mathematical and statistical methods, file I/O, linear algebra (4.1. 4.2, 4,3, 4.4, 4.5 of McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. Beijing: O'Reilly.)	2 Hours
5.4	Pandas basics, essential functionality, summarizing and computing descriptive statistics (5.1, 5.2, 5.3 of McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. Beijing: O'Reilly.)	2 Hours
5.5	Deep learning: networks and depth, back propagation, word and graph embeddings (11.6.1, 11.6.2, 11.6.3 of Skiena, S. S. (2017). *The data science design manual*, Springer.)	1Hour

SEMESTER VI

PROGRAM ELECTIVE I

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT312	USER INTERFACE AND USER EXPERIENCE DESIGN	PEC	2	1	0	3

Preamble: User Interface and User Experience Design course is intended to deliver students the elementary concepts of User Interface Design, User Experience Design and their importance, thereby equipping them to develop great user interfaces which are appealing to users.

Prerequisite: nil

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

CO No.	Course outcomes (CO)	Bloom's Category Level
CO1	Outline the Basic Principles of Design and User Centered Design	Level 2: Understand
CO2	Infer the basic elements of User Experience Design	Level 2: Understand
CO3	Apply basic principles of Visual Design	Level 3: Apply
CO4	Discuss basic concepts in User Interface Design	Level 2: Understand
CO5	Develop Web and Mobile User Interface	Level 3: Apply

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
CO1	3	1	1	1	-	-	-	-	-	2	2	3
CO2	3	1	1	1	-	-	-	-	-	2	2	2
CO3	3	3	3	1	-	-	-	-	-	2	1	2
CO4	3	1	2	1	-	-	-	-	-	2	1	2
CO5	3	3	3	1	-	-	-	-	-	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	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	5	5	10
Understand	30	30	60
Apply	15	15	30
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 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 (CO1):

1. Explain the importance of seven stages of action in design.
2. Discuss Principles of design for understandability and usability

Course Outcome 2 (CO2):

1. Illustrate basic process components of UX.
2. Summarize basic process components of UX.

Course Outcome 3 (CO3):

1. Demonstrate the importance of typography with examples.
2. Summarize the basic process components of UX.

Course Outcome 4(CO4):

1. Explain the importance of a Good user interface design.
2. Differentiate two types of knowledge required for User Interface Design

Course Outcome 5 (CO5):

1. Create a web application for library with HTML and CSS.
2. List out any three mobile app designing tools.

Model Question Paper

Course Code: ITT312

Course Name: User Interface and User Experience Design

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

PART A

Answer all Questions. Each question carries 3 Marks

1. Define the terms understandability and usability in design.
2. Differentiate knowledge in the world and in the head in connection with design.
3. Explain User Experience.
4. Differentiate HCI and UX.
5. Differentiate Visual Design and fine arts.
6. Illustrate Iconography with an example.
7. Explain the importance of good user interface design.
8. Explain two types of knowledge needed for User Interface design.
9. What are the different design issues for websites?
10. Differentiate inline and block level elements.

PART B

Answer all questions. Each question carries 14 Marks

11. Illustrate the importance of seven stages of action as design aids with examples.

OR

12. Explain seven principles for transforming difficult tasks into simple one.

13. Illustrate funnel model for Agile UX with example.

OR

14. Explain 6D UX process.

15. Illustrate visual design process with example.

OR

16. Demonstrate the importance of any three visual design tools.

17. How to gather requirements for user interface designing?

OR

18. Demonstrate the importance of any three visual design tools.

19. Illustrate different ways for applying css with example.

OR

20. Differentiate stateful and stateless widgets in flutter.

Syllabus

Module 1: INTRODUCTION TO DESIGN (7 Hours)
Fundamentals of Design: Principles of design for understandability and usability, The Principle of mapping, How people do things: the seven stages of action, The seven stages of action as design aids, The trade of between knowledge in the world and in the head, Classification of everyday constraints, Applying affordance and constraints to everyday objects, The structure of tasks, The natural evolution of design, The complexity of design process **User Centered Design:** Seven Principles for transforming difficult tasks into simple one, Deliberately making the things difficult, Design and society, The design of everyday things
Module 2: FUNDAMENTALS OF USER EXPERIENCE DESIGN (7 Hours)
Basics of UX Design: The expanding concept of interaction, Definition of UX, UX Design, The components of UX, What UX is not, Kinds of interaction and UX, The basic process components of UX, UX Design techniques as life skills, Choosing UX Processes Methods and Techniques, The funnel model of Agile UX, Shifting paradigms in HCI and UX **Introduction To 6d:** 6D UX process – Discover, Design, Dream, Design, Develop, Deliver.
Module 3: VISUAL DESIGNING (7 Hours)
Introduction To Visual Design: The visual brain, Benefits to learning, The picture superiority effect, Visual design versus fine arts, The purpose of design, The role of the visual designer, A visual design process, The mindset of the visual designer, Build a graphic design

toolbox, Design with templates, Where to find visual inspiration, Know the technical terms, Use color with purpose, Establish a visual hierarchy, Tell stories with visuals, draft your verbal brand, Anatomy of typeface, color theory, understanding visual weight

VISUAL DESIGN TOOLS: visual design tools – Photoshop, Illustrator, Creating layouts, iconography, digital color schemes, infographics, typography

Module 4: USER INTERFACE DESIGNING (6 Hours)

Basics Of Ui Development: Why the user interface matters?, The importance of good user interface design, Designing for users, Evaluation, How to gather requirements: Observing your users, Interviewing users, Questionnaire and surveys; Finding out about users and domain: Users-finding out who they are, User's needs, The domain; Describing user's work, Two types of knowledge needed for User Interface design, Design principles and design rules, Usability requirements, The Modern day view of usability, wireframing, prototyping

Wireframing And Prototyping Tools: AdobeXD, Invision, AxureRP - overview

Module 5: UI DESIGNING FOR WEB AND MOBILE (8 Hours)

Designing for Web: Design principles for websites, Designing Websites, Designing Home pages and Interior pages, Design issues for web pages, Writing contents for web pages

Front End Development: Front-end development technologies – HTML, Structure of HTML Page, Mandatory tags in html page (html, head, body), Heading tags (H1…H6), Tags and attributes (Class, Id, style etc.). Inline and block level elements, CSS, Different ways of applying CSS for elements, Responsive Web Designing, Bootstrap, Material Design, DOM, JQuery- animations

Mobile Front End Development: Mobile App Designing tools- Sketch, Invisio, Adobe XD, Fluid; Mobile App Development- fundamentals, Android studio vs Flutter, Flutter framework- stateful and stateless widgets, Material icons, Basic app Development with Flutter

Textbooks

1. The Design of Everyday things- Donald A Norman, Currency and Doubleday, 2nd Edition
2. The UX Book-Rex Hartson and PardhaPyla, Morgan Kaufmann, 2nd Edition
3. Visual Design Solutions- Connie Malamed, Wiley, 1st Edition
4. User Interface Design and Evaluation - Debbie Stone,The Open University, 2nd Edition

Reference Books

1. Graphic Design For Everyone - Cath Caldwell, 2nd Edition
2. Adobe Photoshop, Illustrator, In-Design Basics - John Richards, 3rd Edition
3. Adobe XD classroom in a book - Brian Wood, 2nd Edition
4. How to build a web app in 4 stages -KarimAraoui
5. Axure RP Prototyping cookbook - John Henry Krahenbuhl

6. UI/UX Sketchbook for wireframing and prototyping - Amazon Digital Services LLC
7. Mobile UI/UX Sketchbook - (Independently published)
8. HTML and CSS: Design and Build Websites - Jon Duckett, Wiley
9. Flutter: for absolute beginners -PouyaHosseini
10. Seductive Interaction Design: Creating Playful, Fun, and Effective User Experiences - Stephen P Anderson,

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	**INTRODUCTION TO DESIGN**	**7 Hours**
1.1	**Fundamentals of Design:** Principles of design for understandability and usability, The Principle of mapping, How people do things: the seven stages of action	2 Hours
1.2	The seven stages of action as design aids, The trade of between knowledge in the world and in the head, Classification of everyday constraints	2 Hours
1.3	, Applying affordance and constraints to everyday objects, The structure of tasks, The natural evolution of design, The complexity of design process	1 Hour
1.4	**User Centered Design:** Seven Principles for transforming difficult tasks into simple one, Deliberately making the things difficult, Design and society, The design of everyday things	2 Hours
2	**FUNDAMENTALS OF USER EXPERIENCE DESIGN**	**7 Hours**
2.1	**Basics Of UX Design:**The expanding concept of interaction, Definition of UX, UX Design, The components of UX	2 Hours
2.2	What UX is not, Kinds of interaction and UX, The basic process components of UX,	1 Hour
2.3	UX Design techniques as life skills, Choosing UX Processes Methods and Techniques, The funnel model of Agile UX, Shifting paradigms in HCI and UX	2 Hours
2.4	**Introduction To 6d:** 6D UX process – Discover, Design, Dream, Design, Develop, Deliver.	2 Hours
3	**VISUAL DESIGNING**	**7 Hours**
3.1	**Introduction To Visual Design:** The visual brain, Benefits to learning,	2 Hours

	The picture superiority effect	
3.2	Visual design versus fine arts, The purpose of design, The role of the visual designer, A visual design process, The mindset of the visual designer	1 Hour
3.3	, Build a graphic design toolbox, Design with templates, Where to find visual inspiration, Know the technical terms, Use color with purpose, Establish a visual hierarchy, Tell stories with visuals, draft your verbal brand, Anatomy of typeface, color theory, understanding visual weight	3 Hours
3.4	**VISUAL DESIGN TOOLS:** visual design tools – Photoshop, Illustrator, Creating layouts, iconography, digital color schemes, infographics, typography	1 Hour
4	**USER INTERFACE DESIGNING**	**6 Hours**
4.1	**Basics Of Ui Development:** Why the user interface matters?, The importance of good user interface design, Designing for users, Evaluation,	1 Hour
4.2	How to gather requirements: Observing your users, Interviewing users, Questionnaire and surveys; Finding out about users and domain: Users-finding out who they are, User's needs, The domain; Describing user's work,	2 Hours
4.3	Two types of knowledge needed for User Interface design, Design principles and design rules, Usability requirements, The Modern day view of usability, wireframing, prototyping	2 Hours
4.4	**Wireframing And Prototyping Tools:** AdobeXD, Invision, AxureRP - overview	1 Hour
5	**UI DESIGNING FOR WEB AND MOBILE**	**8 Hours**
5.1	**Designing for Web:** Design principles for websites, Designing Websites, Designing Home pages and Interior pages, Design issues for web pages, Writing contents for web pages	1 Hour
5.2	**Front End Development:**Front-end development technologies – HTML, Structure of HTML Page, Mandatory tags in html page (html, head, body), Heading tags (H1…H6), Tags and attributes (Class, Id, style etc.), Inline and block level elements,	2 Hours
5.3	CSS, Different ways of applying CSS for elements, Responsive Web Designing, Bootstrap, Material Design, DOM, JQuery- animations	2 Hours

5.4	**Mobile Front End Development:** Mobile App Designing tools- Sketch, Invisio, Adobe XD, Fluid; Mobile App Development- fundamentals,	1 Hour
5.5	Android studio vs Flutter, Flutter framework- stateful and stateless widgets, Material icons, Basic app Development with Flutter	2 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT322	COMPILER DESIGN	PEC	2	1	0	3

Preamble: This syllabus starts with an introduction about different phases of compilers. Each phase is discussed in detail in other modules. Second and third module contains the lexical analysis phase and automata for this phase. Parsing and different types of parsing techniques are being discussed over here. Different types of construction of parsing tables are included. Different syntax directed translation schemes are included in fourth module. Different code optimization techniques and code generation design issues are also included in the last module.

Prerequisite: ITT 307 Formal Languages and Automata theory

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	Explain the different phases of a compilers	Level 1: Remember
CO 2	Illustrate different automata, context free grammars for lexical analysis and parsing	Level 2: Understand
CO 3	Compare top-down parsers with bottom-up parsers	Level 3: Apply
CO 4	Construct different parsing tables for SLR, LALR ,LR, CLR	Level 3: Apply
CO 5	Illustrate the different syntax directed translation schemes , different code optimization techniques and code generation Issues	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	2	2	2	-	-	-	-	-	-	-	1
CO 2	3	2	2	2	1	-	-	-	-	-	-	1
CO 3	2	3	2	3	-	-	-	-	-	-	-	1
CO 4	3	3	3	3	3	-	-	-	-	-	-	1
CO 5	2	2	2	3	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	Continuous Assessment Tests		End Semester Examination Marks
	Test1 (Marks)	Test2 (Marks)	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	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. State the different phases of a compiler.

2. List the different Finite Automata for token recognition, Lexical Analysis.

3. Define the different compiler writing tools.

Course Outcome 2 (CO2)

1. Demonstrate different context free grammars and derivation trees for ambiguous grammar.

2. Give example for recursive descent parsing.

3. Construct parsing table for LL(1) Grammar.

Course Outcome 3(CO3):

1. Demonstrate first and follow.

2. Construct parsing table for SLR.

3. Construct parsing table for LALR.

Course Outcome 4 (CO4):

1. Demonstrate the syntax directed translation for different statements.

2. Give example for generating physical address for accessing data segment.

3. Describe the bottom-up evaluation and top-down evaluation of inherited attributes.

Course Outcome 5 (CO5):

1. Illustrate the three-address code generation in different formats.

2. Demonstrate different code optimization techniques.

3. Demonstrate the design of code generator.

Model Question paper

Course Code: ITT322
Course Name: COMPILER DESIGN

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions. Each carries 3 marks)

1. Define ambiguous grammar. Give an example.
2. Write a note on derivation tree with an example.
3. Discuss about input buffering.
4. Define Lexemes, token and symbol table.
5. Write a note on operator precedence parsing.
6. What is shift reduce parsing with an example
7. Define synthesized and inherited attribute
8. Write a note on type checking
9. What are the methods used for elimination of ambiguity and non-determinism?
10. Write a note on
    - L attributed definition
    - S attributed definition

PART B

Answer all questions. Each carries 14 marks

11. Write regular expression for the following language (14 marks)
    a. Set of all strings that contains 11 at the beginning and 00 at the end where$\sum$={0,1} and draw a corresponding E-NFA
    b. Set of all strings that contains 3 consecutive a's where$\sum$={a,b} and draw a

corresponding E-NFA

OR

12. Explain the different phases of compiler with neat diagram (14marks)

13. Design CFG for the following language and draw corresponding parse tree (14 marks)

a. Design a CFG for of $a^n b^n$

b. Design a CFG for equal number of zeros and equal number of ones

OR

14 a)Define LR Parsing. Construct LR(0) items for the below grammar. (7 marks)

S->AA

A->aAb

b)Differentiate between LR(0) parsing and SLR Parsing with an example (7marks)

15 . a.Write an algorithm for recursive descent parser (7 marks)

b.Write an algorithm for FIRST and FOLLOW in parser (7 marks)

OR

5. Explain LALR parsing with an example (14 marks)

6. Describe about syntax directed definition with examples (14 marks)

OR

7. Discuss about bottom up evaluation of synthesized attributes (14 marks)

19 a. Discuss about 1. Three address code 2.Quadruples 3.Triples with an example (7 marks)

b. Discuss about various storage allocation strategies (7 marks)

OR

20 a. Discuss about any three code optimization methods (7marks)

b. Write a note on various issues of code generation (7 marks)

Syllabus

Module 1: Introduction to compilers (6 Hours)
Introduction to compilers – Analysis of the source program, Phases of a compiler, Grouping of phases, compiler writing tools – bootstrapping **Lexical Analysis:** The role of Lexical Analyser, Input Buffering, Review of Finite Automata.
Module 2: Syntax Analysis (6 Hours)
Syntax Analysis: Review of Context-Free Grammars – Derivation trees and Parse Trees, Ambiguity. **Top-Down Parsing:** Recursive Descent parsing, Predictive parsing, LL(1) Grammars.
Module 3: Bottom-Up Parsing (9 Hours)
Bottom-Up Parsing: Shift Reduce parsing – Operator precedence parsing **,**LR parsing – Constructing SLR parsing tables, Constructing, Canonical LR parsing tables and Constructing LALR parsing tables.
Module 4: Syntax directed translation (6 Hours)
Syntax directed translation: Syntax directed definitions, Bottom- up evaluation of S-attributed definitions, L- attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes.
Module 5: Intermediate Code Generation (ICG) (8 Hours)
Intermediate Code Generation (ICG): Intermediate languages – Graphical representations, Three-Address code, Quadruples, Triples. **Code Optimization:** Principal sources of optimization, Optimization of Basic blocks **Code generation:** Issues in the design of a code generator, A simple code generator.

Text Books

1. Aho A. Ravi Sethi and D Ullman. Compilers – Principles Techniques and Tools, Addison Wesley, 2006.

2. D. M.Dhamdhare, System Programming and Operating Systems,Tata McGraw Hill & Company, 1996.

Reference Books

1. Kenneth C. Louden, Compiler Construction – Principles and Practice, Cengage Learning Indian Edition, 2006.

2. Tremblay and Sorenson, The Theory and Practice of Compiler Writing, Tata McGraw Hill & Company,1984.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to compilers**	**6 Hours**
1.1	Analysis of the source program	1 Hour
1.2	Phases of a compiler	1 Hour
1.3	Grouping of phases, compiler writing tools ,bootstrapping	1 Hour
1.4	**Lexical Analysis:** The role of Lexical Analyser, Input Buffering	1 Hour
1.5	Review of Finite Automata	2 Hours
2	**Syntax Analysis**	**6 Hours**
2.1	Review of Context-Free Grammars	1 Hour
2.2	Derivation trees and Parse Trees, Ambiguity.	1 Hour
2.3	Recursive Descent parsing	2 Hours
2.4	Construction of LL(1) parsing table	2 Hours
3	**Bottom-Up Parsing**	**9 Hours**
3.1	Shift Reduce parsing	1 Hour
3.2	Operator precedence parsing	2 Hours
3.3	SLR parsing tables	2 Hours
3.4	Constructing LALR parsing tables	2 Hours
3.5	Canonical LR parsing tables	2 Hours
4	**Syntax directed translation**	**6 Hours**
4.1	Syntax directed definitions	1 Hour
4.2	Bottom- up evaluation of S- attributed definitions	2 Hours
4.3	L- attributed definitions	1 Hour
	Top-down translation	1 Hour
	Bottom-up evaluation of inherited attributes.	1 Hour
5	**Intermediate Code Generation (ICG)**	**8 Hours**
5.1	Intermediate languages – Graphical representations, Three-Address code, Quadruples, Triples.	2 Hours
5.2	**Code Optimization:** Principal sources of optimization	2 Hours
5.3	Optimization of Basic blocks	2 Hours
5.4	**Code generation:** Issues in the design of a code generator	1 Hour
5.5	A simple code generator	1 Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT332	SOFT COMPUTING	PEC	2	1	0	3

Preamble: The objective of the course is to introduce the basic concepts of soft computing techniques such as Artificial Neural Networks, Fuzzy Logic, Genetic Algorithm and Hybrid Systems.

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	Explain various soft computing techniques and their roles in building intelligent machines	Level 2: Understand
CO 2	Discuss Artificial Neural Network Architectures and different Learning Methods	Level 2: Understand
CO 3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems	Level 3: Apply
CO 4	Apply genetic algorithm to solve optimization problems	Level 3: Apply
CO 5	Explain the concepts of hybrid systems	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	2	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	3	-	1	-	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	2
CO 5	2	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 Marks
	Test1 (Marks)	Test1 (Marks)	
Remember	20	10	30
Understand	20	20	40
Apply	10	20	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. Describe various soft computing techniques.
2. List applications of Neural Networks.
3. Soft computing techniques give best solution to complex problems. Justify.

Course Outcome 2 (CO2):

1. What is unsupervised learning and how is it different from reinforced learning.

2. How does learning takes place in supervised learning.
3. Draw the architecture of back propagation algorithm.

Course Outcome 3(CO3):

1. With suitable example, explain how membership assignment is performed using intuition.
2. Design computer software to perform image processing to locate objects within a scene. The two fuzzy sets representing a plane and a train image are

Plane : $\frac{0.2}{train} + \frac{0.5}{bike} + \frac{0.3}{boat} + \frac{0.8}{plane} + \frac{0.1}{house}\}$

Train : $\frac{1}{train} + \frac{0.2}{bike} + \frac{0.4}{boat} + \frac{0.5}{plane} + \frac{0.2}{house}$

Find the following

(a) Plane □ Train (b) Plain □ Train

(C) $\overline{Plane}$ (d) $\overline{Train}$

(e) Plane□ Train (f) $\overline{\text{Plane} \cup \text{Train}}$

(g) $\overline{\text{Plane} \cap \text{Train}}$ (h) $\overline{\text{Plane} \cup \overline{\text{Plane}}}$

(i) Plain □ $\overline{Plane}$ (j) Train □ $\overline{Train}$

Course Outcome 4 (CO4):

1. Determine the maximum of a function f(x)= x^2 using genetic algorithm.
2. With a neat flowchart, explain the operation of a simple genetic algorithm.

Course Outcome 5 (CO5):

1. Describe Neuro Genetic hybrid systems.
2. Mention the characteristics and properties of Neuro-Fuzzy hybrid systems

Model Question paper

Course Code: ITT 332

Course Name: Soft Computing

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

Part A

Answer all questions. Each question carries 3 marks.

1. Discuss the back propagation process in a neural network.
2. How is fuzzy relation converted into a crisp relation using lamda-cut process?
3. Differentiate convex and nonconvex fuzzy set
4. What is ANFIS?
5. Differentiate hard computing and soft computing
6. What is the significance of weight in an Artificial Neural Network?
7. Define Fuzzy Equivalence Relation.
8. Compare Tuning and learning problems
9. What are the advantages and limitations of Genetic Algorithm?
10. List various encoding techniques used in genetic algorithm.

Part B

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

11. (a) State the basic components of soft computing (6 marks)

    (b) What are the different applications of Soft Computing? (8 marks)

OR

12. (a) What are the characteristics of hard computing and soft computing? (6 marks)

    (b) Describe various soft computing techniques (8 marks)

13. (a)Explain Exclusive OR problem. How it is solved with two layer perceptrons (8 marks)

    (b) Calculate the output y of a three-input neuron with bias. The input feature vector is (x1, x2,x3)= (0.3,0.5,0.6) and weight values are [w1,w2,w3, b] = [0.1, 0.3, -0.2, 0.35]. Use (i) binary sigmoidal and (ii) bipolar sigmoidal activation functions (6 marks)

OR

14. (a) (i) Construct a feed forward network with five input nodes, three hidden nodes and four output nodes.

(ii) Construct a recurrent network with four input nodes, three hidden nodes and two output nodes that has feedback links from the hidden layer to the input layer. (8 marks)

(b) Compare Supervised and Unsupervised Learning Methods. (6 marks)

15. (a) Using the inference approach, find the membership values for the fuzzy triangular shapes(i) isosceles triangle,(ii) equilateral triangle,(iii) right angle triangle,(iv) isosceles and right angle triangle (v) other triangles for a triangle with angles $45^0,55^0,80^0$ (10 marks)

(b) What are the different features of membership functions? (4 marks)

OR

16. (a) Explain different Defuzzification methods (8 marks)

(b) Describe Max-min composition and Max-product composition of Classical Relations

(6 marks)

17. (a) Define the following Aggregation of Fuzzy Rules

(i) Conjunctive system of rules (ii) Disjunctive system of rules (6 marks)

(b) Explain four modes of Fuzzy Approximate Reasoning (8 marks)

OR

18. (a) Compare Mamdani Fuzzy Interface System and Takagi-Sugeno Fuzzy Model

(8 marks)

(b) What is meant by compound rule? List the different methods used for decomposition of compound linguistic rules into simple canonical rules. (6 marks)

19. (a) Briefly explain the selection operation in genetic algorithm. (5 marks)

(b) Compare and contrast cooperative Neuro- fuzzy systems and hybrid Neuro-fuzzy systems. (9 marks)

OR

20. (a) Explain Two-Point Crossover. In a Genetic algorithm, suppose that two potential parents are given by

1	1	0	0	1	1	0	1	1	1
0	0	1	1	1	0	1	0	0	1

Assuming the numbering goes from left to right and that $\square_1$=4 and $\square_2$=8, show result of two point crossover

(6 marks)

(b) Describe Neuro Genetic Hybrid Systems (8 marks)

Syllabus

Module 1: Introduction to Soft Computing (5 Hours)
Evolution of Computing-From Conventional Artificial Intelligence to Computational Intelligence, Characteristics of Hard Computing and Soft Computing, Soft Computing Constituents, Applications of Soft Computing
Module 2: Artificial Neural Networks (7 Hours)
Biological Neuron, Artificial Neural Network Architectures: Single-Layer Feed Forward Network, Multi-Layer Feed Forward Network and Recurrent Network, Learning Methods: Supervised, Unsupervised and Reinforced Learning
Module 3: Fuzzy Logic (8 Hours)
Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Membership Functions, Fuzzification, Methods of Membership Value Assignments, Defuzzification Methods
Module 4: Fuzzy System (6 Hours)
Fuzzy Rules: Formation, Decomposition and Aggregation, Fuzzy Reasoning, Fuzzy Inference System: Mamdani Fuzzy System and Sugeno Fuzzy System
Module 5: Genetic Algorithm and Hybrid Systems (9 Hours)
Genetic Algorithm: Basic Version of Genetic Algorithm, Encoding Methods, Operators in Genetic Algorithm: Selection, Crossover and Mutation Hybrid Systems: Basic Concept, Neuro-Fuzzy Hybrid System, Neuro-Genetic Hybrid System and Fuzzy-Genetic Hybrid System

Text Books

1. S.N.Sivanandam , S.N.Deepa, Principles of Soft Computing, Wiley India Pvt. Ltd., 2nd Edition, 2011.
2. S.Rajasekaran, G.A.Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications , PHI Learning Pvt. Ltd., 2017.

Reference Books

1. James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003.
2. Jacek M. Zurada, Introduction to Artificial Neural Systems, PWS Publishers, 1992.
3. George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 1996.
4. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall, 1998.
5. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison Wesley,1997.
6. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to Soft Computing**	**5 Hours**
1.1	Evolution of Computing-From Conventional Artificial Intelligence to Computational Intelligence	2 Hours
1.2	Characteristics of Hard Computing and Soft Computing,	1 Hour
1.3	Soft Computing Constituents	1 Hour
1.4	Applications of Soft Computing	1 Hour
2	**Artificial Neural Networks**	**7 Hours**
2.1	Biological Neuron and Artificial Neural Network Concepts	1 Hour
2.2	Single-Layer and Multi-Layer Feed Forward Networks	2 Hours
2.3	Recurrent Network	1 Hour
2.4	Supervised Learning	1 Hour
2.5	Unsupervised Learning	1 Hour
2.6	Reinforced Learning	1 Hour
3	**Fuzzy Logic**	**8 Hours**
3.1	Fuzzy Sets and Operations on Fuzzy Sets	2 Hours
3.2	Fuzzy Relations and Operations on Fuzzy Relations	2 Hours
3.3	Fuzzy Membership Functions	2 Hours
3.4	Fuzzification and Methods of Membership Value Assignments	1 Hour
3.5	Defuzzification Methods	1 Hour
4	**Fuzzy System**	**6 Hours**
4.1	Fuzzy Rules: Formation, Decomposition and Aggregation	2 Hours
4.2	Fuzzy Reasoning	2 Hours
4.3	Fuzzy Inference System: Mamdani and Sugeno Fuzzy Systems	2 Hours
5	**Genetic Algorithm and Hybrid Systems**	**9 Hours**
5.1	Basic Version of Genetic Algorithm	1 Hour

5.2	Encoding Methods	1 Hour
5.3	Operators in Genetic Algorithm: Selection, Crossover and Mutation	3 Hours
5.4	Basic Concept of Hybrid Systems	1 Hour
5.5	Neuro-Fuzzy Hybrid System	1 Hour
5.6	Neuro-Genetic Hybrid System	1 Hour
5.7	Fuzzy-Genetic Hybrid System	1 Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT342	MICROPROCESSORS	PEC	2	1	0	3

Preamble: This course is intended to deliver students the concepts of Microprocessors and Micro-controllers. It also helps them to learn how to write an 8086 program assembly language. Introduction to Interfacing of micro-processors, its use and applications are also covered in the syllabus

Prerequisite:ITT204 Computer Organization

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	Explain different modes of operations of a typical microprocessor and microcontroller.	Level 2: Understand
CO 2	Develop assembly language programs for problem solving using software interrupts and various assembler directives.	Level 3: Apply
CO 3	Illustrate how to handle 8086 interrupts	Level2: Understand
CO 4	Identify interfacing of various I/O devices to the microprocessor through assembly language programming	Level 2: Understand
CO 5	Develop assembly language programs using 8051 microcontrollers.	Level 3: Apply

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	-	-	-	-	-	-	-	-	-	-	1
CO 2	3	3	3	-	2	-	-	-	-	-	-	2
CO 3	3	2	-	2	-	-	-	-	-	-	-	1
CO 4	3	3	3	2	3	-	-	-	3	2	3	3
CO 5	3	3	3	-	-	-	-	-	-	-	-	3

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 Marks
	Test 1(Marks)	Test2(Marks)	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	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. State the functionality of a finite state machine and the microprocessor.

2. List the microprocessors launched by various company.

3. Define the functionality of a microprocessor.

Course Outcome 2 (CO2)

1. Demonstrate the segment override instructions in x86

2. List the registers present in x86 microprocessors.

3. Define the functionality of a stack and stack pointer.

Course Outcome 3(CO3):

1. Illustrate that how to handle interrupts in x86 architecture.

2. Show the program for accessing a maskable interrupt in x86.

3. Discuss Interfacing with 8259.

Course Outcome 4 (CO4):

1. Explain the Interfacing and mode of operation of 8257 with 8086.

2.Outline theInterfacing 8253 with 8086.

3.Write a program to do LED display using 8279 with 8086.

Course Outcome 5 (CO5):

1.List criteria for Selecting a microcontroller for Applications.

2.Draw and explain 8051 Architecture

3.Explain Memory and I/O addressing with 8051

Model Question paper

Course Code: ITT342
Course Name: MICROPROCESSORS

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

PART A

(Answer all questions. Each question carries 3 Marks)

1.Compare microprocessor and microcomputer.

2.List the instructions which are used for memory operation in 8088 microprocessors.

3.Explain the purpose of the following signals in 8086.

(i) READY (ii) HOLD

4.Write a program to do data conversions from HEX to ASCII in 8086 assembly code.

5.Explain MOV, AAA, HLT instructions of 8086 Micro-processor.

6. Illustrate with an example how arrays are used in 8086.

7.Describe different modes of operation of the following peripheral ICs:

i) 8255 ii) 8257

8.Write the Control Word Format in 8255.

9.Write any three applications of microcontrollers.

10. Write short notes on memory and IO addressing of 8051 microcontrollers.

Part B

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

11.a) Draw the architectural diagram of 8086 microprocessor and explain. (8 marks)

b) Draw the pin diagram of 8086 micro-processor and explain the function of each pin. (6 marks)

OR

12. a) Compare 8086 and 8088 processors. (7 marks)

b) Explain 8086 Addressing mode (7 marks)

13.a) Write an 8086 program to perform linear search (8 marks)

b) An array of 10 numbers is stored in the internal data RAM starting from location 30 H. Write an assembly language program to sort the array in ascending order starting from location 40 H. (7 marks)

OR

14.a) Write an 8086 based assembly language program to perform addition of two 2x2 matrices. (7 marks)

b) Write an assembly program to add N numbers. (5 marks)

15.a) Explain multiple Interrupt handling. (6 marks)

b) Explain the architecture of programmable interrupt controller 8259. (8 marks)

OR

1. a) What are different types of Interrupts? What is Interrupt service Routine? (6 marks)

b) Draw the memory map and briefly explain the memory organization for 128-byte internal RAM of 8086 micro-controller. (8 marks)

2. a) Explain 8255 Interfacing (7 marks)

b) Explain modes of 8257 (7 marks)

OR

3. a). Explain Keyboard Display controller 8279. (7 marks)

b) Give the advantage of using 8279 for keyboard/display interface? What are scan lines used for? Explain (i) Encoded Scan Mode and (ii) Decoded scan mode. (7 marks)

19.(a) List out criteria for selecting a microcontroller for applications. (6 marks)

(b)Explain the interfacing of 8253 Timer using 8051 micro-controllers. (8 marks)

OR

21. (a) Explain the functions of ports in 8051 micro-controllers. How can P1 be used as both output and input port? (6 marks)

b) Discuss the addressing modes of 8051 Instruction set. (8 marks)

Syllabus

Module 1:Introduction to Microprocessors(6 Hours)
Evolution of microprocessors, 8086 Microprocessor – Architecture, Memory organisation, Minimum and maximum mode of operation, Minimum mode Timing Diagram. Comparison of 8086 and 8088, Pentium series -introduction to 8087 math coprocessors.8086 Addressing Modes.
Module 2: Instructions and Programming(8 Hours)
8086 Instruction set and Assembler Directives - Assembly Language Programming with Subroutines, Macros, Passing Parameters, Use of stack. Linking and Relocation - Stacks - Procedures – Timing and control unit, op-code fetch machine cycle, memory read/write machine cycles, I/O read/write machine cycles.
Module 3: Interrupt handling(6 Hours)
Interrupts:- Types of Interrupts and Interrupt Service Routine. Handling Interrupts in 8086, Interrupt programming. Handling multiple interrupts Basic Peripherals and their Interfacing with 8086 – Programmable Interrupt Controller - 8259 - Architecture.
Module 4: Interfacing(8 Hours)
Interfacing Memory, I/O, 8255 - Detailed study - Architecture, Control word format and modes of operation, Architecture and modes of operation of 8279 and 8257, programmable counter/interval timer (8253 and 8254)
Module 5: Microcontroller(7 Hours)
Microcontrollers - Types of Microcontrollers - Criteria for selecting a microcontroller - Example Applications. Characteristics and Resources of a microcontroller. Organization and design of these resources in a typical microcontroller - 8051. 8051 Architecture, Register Organization, Memory and I/O addressing, Interrupts and Stack.

Text Books

1.Muhammad Ali Mazidi,et.al,, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson Education, 2007

2. Barry B. Brey, The Intel Microprocessors – Architecture, Programming and Interfacing, Eighth Edition, Pearson Education, 2015

3. Douglas V. Hall, SSSP Rao, Microprocessors and Interfacing, Third Edition, McGrawHill Education, 2012.

Reference Books

1.Bhurchandi and Ray, Advanced Microprocessors and Peripherals, Third Edition McGraw Hill, 2012

2. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education, 2011.

3. A. NagoorKani, Microprocessors and Microcontrollers, Second Edition, Tata McGraw Hill, 2012.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to Microprocessors6 Hours**	
1.1	Evolution of microprocessors	1Hour
1.2	8086 Microprocessor – Architecture	1Hour
1.3	Memory organisation, Minimum and maximum mode of operation,	1Hour
1.4	Minimum mode Timing Diagram.	1(T)Hour
1.5	8086 Addressing Modes	1Hour
1.6	Comparison of 8086 , 8088 and Pentium series	1(T)Hour
2	**Instructions and Programming8 Hours**	
2.1	8086 Instruction set and Assembler Directives	2Hours
2.2	Assembly Language Programming with Subroutines, Macros, Passing Parameters	1Hour
2.3	Linking and Relocation - Stacks - Procedures	1Hour
2.4	Timing and control unit	1Hour
2.5	Op-code fetch machine cycle, memory read/write machine cycles, I/O read/write machine cycles,	2Hours
2.6	8086 Programming	1(T)Hour
3	**Interrupt handling6 Hours**	
3.1	Interrupts - Types of Interrupts and Interrupt Service Routine.	1Hour
3.2	Handling Interrupts in 8086,	1Hour
3.3	Handling multiple interrupts	1Hour

3.4	Basic Peripherals and their Interfacing with 8086	1Hour
3.5	Programmable Interrupt Controller - 8259 - Architecture.	1Hour
3.6	Interrupt programming.	1(T)Hour
4	**Interfacing8Hours**	
4.1	Interfacing Memory, I/O,	1Hour
4.2	8255 - Detailed study - Architecture	1Hour
4.3	Control word format and modes of operation	1Hour
4.4	Architecture and modes of operation of 8279	1Hour
4.5	Architecture and modes of operation of 8257	1Hour
4.6	Programmable counter/interval timer (8253 and 8254)	1Hour
4.7	Interfacing using Simulator	2(T)Hours
5	**Microcontroller7 Hours**	
5.1	Microcontrollers - Types of Microcontrollers - Criteria for selecting a microcontroller - Example Applications.	1Hour
5.2	Characteristics and Resources of a microcontroller. Organization and design of these resources in a typical microcontroller -8051	1 Hour
5.3	8051 Architecture, Register Organization,	2Hours
5.4	Memory and I/O addressing,	1Hour
5.5	Interrupts and Stack.	1Hour
5.6	Interfacing with Timer using simulator	1(T)Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT352	DISTRIBUTED SYSTEMS	PEC	2	1	0	3

Preamble: This course covers introductory concepts in the design and implementation of distributed systems. The course aims to cover all the fundamental and applied techniques in distributed systems ranging from various distributed architectural styles to consistency, replication and fault tolerance in distributed systems. It also covers design of computer clusters for scalable parallel computing.

Prerequisites:

- ITT201 Data Structures
- ITT305 Data Communication and Networking

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

CO No	Course Outcomes (CO)	Bloom's Category Level
CO 1	Discuss the characteristics and design goals of basic distributed systems.	Level 2: Understand
CO 2	Apply knowledge of distributed systems techniques and methodologies.	Level 3: Apply
CO 3	Explain the design and development of distributed systems and distributed systems applications.	Level 3: Understand
CO 4	Use the application of fundamental computer science methods and algorithms in the development of distributed systems and distributed systems applications.	Level 3: Apply
CO 5	Interpret the design and testing of a large software system, and to be able to communicate that design to others.	Level 3: Apply

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	2	-	-	-	-	-	-	-	-	-	2
CO 2	3	3	-	1	-	-	-	-	-	-	-	2
CO 3	3	3	2	1	-	-	-	-	-	-	-	2
CO 4	3	3	3	1	-	-	-	-	-	-	-	2
CO 5	3	3	3	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	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	10
Understand	20	20	40
Apply	20	20	50
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. Specify the characteristics of a distributed system.
2. What are the design objectives of computer clusters?

Course Outcome 2 (CO2):

1. Identify the major design issues of clustered and massively parallel processor system.
2. Differentiate and exemplify compact versus slack clusters.

Course Outcome 3(CO3):

1. Discuss about InfiniBand system fabric built in a typical high-performance computer cluster.
2. Give the organization of an internet search engine and explain the layers associated with it.

Course Outcome 4 (CO4):

1. With an example, explain how bully algorithm works.
2. Explain in detail checkpointing and recovery techniques used cluster systems?

Course Outcome 5 (CO5):

1. Specify the operate-repair cycle of a computer system.
2. Explain in detail how gossip-based publish-subscribe system handles subscriber queries.

Model Question paper

Course Code: ITT352
Course Name: Distributed Systems

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

PART A

(Answer all Questions. Each question carries 3 Marks)

1 What are the different forms of transparency in a distributed system?

2 What are the important role of wrappers?

3 Differentiate stateless and stateful serv(ers.

4 A major drawback of user level threads comes from deploying the many-to-one threading model. Explain.

5 Mention the properties of a true identifier.

6 What is the alternative technique used, when GPS is not an option?

7 Clarify the difference between consistency and coherence

8 What is the role of orphan process?

9 List the parts of a job management system.

10 Explain gang scheduling.

PART B

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

11.a. Illustrate a layered communication protocol stack?

OR

12.a With a neat diagram, explain the basic NFS architecture for unix system

13.a What is code migration? List the reasons for migrating code.

b. Explain how RPC achieves its transparency?

OR

14. What is virtualisation? Explain the different types of virtualisation based on the interfaces of a computer system.

15.a. Flat names are good for machines, but are generally not very convenient for humans to use. Explain the alternative human friendly way of naming system and the way these names are resolved to address.

b. How clock synchronisation happens in a wireless network?

OR

16.a. Explain attribute-based naming scheme.

b. With an example, explain how bully algorithm works.

17.a. Explain the three different types of replicas of content replication and placement

b. What is a dependable system? Mention the requirements of a distributed system for dependable.

OR

18.a. How client-centric consistency is implemented?

b. Give solution to reach reliable group communication.

19.a. Draw and explain the architecture of a computer cluster built with commodity hardware, software, middleware and network components supporting HA and SSI.

OR

20.a Explain the design principals of SSI.

Syllabus

Module 1: Introduction and Architectural style (5 Hours)
Introduction and Architectures – Characteristics – Design goals – Types of distributed systems - High performance distributed computing – Distributed information systems – Pervasive systems – Architectural styles – Middleware organization – System architecture – Centralized – Decentralized – Hybrid organizations - The Network File System.
Module 2: Processes & Communication (8 Hours)
Processes & Communication – Threads in distributed systems – Virtualization – Clients – Servers – code migration – Communication – layered protocols and types of communication – remote procedure call – Basic RPC operation – Parameter passing – RPC-based application support – Variations on RPC – Message-oriented communication – Simple transient messaging with sockets – Advanced transient messaging – Message-oriented persistent communication – multicast communication.
Module 3: Naming & Coordination (7 Hours)
Naming & Coordination – Names, identifiers, and addresses – Flat naming – Structured naming - Attribute-based naming – Coordination - Clock synchronization Logical clocks – Mutual exclusion - Election algorithms - Location systems
Module 4: Consistency, replication, and Fault tolerance (9 Hours)
Consistency, replication, and Fault tolerance – Reasons for replication - Replication as scaling techn**i**que - Data-centric consistency models - Client-centric consistency models - Replica management – Consistency protocols - Example: Caching and replication in the Web - Fault tolerance – Basic concepts - Failure models – Failure masking by redundancy - Process resilience – Resilience by process groups – Failure masking and replication – Consensus in faulty systems with crash failures – Example: Paxos – Consensus in faulty systems with arbitrary failures – limitations on realizing fault tolerance – Failure detection.
Module 5: Computer Clusters for Scalable Parallel Computing (6 Hours)
Computer Clusters for Scalable Parallel Computing – Clustering for Massive Parallelism – Computer Clusters and MPP Architectures – Design Principles of Computer Clusters – Cluster Job and Resource Management.

Text Books

1. Tanenbaum, Andrew S, Van. Steen, Maarten, " Distributed systems Principles and paradigms", Third Edition , Pearson, 2017.

2. Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra , "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things.", Morgan Kaufman, 2012.

References

1. Distributed Systems: Concepts and Design, G. Coulouris, Jean Dollimore and Tim Kindberg, Addison Wesley, 4th Edition
2. Principles of Computer System Design. Jerome Saltzer and M. Frans Kaashoek, Morgan Kaufmann.
3. Large-scale Incremental Processing Using Distributed Transactions and Notifications, Proceedings of the 9th USENIX Symposium on Operating Systems Design and Implementation, 2010
4. The Google File System, Proceedings of the 19th ACM Symposium on Operating Systems Principles, 2003
5. Vijay Garg, Elements of Distributed Computing, Wiley, 2002.
6. Nancy A. Lynch, Distributed Algorithms, Morgan Kaufmann, 1996.
7. Kurose and Ross, Computer Networking: A top-down approach, Pearson, 2013.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction and Architectural style**	**5 Hours**
1.1	Introduction and Types of distributed systems	2 Hours
1.2	Architectural styles	2 Hours
1.3	Middleware organization - System architecture	1 Hour
2	**Processes & Communication**	**8 Hours**
2.1	Threads in distributed systems and Virtuliazation	2 Hours
2.2	Clients – Servers - code migration	2 Hours
2.3	Remote procedure call	3 Hours
2.4	Message-oriented communication	1 Hour
3	**Naming & Coordination**	**7 Hours**
3.1	Naming types	1 Hour
3.2	Clock synchronization Logical clock	2 Hours
3.3	Election algorithms	3 Hours
3.4	Location systems	1 Hour

4	**Consistency, replication, and Fault tolerance**	**9 Hours**
4.1	Replication and consistency models	3 Hours
4.2	Replica management - Consistency protocols	3 Hours
4.3	Failure models and Process resilience	3 Hours
5	**Computer Clusters for Scalable Parallel Computing**	**6 Hours**
5.1	Clustering for Massive Parallelism, MPP architectures	2 Hours
5.2	Design Principles of Computer Clusters	2 Hours
5.3	Cluster Job and Resource Management .	2 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT362	DIGITAL IMAGE PROCESSING	PEC	2	1	0	3

Preamble: This course is intended to make the students capable of Understanding the fundamental concepts and applications of digital image Processing and methods for image segmentation and compression. They should also be able to perform various basic operations such as transforms, morphological operations and filters in digital image processing

Prerequisite: Basic understanding on signals and systems

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

CO No	Course outcomes (CO)	Bloom's Category Level
CO 1	Demonstrate the fundamentals of image processing such as representation of digital images, pixel relationships and representation of color images.	Level 2: Understand
CO 2	Apply various image transforms and different image compression techniques.	Level 3: Apply
CO 3	Summarize various methods for digital image enhancement in spatial domain.	Level 2: Understand
CO 4	Explain various methods for digital image enhancement in frequency domain.	Level 2: Understand
CO 5	Discuss the various methods for image segmentation and morphological operations in digital image processing.	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	2	2	-	-	-	-	-	-	2
CO 2	3	2	2	1	2	-	-	-	-	-	-	2
CO 3	3	2	2	2	-	-	-	-	-	-	-	2
CO 4	3	2	2	2	2	-	-	-	-	-	-	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 Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	20
Understand	30	30	60
Apply	10	10	20

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. Describe fundamentals of image representation

2. Discuss standards for representing colour images

3. Explain applications of image processing.

Course Outcome 2 (CO2)

1. Apply various image transforms

2. Compare lossy and lossless image compression

3. Compare techniques and standards for image compression

Course Outcome 3(CO3):

1. Compare various image transformation functions

2. Discuss the use of image transformation functions for image enhancement in spatial domain

3. Explain the basics of spatial filtering

Course Outcome 4 (CO4):

1. Differentiate various image enhancement methods in frequency domain

2. Differentiate smoothing and sharpening filters in frequency domain

3. Illustrate the concept of homomorphic filtering for image enhancement

Course Outcome 5 (CO5):

1. Discuss the concept of image segmentation

2. Explain various approaches for image segmentation

3. Discuss various morphological operations in digital image processing

Model Question paper

Course Code: ITT362

Course Name: DIGITAL IMAGE PROCESSING

Max.Marks:100
Duration: 3 Hours

PART A
Answer all Questions. Each question carries 3 Marks

1. Define m-adjacency
2. Explain RGB model for colour image representation
3. Compute the value of the underlined pixel after 5x5 median filter for the image [2 1 3 4 5 ; 1 1 4 2 3 ; 2 1 0 1 2 ; 5 1 4 3 1 ; 4 3 1 2 0]
4. Write mathematical equation for power law gray level transformations
5. Differentiate between ideal low pass and high pass filter in frequency domain
6. Describe the concept of homomorphic filtering for image enhancement
7. Explain Huffman coding with simple example.
8. Discuss about region growing based image segmentation.
9. Differentiate between dilation and erosion
10. Explain closing and opening morphological operations with suitable examples

Part B
Answer any one Question from each module. Each question carries 14 Marks

11. a) Explain the image formation model and briefly explain significance of sampling and quantization. 7 Marks

b) List and explain three areas in which digital image processing is widely used. 7 Marks

OR

12 a)With a neat block diagram, explain the fundamental steps in digital image processing. 6 Marks

b) Describe the terms i) brightness ii)contrast iii) hue iv) saturation 8 Marks

13. a) Define the 2D Walsh transform function and construct the Walsh basis matrix for N = 4 6 Marks

b) A file contains the following characters with the frequencies as shown. If Huffman Coding is used for data compression, determine-

1. Huffman Code for each character
2. Average code length
3. Length of Huffman encoded message (in bits)

characters	frequencies
A	10
E	15
I	12
O	3
U	4
S	13
T	1

8 Marks

OR

14 a) Explain JPEG image compression with help of a block schematic

7 marks

b) Compute the inverse 2D DFT of the transform coefficient given below 7 Marks

$$\begin{matrix} 16 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{matrix}$$

15. a) Explain the following methods of image enhancement in spatial domain.
i) Power Law Transformation.
ii) Gray level slicing 8 marks

b) Differentiate between linear and nonlinear spatial filter. 6 Marks

OR

16. a) Explain the various sharpening filters used in spatial domain. 7 marks

b) Explain the following grey level transformation functions
i) image negatives
ii) Log Transformation 7 Marks

17. a) Explain Butterworth filters for image smoothening and image sharpening. 7 Marks

b) Write short note on
(i) Averaging filter (ii) Weighted Averaging filter. 6 marks

OR

18. a)Describe about unsharp masking and highboost filtering in frequency domain. 7 Marks

b)What do you mean by histogram of an image? Explain about the histogram of basic image types. 8 Marks

19. a) Explain region split and merge technique for image segmentation 7 Marks

b) Write a short note on edge detection. 8 Marks

OR

20. a) Discuss the concept of boundary segments. 7 Marks

b) Define image gradient and explain its uses in edge detection. 7 Marks

Syllabus

Module 1: Introduction to Image processing (7 Hours)
Introduction to Image processing: Fundamental steps in image processing; Pixels; Image sampling and quantization; Representation of digital images; Basic relationship between pixels; Brightness, contrast, hue, saturation; Colour image fundamentals-RGB, CMY, HIS models; Applications of Image Processing
Module 2: Image transforms (7 Hours)
Image transforms - Discrete Fourier Transform; Discrete Cosine Transform; Walsh Transform; Hadamard Transform. Image compression –Fundamental concepts of image compression – Compression models. Lossless Compression – Huffman Coding, Run length coding. Lossy compression – Transform coding, JPEG standard
Module 3: Image Enhancement in spatial domain (7 Hours)
Image Enhancement in spatial domain: Basic Gray Level Transformation functions – Image Negatives; Log Transformations; Power-Law Transformations. Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Processing–Equalization. Basics of Spatial Filtering – Smoothing: Smoothing Linear Filters; Ordered Statistic Filters; Sharpening Filters: Laplacian
Module 4: Image Enhancement in Frequency Domain (7 Hours)
Image Enhancement in Frequency Domain: Basics of Filtering in Frequency Domain, Filters - Smoothing Frequency Domain Filters : Ideal Low Pass Filter; Butterworth Low Pass Filter; Sharpening Frequency Domain Filters: Ideal High Pass Filter; Butterworth High Pass Filter; Homomorphic Filtering.
Module 5 : Image Segmentation (7 Hours)
Image Segmentation: Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method; Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge, Edge Detection - Edge Operators. Morphological Operations, Basics of Set Theory; Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing;

Text Books

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing (English) 3rd Edition, Pearson India, 2013.

2. S Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Procesing, McGraw Hill Education , 2009.

Reference Books

1. A K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989

2. AlBovik, The Essential Guide to Image Processing, Academic Press, 2009

3. MilanSonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis, and Machine Vision, Thomson Learning, 2008.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to Image processing**	**7 Hours**
1.1	Fundamental steps in image processing	1 Hour
1.2	Pixels; Image sampling and quantization	1 Hour
1.3	Representation of digital images;	1 Hour
1.4	Basic relationship between pixels; Brightness, contrast, hue, saturation	2 Hours
1.5	Colour image fundamentals-RGB, CMY, HIS models	1 Hour
1.6	Applications of Image Processing	1 Hour
2	**Image transforms**	**7 Hours**
2.1	Discrete Fourier Transform, Discrete Cosine Transform;	1 Hour
2.2	Walsh Transform; Hadamard Transform	1 Hour
2.3	Image compression –Fundamental concepts of image compression	1 Hour
2.4	Compression models. Lossless Compression , Huffman Coding, Run length coding	2 Hours
2.5	Lossy compression – Transform coding	1 Hour
2.6	JPEG standard	1 Hour
3	**Image Enhancement in spatial domain**	**7 Hours**
3.1	Basic Gray Level Transformation functions – Image Negatives;	1 Hour
3.2	Log Transformations; Power-Law Transformations	1 Hour
3.3	Piecewise-Linear Transformation Functions, Contrast Stretching;	2 Hours
3.4	Histogram Processing–Equalization	1 Hour
3.5	Basics of Spatial Filtering – Smoothing, Smoothing Linear Filters; Ordered Statistic Filters, Sharpening Filters: Laplacian	2 Hours
4	**Image Enhancement in Frequency Domain**	**7 Hours**
4.1	Basics of Filtering in Frequency Domain	1 Hour
4.2	Filters -Smoothing Frequency Domain Filters	1 Hour
4.3	Ideal Low Pass Filter; Butterworth Low Pass Filter	1 Hour
4.4	Sharpening Frequency Domain Filters: Ideal High Pass Filter	2 Hours
4.5	Butterworth High Pass Filter	1 Hour

4.6	Homomorphic Filtering.	1 Hour
5	**Image Segmentation**	**7 Hours**
5.1	Pixel-Based Approach- Multi-Level Thresholding, Local Thresholding, Threshold Detection Method	1 Hour
5.2	Region-Based Approach- Region Growing Based Segmentation, Region Splitting, Region Merging, Split and Merge	2 Hours
5.3	Edge Detection - Edge Operators. Morphological Operations, Basics of Set Theory;	2Hours
5.4	Dilation and Erosion - Dilation, Erosion; Structuring Element; Opening and Closing;	2 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT372	SEMANTIC WEB	PEC	2	1	0	3

Preamble: This course is intended to make the students capable of understanding the limitations of today's web. Keyword-based search will be replaced by semantic query answering. It covers handling RDF Schema Language and Querying RDF document using SPARQL and developing the basic idea of OWL Language.

Prerequisite: ITT301 Web application Development

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

CO No.	Course Outcome	Bloom's Category Level
CO 1	Demonstrate the concepts of semantic web technologies and semantic web architecture	Level 2: Understand
CO 2	Explain the use of XML in Semantic Web	Level 2: Understand
CO 3	Discuss RDF and OWL Languages.	Level 2: Understand
CO 4	Interpret Logic and Inference	Level 3: Apply
CO 5	Develop applications of semantic web and make use of the concepts of ontology engineering .	Level 3: Apply

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	1	2	2	3	2	1	-	-	1	-	-	2
CO 2	2	2	1	1	2	2	-	-	1	-	-	-
CO 3	1	2	1	2	3	1	-	-	-	2	-	-
CO 4	2	2	1	3	1	2	-	2	-	-	-	-
CO 5	2	3	1	2	1	2	1	-	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 Marks
	Test 1 (Marks)	Test 2(Marks)	
Remember	5	5	10
Understand	30	30	60
Apply	15	15	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 Semantic Web.

2. Describe about Software Agents?

3. Explain about semantic web layers?

Course Outcome 2 (CO2):

1. What is a Statement in RDF?
2. Explain Core Classes and Core Properties in RDF.
3. State the Reification in Statements?

Course Outcome 3(CO3):

1. Describe in detail about OWL Full, OWL DL, and OWL Lite.
2. Define Thing Class and Nothing Class in OWL.
3. Explain the concept of OWL DLP with Diagram.

Course Outcome 4 (CO4):

1. State Defeasible rules and Competing Rules.
2. Explain the importance of Logic.
3. Describe about First-Order Interpretation of Goals in Monotonic Rules. Also explain Parameterized Witnesses and Ground Witnesses.

Course Outcome 5 (CO5):

1. State the Elsevier Problem? Explain the contribution of Semantic web Technology in Elsevier Problem.
2. Describe about Main stages in Ontology Development.
3. Explain about Ontology Mapping.

Model Question paper

Course Code: ITT372
Course Name: SEMANTIC WEB

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all Questions. Each question carries 3 Marks)

1. State the Problems of Keyword Based Search Engines
2. What is an XML Prolog?
3. Explain Resource, Properties in RDF with Example.
4. What is a Statement in RDF?
5. Write notes on Meta Classes.
6. Describe about OWL DL
7. Write notes on SWRL
8. Define Variables, Constants, Predicates and Function Symbols with Example.
9. Restate about Elseveir Problem.
10. List out the points of DAML-S and OWL-S.

Part B

(Answer all Questions. Each question carries 14 marks)

11 a) Explain about Semantic Layers with neat Diagram. (7 Marks)

b) Explain about Semantic Web Technologies. (7Marks)

OR

12. a) Write the Examples of Semantic Web. (7 Marks)

b) Describe about Structuring of XML Document this using XML Schema (7 Marks)

13.a) Describe in detail about OWL Full, OWL DL, and OWL Lite. (6 Marks)

b) Explain about Querying in SPARQL. (8 Marks)

OR

14. a) Summarize the Constraints of axiomatic semantics for RDF and RDF Schema (7 Marks)

b) Write the RDF Schema of "Lecturer is a subclass of Academic Staff Member. (7 Marks)

15. a) Explain three Sublanguages of OWL (7 Marks)

b) Describe about the Requirements of Ontology Languages? (7 Marks)

OR

16. a) State Defeasible rules and Competing Rules (6 Marks)

b) Explain the two kinds of Properties in OWL with Example. (8 Marks)

17 a) Explain about the Semantics of Monotonic Rules (7 Marks)

b) Explain about Description Logic Programs. (7 Marks)

OR

18 a) How would you apply Priorities are used to resolve some conflicts between

19 Non-Monotonic Rules? (7 Marks)

b) Describe about First-Order Interpretation of Goals in Monotonic Rules. Also explain Parameterized Witnesses and Ground Witnesses. (7 Marks)

20 a) What is Elsevier Problem? How would you solve this Problem by using Semantic Web Technology? (6 Marks)

b) Discuss about main stages of ontology development. (8 Marks)

OR

21 a) Explain the contribution of Semantic Web Technology in E-Learning.(7 Marks)

b) Restate about the four Sub ontologies of OWL-S Ontology. (7 Marks)

Syllabus

Module 1: Introduction and Semantic Web Technologies (8 Hours)
The Semantic Web Vision, Today's Web, From Today's Web to the SemanticWeb: Examples, Semantic Web Technologies, A Layered Approach, Structured Web Document in XML, The XML Language, Structuring, Namespace.
Module 2: RDF Schema Language (6 Hours)
Describing Web Documents in RDF, RDF: XML-Based Syntax,RDF Schema, An Axiomatic Semantics for RDF and RDF Schema, Querying in RQL
Module 3: Web Ontology Language(OWL)(6 Hours)
Web Ontology Language(OWL), Examples, OWL in OWL, Future Extensions
Module 4: Logic and Inference (6 Hours)
Logic and Inference:Rules , Example of Monotonic Rules: Family Relationships , Monotonic Rules Syntax and Semantics, Nonmonotonic Rules: Motivation, Syntax and Example, Rule .Markup in XML
Module 5: Applications and Ontology Engineering(9 Hours)
Applications: Horizontal Information Products at Elsevier, e-Learning, WebServices **Ontology Engineering:** Constructing Ontologies Manually, Reusing ExistingOntologies, Ontology Mapping, On-To- Knowledge Semantic Web Architecture

Text Books

1. Grigoris Antoniou, Frank Van Harmelon, "A Semantic Web Primer", Second Edition , The MITPress.
2. J. Davies, D. Fensel, and F. van Harmelen. Towards the Semantic Web:Ontology-Driven Knowledge Management, New York, Wiley, 2003.

Reference Books

1. Natalya. F. Noy and Deborah L. McGuinness, Ontology Development 101: AGuide to Creating Your First Ontology, http://protege.stanford.edu/publications/ontology_development/ontology101.pd

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction and Semantic Web Technologies**	**8 Hours**
1.1	From Today's Web to the Semantic Web	2 hours
1.2	The Semantic Web Impact	3 hours
1.3	Semantic Web Technologies	3 hours
2	**RDF Schema Language**	**6 Hours**
2.1	XML Basics	2 hours
2.2	RDF Schema Language	2 hours
2.3	An Axiomatic Semantics for RDF and RDF Schema	2 hours
3	**Web Ontology Language(OWL)**	**6 Hours**
3.1	Examples of OWL	1 hours
3.2	OWL Sublanguages	3 hours
3.3	OWL in OWL	2 hours
4	**Logic and Inference**	**6 Hours**
4.1	Monotonic Rules	2 hours
4.2	Non Monotonic Rules	3 hours
4.3	Rule Markup in XML	1 hours
5	**Applications and Ontology Engineering**	**9 Hours**
5.1	Elsevier, e-Learning, Web Services	4 hours
5.2	Constructing Ontologies Manually	3 hours
5.3	Reusing Existing Ontologies	2 hours

HUT 300	Industrial Economics & Foreign Trade	Category	L	T	P	CREDIT
		HSMC	3	0	0	3

Preamble: To equip the students to take industrial decisions and to create awareness of economic environment.

Prerequisite: Nil

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

CO1	Explain the problem of scarcity of resources and consumer behaviour, and to evaluate the impact of government policies on the general economic welfare. (Cognitive knowledge level: **Understand**)
CO2	Take appropriate decisions regarding volume of output and to evaluate the social cost of production. (Cognitive knowledge level: **Apply**)
CO3	Determine the functional requirement of a firm under various competitive conditions. (Cognitive knowledge level: **Analyse**)
CO4	Examine the overall performance of the economy, and the regulation of economic fluctuations and its impact on various sections in the society. (Cognitive knowledge level: **Analyse**)
CO5	Determine the impact of changes in global economic policies on the business opportunities of a firm. (Cognitive knowledge level: **Analyse**)

Mapping of course outcomes with program outcomes

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

CO4	2	2	1			1					3	
CO5	2	2	1								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	Lifelong learning

Assessment Pattern

Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination Marks**
	Test 1 (Marks)	**Test 2 (Marks)**	
Remember	**15**	**15**	**30**
Understand	**20**	**20**	**40**
Apply	**15**	**15**	**30**

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 (2 numbers)	: 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	: 30 marks
Part B	: 70 marks

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 3 sub-divisions and carries 14 marks.

SYLLABUS

HUT 300 Industrial Economics & Foreign Trade

Module 1 (Basic Concepts and Demand and Supply Analysis)

Scarcity and choice - Basic economic problems- PPC – Firms and its objectives – types of firms – Utility – Law of diminishing marginal utility – Demand and its determinants – law of demand – elasticity of demand – measurement of elasticity and its applications – Supply, law of supply and determinants of supply – Equilibrium – Changes in demand and supply and its effects – Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.

Module 2 (Production and cost)

Production function – law of variable proportion – economies of scale – internal and external economies – Isoquants, isocost line and producer's equilibrium – Expansion path – Technical progress and its implications – Cobb-Douglas production function - Cost concepts – Social cost: private cost and external cost – Explicit and implicit cost – sunk cost - Short run cost curves - long run cost curves – Revenue (concepts) – Shutdown point – Break-even point.

Module 3 (Market Structure)

Perfect and imperfect competition – monopoly, regulation of monopoly, monopolistic completion (features and equilibrium of a firm) – oligopoly – Kinked demand curve – Collusive oligopoly (meaning) – Non-price competition – Product pricing – Cost plus pricing – Target return pricing – Penetration pricing – Predatory pricing – Going rate pricing – Price skimming.

Module 4 (Macroeconomic concepts)

Circular flow of economic activities – Stock and flow – Final goods and intermediate goods - Gross Domestic Product - National Income – Three sectors of an economy- Methods of

measuring national income – Inflation- causes and effects – Measures to control inflation- Monetary and fiscal policies – Business financing- Bonds and shares -Money market and Capital market – Stock market – Demat account and Trading account - SENSEX and NIFTY.

Module 5 (International Trade)

Advantages and disadvantages of international trade - Absolute and Comparative advantage theory - Heckscher - Ohlin theory - Balance of payments – Components – Balance of Payments deficit and devaluation – Trade policy – Free trade versus protection – Tariff and non-tariff barriers.

Reference Materials

1. Gregory N Mankiw, 'Principles of Micro Economics', Cengage Publications
2. Gregory N Mankiw, 'Principles of Macro Economics', Cengage Publications
3. Dwivedi D N, 'Macro Economics', Tata McGraw Hill, New Delhi.
4. Mithani D M, 'Managerial Economics', Himalaya Publishing House, Mumbai.
5. Francis Cherunilam, 'International Economics', McGraw Hill, New Delhi.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Why does the problem of choice arise?
2. What are the central problems?
3. How do we solve the basic economic problems?
4. What is the relation between price and demand?
5. Explain deadweight loss due to the imposition of a tax.

Course Outcome 2 (CO2):

1. What is shutdown point?
2. What do you mean by producer equilibrium?
3. Explain break-even point;
4. Suppose a chemical factory is functioning in a residential area. What are the external costs?

Course Outcome 3 (CO3):

1. Explain the equilibrium of a firm under monopolistic competition.
2. Why is a monopolist called price maker?
3. What are the methods of non-price competition under oligopoly?
4. What is collusive oligopoly?

Course Outcome 4 (CO4):

1. What is the significance of national income estimation?
2. How is GDP estimated?
3. What are the measures to control inflation?
4. How does inflation affect fixed income group and wage earners?

Course Outcome 5 (CO5):

1. What is devaluation?
2. Suppose a foreign country imposes a tariff on Indian goods. How does it affect India's exports?
3. What is free trade?
4. What are the arguments in favour of protection?

Model Question paper

QP CODE: **PAGES:3**

Reg No:_____ **Name :_____**

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: HUT 300

Course Name: Industrial Economics & Foreign Trade

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

PART A

Answer all Questions. Each question carries 3 Marks

1. Why does an economic problem arise?

2. What should be the percentage change in price of a product if the sale is to be increased by 50 percent and its price elasticity of demand is 2?

3. In the production function $Q= 2L^{1/2}K^{1/2}$ if L=36 how many units of capital are needed to produce 60 units of output?

4. Suppose in the short run AVC 4. Suppose in the short run AVC<P<AC. Will this firm produce or shut down? Give reason.

5. What is predatory pricing?

6. What do you mean by non- price competition under oligopoly?

7. What are the important economic activities under primary sector?

8. Distinguish between a bond and share?

9. What are the major components of balance of payments?

10. What is devaluation? **(10 x 3 = 30 marks)**

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Prepare a utility schedule showing units of consumption, total utility and marginal utility, and explain the law of diminishing marginal utility. Point out any three limitations of the law.

    b) How is elasticity of demand measured according to the percentage method? How is the measurement of elasticity of demand useful for the government?

Or

12. a) Explain the concepts consumer surplus and producer surplus.

    b) Suppose the government imposes a tax on a commodity where the tax burden met by the consumers. Draw a diagram and explain dead weight loss. Mark consumer surplus, producer surplus, tax revenue and dead weight loss in the diagram.

MODULE II

13. a) What are the advantages of large-scale production?

    b) Explain Producer equilibrium with the help of isoquants and isocost line. What is expansion path?

Or

14. a) Explain break-even analysis with the help of a diagram.

b) Suppose the monthly fixed cost of a firm is Rs. 40000 and its monthly total variable cost is Rs. 60000.

i. If the monthly sales is Rs. 120000 estimate contribution and break-even sales.
ii. If the firm wants to get a monthly profit of Rs.40000, what should be the sales?

c) The total cost function of a firm is given as $TC=100+50Q - 11Q^2+Q^3$. Find marginal cost when output equals 5 units.

MODULE III

15. a) What are the features of monopolistic competition?

b) Explain the equilibrium of a firm earning supernormal profit under monopolistic competition.

Or

16.a) Make comparison between perfect competition and monopoly.

b) Explain price rigidity under oligopoly with the help of a kinked demand curve.

MODULE IV

17. a) How is national income estimated under product method and expenditure method?

b) Estimate GDPmp, GNPmp and National income

Private consumption expenditure	= 2000 (in 000 cores)
Government Consumption	= 500
NFIA	= -(300)
Investment	= 800
Net=exports	=700
Depreciation	= 400
Net-indirect tax	= 300

Or

18. a) What are the monetary and fiscal policy measures to control inflation?

    b) What is SENSEX?

MODULE V

19. a) What are the advantages of disadvantages of foreign trade?

    b) Explain the comparative cost advantage.

Or

20. a) What are the arguments in favour protection?

    b) Examine the tariff and non-tariff barriers to international trade.

(5 × 14 = 70 marks)

Teaching Plan

Module 1 (Basic concepts and Demand and Supply Analysis)		**7 Hours**
1.1	Scarcity and choice – Basic economic problems - PPC	1 Hour
1.2	Firms and its objectives – types of firms	1 Hour
1.3	Utility – Law of diminishing marginal utility – Demand – law of demand	1 Hour
1.4	Measurement of elasticity and its applications	1 Hour
1.5	Supply, law of supply and determinants of supply	1 Hour
1.6	Equilibrium – changes in demand and supply and its effects	1 Hour
1.7	Consumer surplus and producer surplus (Concepts) – Taxation and deadweight loss.	1 Hour
Module 2 (Production and cost)		**7 Hours**
2.1	Productions function – law of variable proportion	1 Hour
2.2	Economies of scale – internal and external economies	1 Hour
2.3	producers equilibrium – Expansion path	1 Hour
2.4	Technical progress and its implications – cob Douglas Production function	1 Hour
2.5	Cost concepts – social cost: private cost and external cost – Explicit and implicit cost – sunk cost	1 Hour
2.6	Short run cost curves & Long run cost curves	1 Hour
2.7	Revenue (concepts) – shutdown point – Break-even point.	1 Hour
	Module 3 (Market Structure)	**6 hours**
3.1	Equilibrium of a firm, MC – MR approach and TC – TR approach	1 Hour
3.2	Perfect competition & Imperfect competition	1 Hour
3.3	Monopoly **–** Regulation of monopoly **–** Monopolistic competition	1 Hour
3.4	Oligopoly – kinked demand curve	1 Hour
3.5	Collusive oligopoly (meaning) – Non price competition	1 Hour
3.6	Cost plus pricing – Target return pricing – Penetration, Predatory pricing – Going rate pricing – price skimming	1 Hour

Module 4 (Macroeconomic concepts)		**7 Hours**
4.1	Circular flow of economic activities	1 Hour
4.2	Stock and flow – Final goods and intermediate goods – Gross Domestic Product - National income – Three sectors of an economy	1 Hour
4.3	Methods of measuring national income	1 Hour
4.4	Inflation – Demand pull and cost push – Causes and effects	1 Hour
4.5	Measures to control inflation – Monetary and fiscal policies	1 Hour
4.6	Business financing – Bonds and shares – Money market and capital market	1 Hour
4.7	Stock market – Demat account and Trading account – SENSEX and NIFTY	1 Hour
Module 5 (International Trade)		**8 Hours**
5.1	Advantages and disadvantages of international trade	1 Hour
5.2	Absolute and comparative advantage theory	2 Hour
5.3	Heckscher – Ohlin theory	1 Hour
5.4	Balance of payments – components	1 Hour
5.5	Balance of payments deficit and devaluation	1 Hour
5.6	Trade policy – Free trade versus protection	1 Hour
5.7	Tariff and non tariff barriers.	1 Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT308	COMPREHENSIVE COURSE WORK	PCC	1	0	0	1

Preamble: The course Comprehensive Course work is designed to assess the knowledge gained by the students in the core courses in the B Tech programme in Information Technology. The core subjects identified in the area of study is listed in the Prerequisite section of the syllabus. The course shall have an objective type written test of 50 marks similar to comprehensive examination like GATE. The pass minimum for this course is 25. The course will help the students in preparing for comprehensive examinations and improve the confidence in answering questions in objective mode. The course will be mapped to a faculty. The hour allotted for the course may be used by the students for practicing questions in core courses, library reading and for oral assessment if needed.

Prerequisite:

The students must have gone through the following courses before attending the comprehensive examination.

1. ITT 201 Data Structures
2. ITT 202 Principles of Object Oriented Techniques
3. ITT 206 Database Management Systems
4. ITT 303 Operating System Concepts
5. ITT 305 Data Communication and Networking

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	Explain the core concepts in the courses listed in the prerequisite section (ITT 201, ITT 202, ITT 206, ITT 303, ITT 305).	Level2: Understand
CO 2	Interpret questions asked and answer them withconfidence	Level 2: Understand
CO 3	Practice the comprehensive knowledge gained in basic courses in the field of Information Technology to build confidence for appearing for a competitive examination	Level 3: Apply

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	-	-	2	-	-	1	-	-	1	-	3
CO 2	3	-	-	2	-	-	1	-	-	1	-	3
CO 3	3	1	1	-	-	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	CIE	ESE	ESE Duration
50	-	50	1 Hour

End Semester Examination Pattern:

Written examination will be conducted by theUniversity atthe end of the sixth semester. The written examination will be of objective type similar to the competitive examination like GATE.Syllabus for the comprehensive examination consists of 5 modules based on following five core courses in the curriculum.

1. ITT 201 Data Structures
2. ITT 202 Principles of Object Oriented Techniques
3. ITT 206 Database Management Systems
4. ITT 303 Operating System Concepts
5. ITT 305 Data Communication and Networking

The written test will be of 50 marks with 50 multiple choice questions (10 questions from each module) with 4 choices of 1 mark each covering all the five core courses. There will be no negative marking. The pass minimum for this course is 25. The course should be mapped with a faculty and classes shall be arranged for practicing questions based on the core courses listed above.

Written examination : 50marks

Total : 50 marks

Course Level Assessment and Sample Questions:

1. Consider the following sequence of operations and Find the value of S + R =?

Stack	Queue
push (52);	enqueue (43);
push (56);	enqueue (24);
pop ();	dequeue ();
push (62);	enqueue (57);
S = pop ()	R = Dequeue ()

A. 75

B. 86

C. 119

D. None of the above

2. Consider the following statements.

S1: The sequence of procedure calls corresponds to a preorder traversal of the activation tree.

S2: The sequence of procedure returns corresponds to a postorder traversal of the activation tree.

Which one of the following options is correct?

A. S1 is true and S2 is false

B. S1 is false and S2 is true

C. S1 is true and S2 is true

D. S1 is false and S2 is false

3. A full binary tree with n non-leaf nodes contains

A. $\log_2 n$ nodes

B. n+1 nodes

C. 2n nodes

D. 2n+1 nodes

4. Which one of the following are essential features of an object-oriented programming language?

(i) Abstraction and encapsulation

(ii) Strictly-typedness

(iii) Type-safe property coupled with sub-type rule

(iv) Polymorphism in the presence of inheritance

A. (i) and (ii) only

B. (i) and (iv) only

C. (i), (ii) and (iv) only

D. (i), (iii) and (iv) only

8. Which of the following is associated with objects?

A. State

B. Behavior

C. Identity

D. All of the above

9. Consider the following two statements:

S1: A publicly derived class is a subtype of its base class.

S2: Inheritance provides for code reuse.

A. Both the statements S1 and S2 are correct.

B. Neither of the statements S1 and S2 are correct

C. Statement S1 is correct and S2 is incorrect

D. Statement S1 is incorrect and S2 is correct.

10. Consider the following statements S1 and S2 about the relational data model S1 : A Relation schema can have at most one foreign key

S2 : A foreign key in a relational schema R cannot be used to refer to tuples of R

Which of the following choices is correct?

A. Both S1 and S2 are true

B. S1 is true and S2 is false

C. S1 is false and S2 is true

D. Both S1 and S2 are false

11. Which among the following is false?

A. A relation scheme can be in Third Normal Form but not in BCNF

B. Every BCNF relation scheme is in Third Normal Form.

C. BCNF provides freedom from insertion and deletion anomalies.

D. If a relation scheme has partial dependencies, it is in Second Normal Form.

12. Consider following schedules involving three transactions:

S1 : R2(A); W2(A); R3(C); W2(B); W3(A); W3(C); R1(A); R1(B); W1(A); W1(B)

S2 : R2(A); R3(C); W3(A); W2(A); W2(B); W3(C); R1(A); R1(B); W1(A); W1(B)

S3: R1(A); R2(A); R3(B); W1(A); R2(C); R2(B); W2(B); W1(C)

Which of the above schedules is/are NOT conflict serializable?

A. Only S2

B. S1 and S3

C. Only S3

D. S2 and S3

13. Which of the following statement(s) is/are correct in the context of CPU scheduling?

A. Turnaround time includes waiting time

B. The goal is to only maximize CPU utilization and minimum throughput

C. Round-robin policy can be used even when the CPU time required by each of the processes is not known apriori

D. Implementing preemptive scheduling needs hardware support

14. Consider the following statements about process state transitions for a system using preemptive scheduling.

I. A running process can move to ready state.

II. A ready process can move to running state.

III. A blocked process can move to running state.

IV. A blocked process can move to ready state.

Which of the above statements are TRUE ?

A. I, II, and III only

B. II and III only

C. I, II, and IV only

D. I, II, III and IV only

15. Consider the statements S1 to S4

S1: Paging incurred memory overhead

S2 : Multilevel paging is necessary for pages with different size

S3 : Page size has no impact on internal fragmentation.

S4 : Paging help solve the issue of external fragmentation

Which of the above statement(s) are true? Select the appropriate options among the following.

A. S1 and S2

B. S1 and S4

C. S3 and S4

D. S3 only

16. Ten signals, each requiring 3 KHz, are multiplexed on to a single channel using FDM. How much minimum bandwidth is required for the multiplexed channel? Assume that the guard bands are 200 Hz wide.

A. 30,000 Hz

B. 31,800 Hz

C. 32,000 Hz

D. None of the above

17. In an IPv4 packet, the value of HLEN is 15, and the value of the total length field is 0X0064. How many bytes of data are being carried by this packet?

    A. 85 bytes

    B. 49 bytes

    C. 40 bytes

    D. 20 bytes

18. Consider the three-way handshake mechanism followed during TCP connection establishment between hosts P and Q. Let X and Y be two random 32 bit initial sequence numbers chosen by P and Q respectively. Suppose P sends a TCP connection request message to Q with a TCP segment having SYN bit = 1, SEQ number = X and ACK bit = 0. Suppose Q accepts the connection request. Which of the following choices represents the information Present in the TCP segment header that is sent by Q to P?

    A. SYN bit =1, SEQ number = X+1, ACK bit = 0, ACK number = Y, FIN bit = 0

    B. SYN bit =0, SEQ number = X+1, ACK bit = 0, ACK number = Y, FIN bit = 1

    C. SYN bit =1, SEQ number = Y, ACK bit = 1, ACK number = X+1, FIN bit = 0

    D. SYN bit =1, SEQ number = Y, ACK bit = 1, ACK number = X, FIN bit = 0

Syllabus

Module 1: Data Structures
Data Structures-Introduction and Overview- **Arrays**- Searching and Sorting, **Linked lists** - singly linked list, Doubly linked list, Circular linked list, **Stack**, Applications of stacks, **Queue**, **Trees -** Binary Tree, Binary Tree Traversals, **Graph**, **Hash Tables**- closed hashing and Open Hashing
Module 2: Principles of Object Oriented Techniques
The Object-Oriented Approach – Characteristics of Object-Oriented Languages - Objects & Classes – Inheritance – Reusability - Creating New Data Types - Polymorphism and Overloading - Classes fundamentals, objects, methods, constructors, Overloading Methods, Overloading Constructors, Derived Class and Base Class, Usage of super keyword, Creating a Multilevel Hierarchy, Method Overriding, Using Abstract Classes, **Exception handling**- Exception Types, Using try and catch in Java, Java's Built-in Exceptions, Creating

Exception subclasses, the Java Thread Model, Event Handling-delegation event model,.
Module 3: Database Management Systems
Fundamentals of Database Management Systems (DBMS), Database System Architecture, **Entity-Relationship Model**-ER Diagrams, **Relational Model**- Relational Schema, Relational Algebra Operations, **SQL**, **Normalization**, **Transaction Processing**-Concurrency Control
Module 4: Operating System Concepts
Operating Systems- types, System kernel, Shell, **Processes**- . Process Scheduling methods, Inter process Communication,**CPU scheduling** -scheduling algorithms,**Dead locks** - conditions for deadlock, prevention, avoidance, detection, recovery from dead lock, resource trajectories –starvation,**Memory management** -fixed &variable partitions, paging & segmentation - virtual memory concepts - demand paging - page replacement - Disk scheduling, **File system concepts**
Module 5: Data Communication and Networking
Channel capacity, **Transmission media**- Synchronous and Asynchronous transmission, **Sampling theorem**, **Data Encoding** -Encoding digital data into digital signal, Encoding analog data into digital signals, **Multiplexing**, **Error Detecting and correcting codes** , **Concept of layering -** OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; **Data link layer-** framing, error detection, Medium Access Control, **Routing protocols -** shortest path, flooding, distance vector and link state routing; **IP addressing & fragmentation** - IPv4, CIDR notation, **IP support protocols** -ARP, DHCP, ICMP, Network Address Translation (NAT); **Transport layer**- flow control and congestion control, UDP, TCP, **Application layer protocols -** DNS, HTTP, Email.

Reference Books

1. Samanta D., Classic Data Structures, Prentice Hall India, 2/e, 2009.
2. Ellis horowitz, Sartaj Sahni, Fundamentals of Data structures, GalgotiaBooksource
3. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
4. Bahrami A., Object Oriented Systems Development using the Unified Modeling Language, McGraw Hill, 1999.
5. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.
6. Silberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.
7. William Stallings, Operating Systems,6th Edition,Pearson,2009
8. Andrew S. Tanenbaum, “Modern Operating Systems”, 3/e, Prentice Hall

9. J. L. Peterson and A. Silberschatz , Operating System Concepts, 8/e, Addison Wesley.
10. Behrouz A. Forouzan, Data Communications and Networking, 4/e, Tata McGraw Hill.
11. William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.
12. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4/e, Mc Graw Hill

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL332	COMPUTER NETWORKS LAB	PCC	0	0	3	2

Preamble: The course aims to equip students to perform networking using IPv4 and Ipv6. The lab covers static, default, and dynamic routing, setting up layer 2 switching, VLANs and security and access list.

Prerequisite:ITT305 Data Communication and Networking

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	Demonstrate internetworking and network components	Level 2: Understand
CO 2	Explain IPv4 addressing, IPv6 addressing, subnetting and design networks	Level 2: Understand
CO 3	Experiment with static, dynamic and inter VLAN routing	Level 3: Apply
CO 4	Make use of standard and extended access lists	Level 3: Apply
CO 5	Use Webserver, remote login, file transfer and automatic network configuration protocols	Level 3: Apply
CO 6	Use network simulators	Level 3: Apply

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	1	-	-	2	-	-	-	-	-	-	1
CO 2	3	3	3	-	-	-	-	-	-	-	-	2
CO 3	3	3	-	-	2	-	-	-	-	-	-	2
CO 4	3	3	3	-	2	-	-	-	-	-	-	2
CO 5	3	2	-	-	-	-	-	-	-	-	-	2
CO 6	3	1	2	-	3	-	-	-	-	-	-	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	CIE	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 : 15Marks
(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.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Differentiate between a router and a switch
2. Crimp a network cable

Course Outcome 2 (CO2)

1. An IP address of 172.16.0.0/16 is assigned to an ISP. The ISP has to distribute it among 17 organizations. Design the subnets
2. You are given the IP Address of 193.103.20.0 /24 and need 50 Subnets. How many hosts per network, and total networks do you get once sub netted?

Course Outcome 3(CO3):

1. An organization with 7 departments is assigned an IP address of 200.0.0.0/24. The organization should assign address to each department. Design the subnets and connect the first and third network using RIP
2. Subnet the Class B IP Address 130.13.0.0 into 500 Subnets. What is the new Subnet Mask and what is the Increment? Connect the 6^{th} and 15^{th} Subnet using static routing

Course Outcome 4 (CO4):

1. Connect hosts on the networks 17.10.0.0/8 and 168.18.0.0/16 and block FTP traffic from the first network to the second network

Course Outcome 5 (CO5):

1. Install and configure any popular webserver
2. Configure TELNET, login to a remote machine and view the files on the remote machine
3. Configure FTP and transfer files between two machines

Course Outcome 6 (CO6):

1. Implement a mesh network in NS3 network simulator. Perform RIP routing between the nodes in the network. Analyse the packet transfer between the nodes.

LIST OF EXPERIMENTS

(All the listed experiments are mandatory)

I. Internetworking Basics

1. Familiarization of Internetworking - Network Cables- Colour coding - Crimping. Internetworking Operating Systems- Configurations.
2. Backing up and restoring IoS
3. Familiarization of network components – Hub, Switch, Bridge, Router, Access Point

II. Addressing

1. Configure and verify IPv4 addressing and sub netting
2. Configure and verify IPv6 addressing and prefix
3. Compare IPv6 address types

III. IP Routing

1. Configure and verify IPv4 routing
    a. Static Routing
    b. Dynamic Routing – RIP, OSPF, EIGRP
2. Implement Unicast IPv6 Addresses on Routers and verify
    a. Static routing
    b. Dynamic routing – RIPng, OSPFv3
3. Configure and verify dual stack routing

IV. Switching Concepts

1. Layer 2 Switching Configuration – VLAN Configuration
2. VTP Configuration, VTP Pruning
3. Implement inter-VLAN routing

V. Configuring Protocols

1. HTTP
2. TELNET

3. FTP
4. DHCP

VI. Security

1. Standard Access List
2. Extended Access List
3. Familiarization of Wireshark

VII. Network Simulators

1. Familiarize with any popular network simulator

Reference Books

1. CCNA 200-301 Official Cert Guide, Volume 1,Wendell Odom, Cisco Press
2. CCNA –Cisco Certified Network Associate. Study Guide ,Todd Lammle, CCSI, Wiley India Edition-Sixth Edition

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITD 334	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 VI

MINOR

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT382	ANDROID PROGRAMMING	VAC	3	1	0	4

Preamble: The syllabus is prepared with the intended to deliver students the elementary concepts of Android App Development and equip them to code android application built over those concepts. It also introduces to them advanced level areas like event driven programming with Android.

Prerequisite: Java Programming (ITT281), Database Management (ITT282).

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

CO No.	Course Outcome	Bloom's Category Level
CO1	Summarize about different technologies used in mobile.	Level2: Understand
CO2	Summarize Kotlin Programming Language Concepts	Level 2: Understand
CO3	Summarize about Android Framework	Level 2: Understand
CO4	Build basic android applications.	Level 3: Apply
CO5	Build android apps using advanced android concepts.	Level 3: Apply

Mapping of Course Outcomes with Program Outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	2	2	-	1	-	-	-	-	-	-	-
CO2	1	1	2	1	-	-	-	-	-	-	-	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-
CO4	3	1	1	1	-	-	-	-	-	-	-	-
CO5	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	Continuous Assessment Tests (Marks)		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
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 contain10 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 (CO1):

1. Explain processors used in mobile.
2. Describe different sensors used in mobile.
3. Familiarization with mobile peripherals and display technologies...
4. Familiarization with mobile operating systems.
5. Explain different mobile platform architectures.

Course Outcome 2 (CO2):

1. Describe the fundamentals of Kotlin Language.
2. Explain about the conditional and looping statements.

3. Illustrate the concept of Higher Order Functions with an Example.
4. Demonstrate the concept of Classes with an example.
5. Explain ranges and collections in Kotlin programming language.

Course Outcome 3 (CO3):

1. Describe the android framework.
2. Describe AndroidManifest.xml.
3. Illustrate the concept of Activity with an example.
4. Demonstrate the concept of Services with an example.
5. Explain about Broadcast Receiver.

Course Outcome 4 (CO4):

1. Explain Android user interface.
2. Describe UI Layouts in Android.
3. Explain UI Controls in Android.
4. Illustrate the concept of Event handling.
5. Develop an Android app with appropriate UI, UI Layouts, UI Controls and Event handling.

Course Outcome 5 (CO5):

1. Explain device location access.
2. Demonstrate usage of SQLite database with an example.
3. Illustrate how data can be accessed from the internet.
4. Develop an efficient android app using Recycler View and database connectivity.

Model Question Paper

Course Code: ITT382

Course Name: ANDROID PROGRAMMING

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

PART A

(Answer all questions, each carries 3 marks)

1. What are the advantages of using ARM Processor?
2. What is AMOLED?
3. With an example explain the use of lambdas.
4. What is the concept of null safety?
5. Name any three Android Studio IDE project components and their use?
6. How notifications can be provided?
7. Describe UI Layout attributes.
8 Explain intents in Android.
9. How can an android application be published?
10. Compare and contrast different types of location access?

PART B

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

11 a. With a neat diagram, explain the architecture of the Android operating system. (8)
b. Mention about different sensors used in mobile devices. (6)

OR

12 a. With a neat diagram, explain the architecture of the iOS. (8)
b. What are the features of a mobile operating system? Give examples of mobile OS. (6)

13 a. Write a menu driven program to perform arithmetic operations. (10)
a. With an example explain the use of higher order functions. (4)

OR

14 a. Define class. How they can be implemented in Kotlin? (8)
b. What are the different types of inheritance in Kotlin. Give examples. (6)

15 a. Define Android activity. Explain the callbacks defined in activity class (7)
b. Explain the use and significance of AndroidManifest.xml (7)

OR

16 a. With an example illustrate how Broadcast Receiver can be created and used. (7)
b. With a neat diagram explain about Android Service lifecycle (7)

17 a. Explain about different Android Layouts. Give examples (9)
b. Illustrate how an activity can be started from another activity. (5)

OR

18 a. Explain about any four Android UI Controls. (8)
b. With an example demonstrate event handling in Android. (6)

19 a. Explain how content providers supply data from one application to another. Write the steps for creating your own content provider. Also, list out the methods needed to be overridden for the proper working of user defined content provider. (9)
b. Write an android program to access data from internet to implement a social media app with posting capability. (6)

OR

20 a. Write an android program with proper configuration files to show lists using Recycler View. (14)

Syllabus

MODULE 1: GENERAL MOBILE TECHNOLOGY AWARENESS (8 Hours)
Device hardware - Processors - ARM processors. Sensors - Base sensors, Composite Sensors, Uncaliberated, and Interaction composite sensors. Peripherals - audio and custom accessories. Display technologies - Touch, LCD, LED, OLED, AMOLED, display densities. Operating systems - Android, iOS, KaiOS, Tizen, and other operating systems. Platform Architecture: iOS and Android. App Stores – Apple App Store - Google Play. Development languages: Swift for iOS, Kotlin for Android.
MODULE 2: INTRODUCTION TO KOTLIN PROGRAMMING LANGUAGE (8 Hours)
Introduction to Kotlin - basic data types, variables, control flow - conditional statements, Null safety, loops - for loop, while loop, when expression, ranges, collections, functions, higher order functions, lambdas, inline functions. Classes, inheritance, extensions, data classes, objects, enums.
MODULE 3: INTRODUCTION TO ANDROID FRAMEWORK (11 Hours)
Introduction to android framework. Process and application Lifecycle. Introduction to Android Studio IDE. Project components - source files, resources, images, layout XML, and raw assets. Build system - Gradle, build.gradle, adding dependencies. Android app components - Activities, Services, Notifications, Broadcast Receivers, Content Providers.
MODULE 4: BUILDING BASIC ANDROID APPS (9 Hours)
Developing Basic apps using Kotlin, Activities, lifecycle, starting another Activity, Intents. Basic UI components - Layouts, TextView, EditText, Button, CheckBox, ImageView, ToggleButton, ProgressBar. Events and Event Handling.
MODULE 5: ADVANCED ANDROID CONCEPTS (9 Hours)
Showing lists using RecyclerView. Accessing device location, SQLite database, Accessing data from the Internet.

References

1. Android Studio 4.0 Development Essentials - Kotlin Edition by Neil Smyth, Payload Media, June 2020.
2. Android Programming Unleashed, B. M. Harwani, Sams, December 2012
3. ARM Architecture: https://en.wikipedia.org/wiki/ARM_architecture
4. Android Sensors: https://source.android.com/devices/sensors/sensor-types
5. Mobile OS list: https://en.wikipedia.org/wiki/Mobile_operating_system
6. Swift: https://docs.swift.org/swift-book/GuidedTour/GuidedTour.html
7. Kotlin: https://kotlinlang.org/docs/reference/basic-syntax.html
8. Android Platform Architecture: https://developer.android.com/guide/platform
9. Kotlin basics: https://kotlinlang.org/docs/reference/basic-syntax.html
10. Process & App Lifecycle: https://developer.android.com/guide/components/activities/process-lifecycle
11. Android Studio setup: https://developer.android.com/studio/intro

12. Android Studio project files: https://developer.android.com/studio/projects
13. Android App Components: https://developer.android.com/guide/components/fundamentals
14. Activities: https://developer.android.com/guide/components/activities/intro-activities
15. UI Components: https://developer.android.com/guide/topics/ui
16. Google Codelabs for app development: https://codelabs.developers.google.com/android-kotlin-fundamentals/
17. RecyclerView: https://developer.android.com/reference/kotlin/androidx/recyclerview/widget/RecyclerView
18. SQLite: https://developer.android.com/training/data-storage/sqlite
19. Location tracking: https://developer.android.com/training/location

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	**General Mobile Technology Awareness**	**8 Hours**
1.1	**Device hardware** - Processors - ARM processors. Sensors- Base sensors, Composite Sensors, Uncaliberated, and Interaction composite sensors. Peripherals- audio and custom accessories.	2 Hours
1.2	**Display technologies** - Touch, LCD, LED, OLED, AMOLED, display densities.	1 Hour
1.3	**Operating systems** - Android, iOS, KaiOS, Tizen, and other operating systems.	2 Hours
1.4	**Platform Architecture**: iOS and Android. App Stores – Apple App Store - Google Play. Development languages: Swift for iOS, Kotlin for Android.	3 Hours
2	**Introduction to Kotlin Programming Language**	**8 Hours**
2.1	**Introduction to Kotlin** - basic data types, variables, control flow - conditional statements, Null safety, loops - for loop, while loop, when expression, ranges, collections.	2 Hours
2.2	**Functions**- function, higher order functions, lambdas, inline functions.	3 Hours
2.3	**Classes** - class, inheritance, extensions, data classes, objects. Enums.	3 Hours
3	**Introduction to Android Framework**	**11 Hours**
3.1	**Process and application Lifecycle**.	2 Hours
3.2	**Introduction to Android Studio IDE**. Project components - source files, resources, images, layout XML, and raw assets. Build system - Gradle, build.gradle, adding dependencies. custom intents	4 Hours
3.3	**Android app components** - Activities, Services, Notifications - Toast, Broadcast Receivers, Content Providers.	5 Hours

4	**Building Basic Android apps**	**9 Hours**
4.1	**Developing Basic apps using Kotlin -** Activities, lifecycle, starting another Activity, Intents.	3 Hours
4.2	**UI components -** Layouts, TextView, EditText, Button, CheckBox, ImageView, ToggleButton, ProgressBar.	3 Hours
4.3	**Event handling** – Event, Event Listener, Event Handler.	3 Hours
5	**Advanced Android Concepts**	**9 Hours**
5.1	**RecyclerView**– concept, implementation and advantages	3 Hours
5.2	**Accessing Device Location**– Types of location access (Foreground location and Background location**)**	2 Hours
5.3	**SQLite database**– Insert, update, delete and access data	2 Hours
5.4	**Accessing data from internet**– Different methods to access data from internet.	2 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT384	INTERNETWORKING	VAC	3	1	0	4

Preamble: This subject is about the TCP/IP protocol suite and how it is used on the internet. It begins with a review of the underlying communications technologies needed for the internet. The course provides a detailed examination of IP routing, UDP, TCP, network virtualization, and label switching. Finally, internet applications and Software defined networking are discussed.

Prerequisite: ITT 283 Data Communication, ITT 284 Computer Networks

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

CO No.	Course Outcome(CO)	Bloom's Category Level
CO 1	Describe internetworking concepts.	Level 2: Understand
CO 2	Identify the functions of IPv4, IPv6protocols.	Level 3: Apply
CO 3	Familiarize with internet routing architecture and routing protocol.	Level 2: Understand
CO 4	Discuss the design issues and protocols in transport layer.	Level 3: Apply
CO 5	Familiarize with label switching, application layer protocols, network virtualization and software defined networking.	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	2	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	1	-	-	-	-	-	-	-	-	2
CO 3	3	2	-	-	2	-	-	-	-	-	-	2
CO 4	3	2	1	-	-	-	-	-	-	-	-	2
CO 5	3	2	-	-	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	Continuous Assessment Tests		End Semester Examination Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	20
Understand	30	30	60
Apply	10	10	20
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 the need for multiple protocols for internetworking.
2. Explain different layers in TCP/IP reference model.

Course Outcome 2 (CO2)

1. Explain IP datagram fragmentation and reassembly. Also explain different header fields affected in these cases.
2. Compare the headers of IPv4 and IPv6.

Course Outcome 3(CO3):

1. Explain characteristics and message formats in BGP.
2. Explain RIP in detail. What is slow convergence problem and how it is solved?

Course Outcome 4 (CO4):

1. Draw and explain TCP finite state machine.
2. Explain the adaptive retransmission algorithm used by TCP.
3. What is the purpose of using a pseudo-header for UDP checksum computation?
4. Explain the format of IPv6 UDP pseudo-header

Course Outcome 5 (CO5):

1. What is label switching?
2. Explain the difference between persistent and non persistent HTTP.
3. Explain DNS.

Model Question Paper

Course Code: ITT384
Course Name: INTERNETWORKING

Max. Marks: 100 Duration: 3 Hours

PART A

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

1. What is internetworking?
2. Explain the role of routers in Networks.
3. Explain the header fields in IP that are used for datagram fragmentation and reassembly
4. What are the features of connectionless delivery service?
5. Assuming that all routers and hosts are working properly and that all software in both is free of all errors, is there any chance, however small, that a packet will be delivered to the wrong destination?
6. Explain the purpose of exterior gateway routing protocols
7. How does VPN protect user data from external access?
8. A TCP machine is sending full windows of 65535 bytes over a 1 Gbps channel that has a 10 msec one way delay. What is the maximum throughput achievable?
9. What is QoS?
10. What is SDN?

Part B

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

11 List and explain the main features of all the seven layers of the ISO/OSI reference model and compare it with TCP/IP Model.

OR

12 Explain in detail about IPv6 addressing

13 Explain the format of IPv4 and IPv6 datagram.

OR

14 Explain in detail about fragmentation and reassembly of IPv4 datagram

15 What is BGP? Explain the characteristics and message formats of BGP.

OR

16 What is slow convergence problem? How can it be solved?

17 Explain in detail about TCP segment format.

OR

18 What is congestion? Explain in detail about TCP congestion control.

19 Explain triangular routing problem

OR

20 Explain in detail about RTP and RSVP

Syllabus

Module 1: Introduction to Internetworking(8 Hours)
Introduction & Overview – Motivation for internetworking, TCP/IP internet, Internet Services. Internetworking Concept And Architectural Model – Introduction, Application-Level Interconnection, Network-Level Interconnection, Properties Of The Internet, Internet Architecture, Interconnection Of Multiple Networks With IP Routers. **Protocol Layering**- Introduction, The Need For Multiple Protocols, The Conceptual Layers Of Protocol Software, Functionality Of The Layers, ISO 7-Layer Reference Model, The TCP/IP 5-Layer Reference Model, IPv6 Addressing
Module 2: Network Layer (8Hours)
Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) – Introduction, Connectionless Delivery System Characteristics, Purpose and Importance Of The Internet Protocol, The IP Datagram, Datagram Type Of Service And Differentiated Services, Datagram Encapsulation, Datagram Size, Network MTU and Fragmentation, Datagram Reassembly, Header Fields Used For Datagram Reassembly, Time To Live (IPv4) And Hop Limit (IPv6), Optional IP Items, Options Processing During Fragmentation.
Module 3: Routing (10Hours)
Routing Architecture – Cores, Peers and Algorithms, Routing among Autonomous system – BGP - The Scope Of A Routing Update Protocol, Determining A Practical Limit On Group Size, Autonomous System Concept, Exterior Gateway Protocols And Reachability, BGP Characteristics, BGP Functionality And Message Types, Routing Within An Autonomous System - Introduction, Static Vs. Dynamic Interior Routes, Routing Information Protocol (RIP), Slow Convergence Problem, Solving The Slow Convergence Problem, The Disadvantage Of Using Hop Counts, Delay Metric (HELLO), Delay Metrics, Oscillation, And Route Flapping, The Open SPF Protocol (OSPF).
Module 4: Transport Layer (9Hours)
User Datagram protocol – UDP message format, Interpretation of UDP checksum, UDP checksum computation and pseudo header, IPv4 and IPv6 UDP pseudo header format, UDP encapsulation and protocol layering, reserved and available port numbers. **Reliable stream transport service** – need for reliable service, properties of reliable service, reliability, sliding window paradigm, transmission control protocol, Segments, streams and sequence numbers, variable window size and flow control, TCP segment format, TCP options, TCP checksum computation, acknowledgements, retransmissions and timeouts, Karn's algorithm and timer backoff, response to congestion, random early detection, establishing and closing a TCP connection, TCP finite state machine
Module 5: Application Layer (10 Hours)
Label switching, flows and MPLS. Network Virtualization: VPNs, NATs, And Overlays. Mobility and Mobile IP – Introduction, Mobility, Addressing, Routing, Mobility via host address change and changes in datagram forwarding, Mobile IP and operation, Mobile IPv4 addressing, IPv4 foreign agent discovery and registration, communication within an IPv4

foreign agent, IPv6 mobility support,datagram transmission,reception and tunnelling Voice and video over IP (RTP, RSVP, QoS), Software defined networking – Routes, paths, connections, traffic engineering and control of path selection, connection oriented networks, routing overlays, SDN, separation of data and control plane, SDN architecture and external controllers, SDN across multiple devices, implementing SDN with conventional switches, Openflow technology.

Text Books

1. Douglas E Comer, "Internetworking with TCP/IP Principles, Protocol, and Architecture" , Volume I, 6th Edition, Pearson Education, 2013
2. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall, 5th Edition
3. James F Kurose, Keith W Ross, Computer Networking: A top Down Approach featuring the Internet, Pearson Education, 3rd Edition

Reference Books

1. Behrouz A Forouzan, TCP/IP Protocol Suite, Fourth Edition

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to Internetworking-**	**8 Hours**
1.1	Introduction & Overview – Motivation for internetworking, TCP/IP internet, Internet Services. Internetworking Concept And Architectural Model – Introduction, Application-Level Interconnection, Network-Level Interconnection, Properties Of The Internet, Internet Architecture, Interconnection Of Multiple Networks With IP Routers.	2Hours
1.2	Protocol Layering- Introduction, The Need For Multiple Protocols, The Conceptual Layers Of Protocol Software, Functionality Of The Layers, ISO 7-Layer Reference Model.	2Hours
1.3	The TCP/IP 5-Layer Reference Model	2Hours
1.4	IPv6 Addressing	2 Hours
2	**Network Layer-**	**8 Hours**
2.1	Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) – Introduction, Connectionless Delivery System Characteristics, Purpose And Importance Of The Internet Protocol, The IP Datagram, Datagram Type Of Service And Differentiated Services, Datagram Encapsulation, Datagram Size	5Hours
2.2	Network MTU and Fragmentation, Datagram Reassembly, Header Fields Used for Datagram Reassembly, Time To Live (IPv4) and Hop Limit (IPv6),Optional IP Items, Options Processing During Fragmentation.	3Hours
3	**Routing -**	**10 Hours**
3.1	Routing Architecture – Cores, Peers and Algorithms, Routing	2 Hours

	among Autonomous system – BGP – The scope of a routing. Update Protocol, Determining A Practical Limit On Group Size, Autonomous System Concept	
3.2	Exterior Gateway Protocols And Reachability, BGP Characteristics, BGP Functionality And Message Types	2 Hours
3.3	Routing Within An Autonomous System - Introduction, Static Vs. Dynamic Interior Routes	1Hour
3.4	Routing Information Protocol (RIP), Slow Convergence Problem, Solving The Slow Convergence Problem, The Disadvantage Of Using Hop Counts	2 Hours
3.5	Delay Metric (HELLO), Delay Metrics, Oscillation, And Route Flapping	1 Hour
3.6	The Open SPF Protocol (OSPF).	2 Hours
4	**Transport Layer-**	**9 Hours**
4.1	**User Datagram protocol –** UDP message format, Interpretation of UDP checksum, UDP checksum computation and pseudo header, IPv4 and IPV6 UDP pseudo header format, UDP encapsulation and protocol layering, reserved and available port numbers.	3 Hours
4.2	**Reliable stream transport service** – need for reliable service, properties of reliable service, reliability, sliding window paradigm, transmission control protocol, Segments, streams and sequence numbers, variable window size and flow control	2 Hours
4.3	TCP segment format, TCP options, TCP checksum computation, acknowledgements, retransmissions and timeouts	1 Hours
4.4	Karn's algorithm and timer backoff, response to congestion, random early detection	1 Hour
4.5	Establishing and closing a TCP connection, TCP finite state Machine	2 Hours
5	**Application Layer-**	**10 Hours**
5.1	Label switching, flows and MPLS. Network Virtualization: VPNs, NATs, And Overlays	2 Hours
5.2	Mobility and Mobile IP – Introduction, Mobility, Addressing, Routing, Mobility via host address change and changes in datagram forwarding, Mobile IP and operation, Mobile IPv4 addressing, IPv4 foreign agent discovery and registration, communication within an IPv4 foreign agent, IPv6 mobility support, datagram transmission, reception and tunnelling.	2Hours
5.3	Voice and video over IP (RTP, RSVP, QoS	2Hours
5.4	Software defined networking – Routes, paths, connections, traffic engineering and control of path selection, connection oriented networks, routing overlays, SDN, separation of data and control Plane	1Hour
5.5	SDN architecture and external controllers, SDN across multiple devices, implementing SDN with conventional switches.	1 Hour
5.6	Openflow technology	2 Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT386	PRINCIPLES OF SOFTWARE QUALITY ASSURANCE	VAC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable ofunderstanding essential principles of software quality assurance.

Prerequisite: Basicsof Software Engineering

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

CO No.	Course Outcome (CO)	Bloom's Category Level
CO1	Summarize role of software quality assurance	Level 2: Understand
CO2	Identify the factors affecting software quality	Level 2: Understand
CO3	Explain the steps to assure software quality	Level 2: Understand
CO4	Explain Software quality metrics	Level 2: Understand
CO5	Discuss the role of management in quality assurance	Level 2: Understand
CO6	Illustrate CASE tools and their effect on software quality	Level 2: Understand

Mapping of course outcomes with program outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	-	3	2	-	2	3	1	2	1
CO2	2	3	3	1	3	-	-	1	2	2	3	1
CO3	2	1	1	-	3	1	-	1	-	1	-	1
CO4	-	1	-	1	-	1	-	1	3	3	2	1
CO5	1	3	-	1	2	-	-	-	-	-	2	1
CO6	1	-	2	1	-	3	-	3	-	-	2	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 Marks
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	20
Understand	40	40	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 Acontain 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 (CO1):

1. List out the importance of software quality assurance.
2. Explain change control.
3. Describe the elements of Software Configuration Management.
4. Illustrate the steps to develop and implement a Software Quality Assurance Plan.

Course Outcome 2 (CO2):

1. Classify software requirements into software quality factors.
2. Differentiate Verification, validation and qualification.
3. Discuss the components of the software quality assurance system
4. Illustrate the Integration of quality activities in the project life cycle.

Course Outcome 3 (CO3):

1. Compare and contrast team review methods.
2. Illustrate the types of external participants.
3. Explain software testing strategies and implementation.
4. Discuss the process of Assuring the quality of software maintenance components

Course Outcome 4 (CO4):

1. Analyze the basis for economic analysis of architecture.
2. Identify the objectives of quality measurement.
3. Describe Team Software Process (TSP) and Personal Software Process (PSP)
4. Explain the process of Measuring Process Improvement.

Course Outcome 5 (CO5):

1. Explain the classic model of cost of software quality.
2. Illustrate the models of Cost of software quality

Course Outcome 6 (CO6):

1. Analyse the contribution of CASE tools to improved project Management.
2. Explain the effect of CASE tools on software quality.

Model Question Paper

Course Code: ITT386

Course Name: PRINCIPLES OF SOFTWARE QUALITY ASSURANCE

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

PART A

(Each Question carries 3 Marks) (10*3=30)

1. List out the importance of software quality assurance
2. Explain change control.
3. Classify software requirements into software quality factors.
4. Differentiate Verification, validation and qualification.
5. Compare and contrast team review methods.
6. Illustrate the types of external participants.
7. Analyze the basis for economic analysis of architecture.
8. Identify the objectives of quality measurement.
9. Explain the classic model of cost of software quality.
10. Analyse the contribution of CASE tools to improved project Management.

PART B

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

11. Describe the elements of Software Configuration Management.

OR

12. Illustrate the steps to develop and implement a Software Quality Assurance Plan.
13. Discuss the components of the software quality assurance system

OR

14. Illustrate the Integration of quality activities in the project life cycle.
15. Explain software testing strategies and implementation.

OR

16. Discuss the process of Assuring the quality of software maintenance components

17. Describe Team Software Process (TSP) and Personal Software Process (PSP)

OR

18. Explain the process of Measuring Process Improvement.
19. Illustrate the models of Cost of software quality

OR

20. Explain the effect of CASE tools on software quality.

Syllabus

Module 1: Introduction to software quality (9 Hours)
Quality Assurance Framework, Elements of Software Configuration Management, Quality Standards
Module 2: Software quality factors (9 Hours)
Software quality factors, The components of the software quality assurance system, Integrating quality activities in the project life cycle
Module 3: Assuring the quality (9 Hours)
Reviews, Software testing – strategies, implementation, Assuring the quality of software maintenance components, Assuring the quality of external participants' contributions.
Module 4: Software quality metrics (9 Hours)
Objectives of quality measurement, Software Quality Indicators, Software Quality Fault Prediction
Module 5: Management and its role in software quality assurance (9 Hours)
Costs of software quality, Management and its role, CASE tools and their effect on software Quality

Text Books

1. Handbook of Software Quality Assurance, Fourth Edition, G. Gordon Schulmeyer, ARTECH HOUSE, INC., 2008. ISBN-13: 978-1-59693-186-2.
2. Software Testing and Continuous Quality Improvement, William E. Lewis, 3rd Ed. CRC Press, 2016, ISBN 9781420080735

Reference Books

1. Software Testing: Principles, Techniques and Tools, M. G. Limaye, TMH, 2017
2. Foundations of Software Testing, Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black, Cengage Learning, 3rd
3. Software Testing: A Craftsman's Approach, Paul C. Jorgenson, CRC Press, 4th, 2017

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction to software quality**	**9 Hours**
1.1	Quality Assurance Framework:- Quality, Prevention versus Detection , Verification versus Validation	1 Hour
1.2	Software Quality Assurance, Components of Quality Assurance, Software Testing, Quality Control, Software Configuration Management	2 Hours
1.3	Elements of Software Configuration Management, Component Identification, Version Control, Configuration Building, Change Control	2 Hours
1.4	Software Quality Assurance Plan, Steps to Develop and Implement a Software Quality Assurance Plan	2 Hours
1.5	Quality Standards	2 Hours
2	**Software quality factors**	**9 Hours**
2.1	**Software quality factors** The need for comprehensive software quality requirements, Classifications of software requirements into software quality factors, Product operation software quality factors , Product revision software quality factors, Product transition software quality factors, Alternative models of software quality factors, Software compliance with quality factors	3 Hours
2.2	**The components of the software quality assurance system – overview** The SQA system – an SQA architecture, Pre-project components, Software project life cycle components, Infrastructure components for error prevention and improvement, Management SQA components, SQA standards, system certification, and assessment components, Organizing for SQA – the human components, Considerations guiding construction of an organization's SQA system	3 Hours

2.3	**Integrating quality activities in the project life cycle** Classic and other software development methodologies, Factors affecting intensity of quality assurance activities in the development process Verification, validation and qualification, A model for SQA defect removal effectiveness and cost	3 Hours
3	**Assuring the quality**	**9 Hours**
3.1	**Reviews** Review objectives, Formal design reviews (DRs) , Peer reviews , A comparison of the team review methods, Expert opinions	1 Hour
3.2	**Software testing – strategies** Definition and objectives, Software testing strategies , Software test classifications , White box testing , Black box testing	2 Hours
3.3	**Software testing – implementation** The testing process, Test case design, Automated testing, Alpha and beta site testing programs	2 Hours
3.4	**Assuring the quality of software maintenance components** The foundations of high quality, Pre-maintenance software quality components, Maintenance software quality assurance tools	2 Hours
3.5	**Assuring the quality of external participants' contributions** Types of external participants , Risks and benefits of introducing external participants , Assuring quality of external participants' contributions: objectives , SQA tools for assuring the quality of external participants' contributions	2 Hours
4	**Software quality metrics**	**9 Hours**
4.1	Objectives of quality measurement, Classification of software quality metrics, Process metrics Product metrics, Implementation of software quality metrics , Limitations of software metrics	2 Hours
4.2	Software Quality Indicators, Practical Software and Systems Measurement (PSM) , CMMI Measurement and Analysis , CMMI Higher Maturity Measurements	2 Hours
4.3	Practical Implementations, Hewlett Packard, Quantitative SQA, Pragmatic Quality Metrics, Effectiveness Measure , Team Software Process (TSP) , and Personal Software Process (PSP).	3 Hours
4.4	Software Quality Fault Prediction, Measuring Process Improvement Using Stoplight Charts , Six Sigma , Project Managers Control Panel , Predicting Software Quality	2 Hours
5	**Management and its role in software quality assurance**	**9 Hours**
5.1	**Costs of software quality** Objectives of cost of software quality metrics , The classic model of cost of software quality , An extended model for cost of software quality , Application of a cost of software quality system , Problems in the application of cost of software quality metrics	3 Hours

5.2	**Management and its role in software quality assurance** Top management's quality assurance activities , Department management responsibilities for quality assurance , Project management responsibilities for quality assurance	3 Hours
5.3	**CASE tools and their effect on software quality** CASE tool, The contribution of CASE tools to software product quality, The contribution of CASE tools to software maintenance quality,The contribution of CASE tools to improved project Management.	3 Hours

SEMESTER VI

HONOURS

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT394	DESIGN AND ANALYSIS OF NETWORKS	VAC	3	1	0	4

Preamble: This course covers problems in design and analysis of computer networks.

Prerequisite: ITT272 Mathematical Foundation for Networking, ITT393 Wireless Communication

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	Identify the requirements of a network	Level 2: Understand
CO 2	Identify the characteristics of traffic flow on a network and design network architecture.	Level 3: Apply
CO 3	Describe the fundamental concepts about addressing and routing for IP networks and implement network management and the network managementarchitecture.	Level 3: Apply
CO 4	Describethe mechanisms to achieve performance and understand the security mechanisms such as physicalsecurity, protocol and application security, encryption/decryption, and perimeterand remote access security	Level 2: Understand
CO 5	Discuss the need to evaluate the vendor or service provider and come up with traceable blueprints to suit the need of the vendor or service provider	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	2	-	-	-	-	-	-	-	3
CO 2	3	3	3	2	-	-	-	-	-	-	-	2
CO 3	3	3	3	2	-	-	-	-	-	-	-	2
CO 4	3	3	3	2	-	-	-	-	-	-	-	2
CO 5	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	Continuous Assessment Tests		End Semester Examination
	Test 1(Marks)	Test 2(Marks)	
Remember	10	10	10
Understand	20	20	50
Apply	20	20	40
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. Why is requirements analysis important to network architecture and design? Give three reasons.
2. Your customer is a hospital that wants to upgrade its LAN. Develop a questionnaireto gather requirements from users, hospital management, and staff. What kinds of questions would you ask to better understand their environment?

Course Outcome 2 (CO2)

1. Develop a flow model for real-time/near-real-time flows. How would you characterize the flows for this model? What are likely data sources and sinks? Apply your model to an online transaction processing (OLTP) application.

2. What are the differences between the LAN/MAN/WAN and Access/Distribution/Core architectural models? Under what conditions might each be applied to a network?

Course Outcome 3(CO3):

1. ubnet 136.178.0.0 into 16 subnets. Show the binary and dotted-decimal forms of each subnet, as well as the subnet mask.
2. Which of the following are end-to-end characteristics? Per-link/per-network/per-element characteristics?
    a. Round-trip delay between a network management device and a computing server
    b. Percent utilization of the buffers in an IP router
    c. Maximum throughput between two devices (client and server) using a client-server application
    d. Bit error rate (BER) of a DS3 link

Course Outcome 4 (CO4):

1. List four types of problems that the performance architecture addresses. Give examples of each type of problem
2. Explain threat analysis. Give an example of a threat analysis worksheet for an organization

Course Outcome 5 (CO5):

1. Compare differentiated service and integrated service.
2. What are the mechanisms used for traffic management? Explain.

Model Question Paper

Course Code:ITT394

Course Name: DESIGN AND ANALYSIS OF NETWORKS

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

PART A

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

1. Give an example of a mission-critical application for each of these three environments: government, military, commercial. Why would each application be considered mission-critical?
2. Describe two ways to make an uptime requirement of 99.999% more precise.
3. Which flow models apply to each set of flows described below?

a. Users on the Internet accessing the same Web server

b. Forty workstations processing batch jobs overnight, managed by a central mainframe

c. Email use across the Internet

4. Give examples of physical and functional entities that you would use as building blocks for a network.

5. What is the class of each address? Give the default subnet mask.

   a. 192.12.102.0

   b. 10.20.30.100

   c. 130.5.77.15

6. Give any two ways that the management data collected via SNMP counters from each of the routers could be verified.

7. Give two examples each of the requirements which indicate single-tier performance and which indicate Multi-tier performance?

8. What are the common problems that are addressed by the performance architecture?

9. What are ad hoc design decisions? Give an example of an ad hoc design decision.

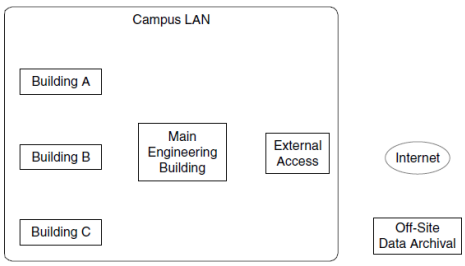
10. What are the primary differences between first-order, second-order, and third-order design products?

PART B

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

11. Based on the following application locations, develop an applications map using the template provided

    a. There is a distributed computing application between all compute servers.
    b. There is a data storage/access application between all compute servers and the storage servers in Main Engineering.
    c. There is a data migration application between Main Engineering, External Access Building, and Off-Site Data Archival.



OR

12. A) Service metrics are used to monitor, measure, and verify services in the network and determine if performance requirements are being met. Therefore, service metrics must be meaningful to the network operators, managers, users, and staff. For each performance requirement below, describe a service metric that could be used to measure and verify the requirement.

    d. Reliability of a T1 link between an enterprise network and its ISP, with IP routers on each end of the T1.
    e. Round-trip delay between devices on network A and servers on server LAN B.
    f. Average traffic rate in and out of a computer server, measured across all four of its LAN interfaces over 15-minute intervals.

    B) Given an MTBCF requirement of 8000 hours and an MTTR requirement of 4 hours, calculate an availability requirement.

13. Develop a flow model for real-time/near-real-time flows. How would you characterize the flows for this model? What are likely data sources and sinks? Apply your model to a videoconferencing application.

OR

14. A) A network's architecture differs from its design, in terms of its scope, level of detail, description, and location information. Describe how an architecture and design differ in each characteristic.

    B) Explain the network architectural models based on flows.

15. Given the network address 129.99.0.0/16, develop a variable-length addressing scheme that best fits the design, with the following numbers of users:

AS Number	Location	Department	Users
1	Chicago Campus Building 1	Legal	120
		Accounting	370
	Chicago Campus Building 2	HQ	1580
		Engineering	200
2	Toronto	Sales	75
	Boston	Sales	110
3	Philadelphia	Operations1	2150
		Operations2	975
		Sales	575

OR

16. What are the layers of network management? Give an example of management at each layer (what is managed, how it is managed).

17. For the queuing mechanisms given below, give an example of how each would be used within a network. What problem(s) is each mechanism solving?

    g. First in first out (FIFO)
    h. Class-based queuing (CBQ)
    i. Weighted fair queuing (WFQ)
    j. Random early detect (RED)
    k. Weighted RED (WRED)

OR

18. Explain the process for PPP/PPPoE Session Establishment.

19. Which of the following evaluation criteria most likely apply to equipment evaluations, which ones apply to service-provider evaluations, and which apply to both?

    l. Available service-level agreements (SLAs)
    m. Standards compliance (IETF)
    n. Mean time between failure (MTBF)
    o. Mean time between service outage (MTBSO)
    p. Hardware scalability

OR

20. Using any suitable example, explain criteria refinement and rating development.

Syllabus

Module 1:REQUIREMENT ANALYSIS (8Hours)
Requirements Analysis: objective and background, User Requirements, Application Requirements, Device Requirements, Network Requirements, Other Requirements, Requirements Specification and Map Requirements Analysis: Process- Gathering and Listing Requirements, Developing Service Metrics, Characterizing behaviour, Developing RMA requirements, Developing delay Requirements, Developing capacity Requirements, Environment-Specific Thresholds and Limits, Requirements for Predictable and Guaranteed Performance, Requirements mapping
Module 2 :FLOW ANALYSISAND NETWORK ARCHITECTURE (10 Hours)
Flow Analysis: Background, Flows, Identifying and Developing Flows, Data Sources and Sinks, Flow Models, Flow Prioritization, The Flow Specification, Example Application of Flow Analysis Network Architecture: Background, Component Architectures, Reference Architecture, Architectural Models, Systems and Network Architectures

Module 3: ADDRESSING AND NETWORK MANAGEMENT(10 Hours)
Addressing and Routing Architecture: Background, Addressing Mechanisms, Routing Mechanisms Addressing Strategies, Routing Strategies, Architectural Considerations Network Management Architecture: Background, Network Devices and Characteristics, Network Management Mechanisms, In-Band and Out-of-Band Management, Centralized, Distributed, and Hierarchical Management, Scaling Network Management Traffic
Module 4:PERFORMANCE AND SECURITY ARCHITECTURE (9 Hours)
Performance Architecture: Background, Developing Goals for Performance, Performance Mechanisms, Evaluation of Performance Mechanisms Security and Privacy Architecture: Background, Developing a Security and Privacy Plan, Security and Privacy Administration, Security and Privacy Mechanisms, Evaluation of Security Mechanisms
Module 5: NETWORK DESIGN (8 Hours)
Network Design: Objectives, Design Concepts, Design Process, Vendor, Equipment, and Service-Provider Evaluations, Network Layout, Design Traceability, Design Metrics

Text Books

1. Network Analysis, Architecture and Design, 3RDEdition (The Morgan Kaufmann Series in Networking) James D. McCabe, Elsevier Science (USA), 2007.

Reference Books

1. Computer Networks: A Systems Approach by Larry L. Peterson, Bruce S. Davie - 2007, Elsevier Inc.
2. Top-down Network Design: [a Systems Analysis Approach to Enterprise Network Design] ByPriscilla Oppenheimer, Cisco Press , 3rd Edition, ISBN-13: 978-1-58720-283-4 ISBN-10: 1-58720-283-2
3. Integrated Management of Networked Systems: Concepts, Architectures, and Their Operational Application (The Morgan Kaufmann Series in Networking), Heinz-Gerd Hegering, Sebastian Abeck,and Bernhard Neumair, 1999.
4. "Network Design and Management" – by Steven T.Karris, Orchard publications, Second edition, Copyright 2009, ISBN 978-1-934404-15-7
5. "Network Design, Management and Technical Perspective", Teresa C. Mann-Rubinson and KornelTerplan, CRC Press, 1999

6. “Ethernet Networks-Design, Implementation, Operation and Management by Gilbert Held,JohnWiley and sons, Fourth Edition

7. James Kurose and Keith Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, 1999

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**REQUIREMENT ANALYSIS**	**8Hours**
1.1	Requirements Analysis: objective and background, User Requirements	1 Hour
1.2	Application Requirements, Device Requirements, Network Requirements, Other Requirements, Requirements Specification and Map	2Hours
1.3	Requirements Analysis: Process- Gathering and Listing Requirements, Developing Service Metrics	1Hour
1.4	Characterizing behaviour, Developing RMA requirements, Developing delay Requirements	2Hours
1.5	Developing capacity Requirements, Environment-Specific Thresholds and Limits, Requirements for Predictable and Guaranteed Performance, Requirements mapping	2 Hours
2	**FLOW ANALYSISAND NETWORK ARCHITECTURE**	**10Hours**
2.1	Flow Analysis: Background, Flows, Identifying and Developing Flows, Data Sources and Sinks	3 Hours
2.2	Flow Models, Flow Prioritization, The Flow Specification, Example Application of Flow Analysis	3Hours
2.3	Network Architecture: Background, Component Architectures	1 Hour
2.3	Reference Architecture,Architectural Models, Systems and Network Architectures	3 Hours
3	**ADDRESSING AND NETWORK MANAGEMENT**	**10 Hours**
3.1	Addressing and Routing Architecture: Background, Addressing Mechanisms	3 Hours
3.2	Routing Mechanisms Addressing Strategies, Routing Strategies, Architectural Considerations	3 Hours
3.3	Network Management Architecture: Background, Network Devices and Characteristics, Network Management Mechanisms	2 Hours
3.4	In-Band and Out-of-Band Management, Centralized, Distributed, and Hierarchical Management, Scaling Network Management Traffic	2 Hours
4	**PERFORMANCE AND SECURITY ARCHITECTURE**	**9Hours**
4.1	Performance Architecture: Background, Developing Goals for Performance	1 Hour
4.2	Performance Mechanisms, Evaluation of Performance	2Hours

	Mechanisms	
4.3	Security and Privacy Architecture: Background, Developing a Security and Privacy Plan	2Hours
4.4	Security and Privacy Administration	2 Hours
4.5	Security and Privacy Mechanisms, Evaluation of Security Mechanisms	2 Hours
5	**NETWORK DESIGN**	**8Hours**
5.1	Network Design: Objectives, Design Concepts	2Hours
5.2	Design Process, Vendor, Equipment, and Service-Provider Evaluations	3Hours
5.3	Network Layout, Design Traceability, Design Metrics	3Hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT396	APPLIED COMPUTER SECURITY	VAC	3	1	0	4

Preamble: The syllabus is designed with the view of preparing the students capable of understanding various application areas of computer security. The students will get to know about vulnerabilities and threats occurring in various information systems. Furthermore, the student will be able to identify suitable security mechanisms to handle security issues faced by various applications.

Prerequisite: ITT206 Database management systems , ITT303 Operating systems**,** ITT305 Data communication and Networking, ITT395 Security in Computing**,**

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	Outline the basic concepts and techniques to secure various applications	Level 2: Understand
CO 2	Explain various security mechanisms for storage Infrastructure	Level 2: Understand
CO 3	Interpret the security techniques of IoT environment	Level 2: Understand
CO 4	Apply the underlying principles of security to cloud computing platforms	Level 3: Apply
CO 5	Apply the significance of blockchain technology for securing various applications	Level 3: Apply

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	2	2	1	1	1	1	1	-	-	-	2
CO 2	3	2	2	1	1	-	-	1	-	-	-	2
CO 3	3	2	2	1	1	1	-	1	-	-	-	1
CO 4	3	2	1	1	2	-	-	2	-	-	-	2
CO 5	3	3	2	2	2	2	1	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	Continuous Assessment Tests		End Semester Examination
	Test1(Marks)	Test2(Marks)	
Remember	10	10	20
Understand	40	20	40
Apply		20	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 maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain various issues and challenges in smart phone security.
2. Summarize key success factors for biometric systems.
3. Outline various countermeasures to protect from threats posed through emails.

Course Outcome 2 (CO2):

1. Compare auditing the security of a storage environment with SAN, NAS, and iS CSI implementations.
2. Outline various threats and vulnerabilities occur in virtualized and cloud environments.
3. Explain various security concerns and measures in the virtualized and cloud environment.

Course Outcome 3 (CO3):

1. Summarize various attack types that relate to IoT
2. Outline the importance of IoT security CONOPS document in IoT System development.
3. Explain the IoT System security verification and validation (V&V) procedure.

Course Outcome 4 (CO4):

1. Identify the effect of six surfaces of attacks in a cloud computing environment on SaaS,PaaS,Iaas.
2. Compare the benefits and the potential problems due to virtualization on public,private and hybrid clouds.
3. Identify the implications of a two-level security model of commodity operating systems.

Course Outcome 5 (CO5):

1. Explain various building blocks of blockchain technology.
2. Identify the ways in which blockchain technology can be compromised.
3. Apply blockchain technology to solve automotive security and privacy issues.

Model Question Paper

Course Code: ITT396

Course Name: APPLIED COMPUTER SECURITY

Max.Marks:100 Duration: 3 Hour

PART A

(Each Question carries 3 Marks) (10*3=30)

1. Explain security threats associated with wearable devices.
2. Outline various security issues and concerns in electronic commerce.
3. Explain the concept of risk triad.
4. Outline IP SAN security implementation in storage networking.
5. Summarize the essential components of information assurance (IA).
6. Compare the use of attack trees with that of an attack vector for understanding a system's security posture.
7. Examine the security risks posed by the cloud users.
8. Identify the Surfaces of attacks in a cloud computing environment.
9. Design the structure of a block in a blockchain with the help of a neat diagram.

10. Obtain blockchain and its operations.

PART B

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

11. Explain key success factors for biometric systems.

OR

12. Summarize various security threats posed by electronic mails and its countermeasures.

13. Illustrate various storage security domains with suitable diagrams.

OR

14. Outline security implementations in storage networking. (i) FC SAN and (ii) NAS

15. a. Explain the need for building security into design and development. (7)

b. Summarize the issues and techniques related to securely engineering IoT systems. (7)

OR

16. a. Explain the implementation and integration aspects of the IoT security lifecycle. (10)

b. Outline the IoT System security verification and validation (V&V) procedure. (4)

17. a. Identify the indications of the lack of trusted paths in commodity operating systems with examples showing the effects of this deficiency. (10)

b. Obtain the two-level security model of commodity operating systems. (4)

OR

18. a.Obtain the Security risks posed by a management OS. (9)

b. Identify the privacy concerns for three cloud delivery models. (5)

19. Identify various peer to peer attacks on blockchain and its countermeasures.

OR

20. a. Identify various application oriented attacks on blockchain and its countermeasures. (7)

b. Apply blockchain technology to solve security and privacy issues in various applications. Explain with an example. (7)

Syllabus

Module 1: Security of Applications (10 Hours)
Security Considerations in Mobile and Wireless Computing, Smartphone Security, Biometrics for Security, Security of Electronic Mail Systems, Security of Electronic Commerce. (T1: Chapter - 6, 8, 11,18 & 19)
Module 2: Storage Security (8 Hours)
Securing the storage Infrastructure - Information Security Framework, Risk Triad, Storage Security Domains, Security Implementation in Storage Networking, Securing Storage Infrastructure in virtualized and Cloud Environments, RSA and VMware Security Products. (T2: Chapter - 14)
Module 3 : IOT Security (9 Hours)
IoT and cyber-physical systems, IoT security (vulnerabilities, attacks, and countermeasures)-Common IoT attack types-Attack trees-Building an attack tree, security engineering for IoT development-Secure design-Safety and security design, IoT security lifecycle-The secure IoT system implementation lifecycle -Implementation and integration-IoT security CONOPS document-Network and security integration-System security verification and validation (V&V)-Security training-Secure configurations. (T3: Chapter - 2,3 & 4)
Module 4 : Cloud Security (8 Hours)
Introduction to Cloud and Virtualization- Cloud Security - Cloud Security Risks, Trust, Operating System Security, VM Security, Security of Virtualization, Security Risks Posed by Shared Images, Security Risks Posted by Management OS. (T4: Chapter -9)
Module 5 : Distributed Systems Security (10 Hours)
Introduction to Blockchain - Blockchain Overview, Blockchain Building Blocks, Blockchain Commercial Use cases, Blockchain Military Cyber Operations Use cases, Blockchain Challenges, Overview of Attack Surfaces in Blockchain - Overview of Blockchain and its Operations, Blockchain Attacks, Blockchain's Peer to Peer System, Application Oriented Attacks, A Blockchain-based Solution to Automotive Security and Privacy - The Proposed Framework, Applications. (T5: Chapter - 1, 3 & 5)

Text Books

T1. Nina Godbole, "Information System Security", 2nd Edition, Wiley

T2. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, Wiley; 2nd Edition, EMC Corporation, 2012.

T3. B.Rusell and D. Van Duren, "Practical Internet of Things Security," Packt Publishing, 2016.

T4. Marinescu D C, Cloud Computing Theory and Practice, Morgan Kaufmann (2014).

T5. Sachin Shetty, Charles A. Kamhoua , Laurent L. Njilla , "Blockchain for Distributed Systems Security", Wiley

Reference Books

R1: Sarika Gupta, “Information and Cyber Security”, Khanna Publishing House, Delhi.
R2: Zhou, Honbo. The internet of things in the cloud: A middleware perspective. CRC press, 2012.
R3: Antony Lewis, “The Basics of Bitcoins and Blockchains”, Mango Publishing

Course Contents and Lecture Schedule

1	**Security of Applications**	**10** Hours
1.1	Security Considerations in Mobile and Wireless Computing	2 Hours
1.2	Smartphone Security	2 Hours
1.3	Biometrics for Security	2 Hours
1.4	Security of Electronic Mail Systems	2 Hours
1.5	Security of Electronic Commerce	2 Hours
2	**Storage Security**	**8 Hours**
2.1	Securing the storage Infrastructure - Information Security Framework,	1 Hour
2.2	Risk Triad	1 Hour
2.3	Storage Security Domains	2 Hours
2.4	Security Implementation in Storage Networking	2 Hours
2.5	Securing Storage Infrastructure in virtualized and Cloud Environments	1 Hour
2.6	RSA and VMware Security Products.	1 Hour
3	**IoT Security**	**9 hrs**
3.1	Introduction: IoT and cyber-physical systems.	1 Hour
3.2	IoT security (vulnerabilities, attacks, and counter measures) - Common IoT attack types-Attack trees-Building an attack tree.	2 Hours
3.3	Security engineering for IoT development-Secure design-Safety and security design.	1 Hour
3.4	IoT security lifecycle-The secure IoT system implementation lifecycle - Implementation and integration-IoT security CONOPS document.	2 Hours
3.5	Network and security integration.	1 Hour

3.6	System security verification and validation (V&V)	1 Hour
3.7	Security training-Secure configurations	1 Hour
4	**Cloud Security**	**8 hrs**
4.1	Introduction to Cloud and Virtualization, Cloud Security - Cloud Security Risks-Security: The top concern for cloud users-Privacy and privacy impact assessment	2 Hours
4.2	Trust, Operating System Security	1 Hour
4.3	VM Security	1 Hour
4.4	Security of Virtualization	2 Hours
4.5	Security Risks Posed by Shared Images	1 Hour
4.6	Security Risks Posted by Management OS	1 Hour
5	**Distributed Systems Security**	**10 hrs**
5.1	Introduction to Distributed systems and Blockchain - Blockchain Overview, Blockchain Building Blocks	2 Hours
5.2	Blockchain Commercial Use cases	1 Hour
5.3	Blockchain Military Cyber Operations Use cases, Blockchain Challenges	1 Hour
5.4	Overview of Attack Surfaces in Blockchain - Overview of Blockchain and its Operations	1 Hour
5.5	Blockchain Attacks	1 Hour
5.6	Blockchain's Peer to Peer System	1 Hour
5.7	Application Oriented Attacks	1 Hour
5.8	A Blockchain-based Solution to Automotive Security and Privacy	1 Hour
5.9	The Proposed Framework, Applications.	1 Hour

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT398	EMBEDDED SYSTEM	VAC	3	1	0	4

Preamble: Embedded Systems course is intended to deliver students the concepts of embedded hardware and software. It also helps them to develop embedded systems using Raspberry Pi and Arduino.

Prerequisites:

- Basics of Computer programming,
- ITT296 Microprocessor and Microcontroller programming,
- ITT397 Advanced Computer Architecture

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

CO No.	Course Outcome (CO)	Bloom's Category Level
CO1	Discuss the concepts of embedded systems, micro controllers and sensors	Level2: Understand
CO2	Describe examples of embedded systems, buses, protocol and ARM Processors	Level 2: Understand
CO3	Implement embedded system design techniques and software development tools	Level 3: Apply
CO4	Apply the basic concepts of real time operating systems using Raspberry Pi.	Level 3: Apply
CO5	Develop small or medium scale embedded systems using Arduino	Level 3: Apply

Mapping of course outcomes with program outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	1	-	-	2	1	-	-	-	-	-
CO2	3	3	3	-	2	2	2	-	-	-	-	2
CO3	3	3	3	-	2	2	1	-	-	-	-	2
CO4	3	3	3	-	3	2	2	-	3	2	2	3
CO5	3	3	3	-	3	3	2	-	3	2	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	Continuous Assessment Test		End Semester Examination
	Test 1(Marks)	Test 2(Marks)	
Remember	15	15	30
Understand	30	15	30
Apply	5	20	40
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.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):
1. With the help of a diagram explain the generic model of an embedded system.
2. Working principle of sensors.

Course Outcome 2 (CO2):
1. Describe examples of embedded systems.
2. Explain buses and protocols in Embedded systems.

Course Outcome 3 (CO3):
1. Describe the importance of design techniques in the development of embedded systems.
2. How software development tools helps in embedded programming.
3. Consider an embedded system-GPS moving map that displays the map of a terrain around the

users' current position. List the various requirements to design GPS moving map and prepare a requirement form or chart.

Course Outcome 4 (CO4):

1. With an example explain real time scheduling algorithm.
2. Write a program to illustrate reading a button using PI.

Course Outcome 5 (CO5):

1. With an example illustrate Read/write operation for Digital and Analog Input/output.
2. Write an Arduino Sketch to Read/write operation from a digital camera.

Model Question Paper

Course Code: ITT398

Course Name: EMBEDDED SYSTEM

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

PART A

(Each question carries 3 Marks) (10*3=30)

1. Explain the features of embedded system.
2. Briefly discuss about the working principle of IR sensor.
3. Define buses and protocol.
4. List any 3 applications of embedded system.
5. Why it is said that a requirement bug is more costlier than a coding bug?
6. Explain the difference between emulator and simulator.
7. Write example for hard, soft and firm real time tasks.
8. Differentiate Arduino and Raspberry Pi.
9. Make a program that light up LED in any pattern.
10. Write an Arduino sketch to read a RF Id tag

PART B

(Each full question carries 14 marks) (5*14=70)

11. a) What are the merits of embedded systems? (7 marks)

b) Distinguish control interface and data interface for an ADC. (7 marks)

OR

12. a) Explain the working of range and temperature sensor. (8 marks)

b) What are the factors to be considered for low power design of embedded systems? (6 marks)

13. a) The content of some registers are given as: R1=0xEF00DE12, R2=0x0456123F, R5=4, r6=28 Find the result when following instructions are executed?

i) LSL R1,#8
ii) ASR R1,R5
iii) ROR R2,R6
iv) LSR R2,#5 (8 marks)

b) With a neat diagram explain fundamental blocks of a mobile phone and explain the function of each block (6 marks)

OR

14. a) With diagram explain Following buses
i) SPI
ii) USB. (8 marks)
b) Explain ARM Processor's Memory Organization with neat diagram. (6 marks)

15. a) Consider an embedded system-GPS moving map that displays the map of a terrain around the users' current position. List the various requirements to design GPS moving map and prepare a requirement form or chart. (7 marks)

b) Explain the embedded program development environment. (7 marks)

OR

16. a) Discuss how quality is assured by verifying specification. (7 marks)
b) Discuss Software Development Tools used in embedded systems. (7 marks)
17. a) Explain Inter process Communication Mechanisms. With example. (7 marks)
b) What are the general characteristics that make Raspberry Pi become popular in market. (7 marks)

OR

18. a) Explain about Real time scheduling algorithms. (7 marks)
b) Design a lamp timer using Raspberry Pi and schedule the timer using Cron utility such that lamp is switched ON at 10pm and Switched OFF at 5pm only for weekends . (7 marks)

19. a) Write an Arduino sketch to display only EVEN numbers using 7 segments display in common anode connection. (7 marks)

b) A manufacturer wants to design a new safety feature into their cars. The safety feature simply alerts the driver if the speed of the car exceeds 100 km/h by beeping a buzzer constantly until the speed drops below 100 km/h again. Develop a project, suitable for an Arduino that implements the functionality required by the manufacturer. Assume that the speedometer of the car is connected to ADC pin 5 of the Arduino and the buzzer is connected to digital pin 13. The range of the speedometer is from 0 km/h to 140km/h where:

□ 0 km/h represents an ADC value of 0
□ 140 km/h represents an ADC value of 1023
. (7 marks)

OR

20. a) Write an Arduino program for Getting Location from a GPS. (7 marks)

b) Write an Arduino program that light up LED from top to bottom and then goes backward with only one LED is ON at any time. (7 marks)

Syllabus

Module 1: Embedded Systems-Introduction (10 hours)
Embedded Systems-Introduction, Features, Model, Merits, Classification. The Hardware Point of View- Microcontroller Unit, 8 bit MCU, Memory for Embedded System-Flash memory, Low Power Design Sensors, ADCs and Actuators-Temperature Sensors, Light Sensors, Range Sensors, Humidity Sensors, Other Sensors, Analog to Digital Converters, Actuators.
Module 2: ARM Processor, Buses and Protocols (10 hours)
ARM Processor- Processor and Memory Organization, Data Operations, Flow of Control Buses and Protocols – Defining Buses and Protocols, On-board buses for Embedded Systems, External Buses, Automotive Buses Examples of Embedded Systems –Automotive Electronics, RFID, Robotics, Brain Machine Interface
Module 3: Embedded Systems Design Techniques and Software Development Tools (7 hours)
Embedded Systems Design Techniques – Design Methodologies, Requirements Analysis, Specifications, System Analysis and Architecture Design, Quality Assurance, Design Examples Software Development Tools-Embedded program development, Downloading the hexfile to Non-volatile memory- Emulator- Hardware simulator.
Module 4: RTOS and Raspberry Pi (9 hours)
Real Time Operating Systems, Real time Scheduling algorithms-RM,EDF Inter process Communication Mechanisms Raspberry Pi – Introduction, Python and Raspberry Pi, Arduino and Raspberry Pi, Basic Input and Output, Programming Inputs and Outputs with Python
Module 5: Interfacing of micro-controllers (9 hours)
Arduino – Introduction-Making the Sketch Simple Digital and Analog Input-Using a Switch, Reading a Keypad, Reading Analog Values Getting Input from Sensors-Detecting Movement, light, motion, distance, vibration, sound and temperature Reading RFID Tags, Getting Location from a GPS Visual Output-Connecting and Using LEDs Physical Output-Controlling the Position of a Servo Remotely Controlling External Devices-Controlling a Digital Camera

Text Books

1. Embedded Systems : An Integrated Approach -Lyla B Das, Pearson Education, 2013
2. Getting Started With Raspberry Pi-Matt Richardson, Shawn Wallace, O'Reilly, 2013
3. Arduino Cookbook -Michael Margolis, O'Reilly, 2011
4. Modern Embedded Computing -Peter Barry, Patrick Crowley, Morgan Kaufmann 2012
5. Computers as Components : Principles of Embedded Computing System Design -Wayne Wolf, Elsevier

Reference Books

1. Embedded Systems- Architecture Programming and design -Raj Kamal , McGraw-Hill, second edition
2. Introduction to Arduino Alan G. Smith , CreateSpace Independent Publishing Platform , 2011

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Embedded Systems-Introduction**	**10 Hours**
1.1	Embedded Systems-Introduction, Features	1 Hour
1.2	Embedded Systems-Model, Merits, Classification.	1 Hour
1.3	The Hardware Point of View- Microcontroller Unit,	1 Hour
1.4	Memory for Embedded System-Flash memory	1 Hour
1.5	8 bit MCU	1 Hour
1.6	Low Power Design	1 Hour
1.7	Sensors -Temperature Sensors, Light Sensors	1 Hour
1.8	Sensors-Range Sensors, Humidity Sensors, Other Sensors,	1 Hour
1.9	Actuators	1 Hour
1.10	Analog to Digital Converters	1 Hour
2	**ARM Processor,Buses and Protocols**	**10 Hours**
2.1	ARM Processor- Processor and Memory Organization	1 Hour
2.2	ARM-Data Operations	1 Hour
2.3	ARM- Flow of Control	1 Hour

2.4	Buses and Protocols – Defining Buses and Protocols	1 Hour
2.5	On-board buses for Embedded Systems	1 Hour
2.6	External Buses	1 Hour
2.7	Automotive Buses	1 Hour
2.8	Examples of Embedded Systems –Automotive Electronics	1 Hour
2.9	RFID, Robotics	1 Hour
2.10	Brain Machine Interface	1 Hour
3	**Embedded Systems Design Techniques and Software Development Tools**	**7 Hours**
3.1	Embedded Systems Design Techniques	1 Hour
3.2	Design Methodologies, Requirements Analysis and Architecture	1 Hour
3.3	Specifications, System Analysis	1 Hour
3.4	Quality Assurance, Design Examples	1 Hour
3.5	Software Development Tools-Embedded program development	1 Hour
3.6	Downloading the hexfile to Non-volatile memory	1 Hour
3.7	Emulator- Hardware simulator	1 Hour
4	**RTOS and Raspberry Pi**	**9 Hours**
4.1	Real Time Operating Systems	1 Hour
4.2	Real time Scheduling algorithms-RM	1 Hour
4.3	Real time Scheduling algorithms-EDF	2 Hours
4.4	Inter process Communication Mechanisms	2 Hours
4.5	Raspberry Pi – Introduction	1 Hour
4.6	Python and Raspberry Pi, Arduino and Raspberry Pi	1 Hour
4.7	Basic Input and Output, Programming Inputs and Outputs with Python	1 Hour
5	**Interfacing of micro-controllers**	**9 Hours**
5.1	Arduino – Introduction-Making the Sketch	1 Hour
5.2	Simple Digital and Analog Input-Using a Switch	2 Hours
5.3	Reading a Keypad, Reading Analog Values	1 Hour
5.5	Reading RFID Tags, Getting Location from a GPS	2 Hours
5.6	Visual Output-Connecting and Using LEDs	1 Hour
5.7	Physical Output-Controlling the Position of a Servo	1 Hour
5.8	Remotely Controlling External Devices-Controlling a Digital	1 Hour