

CBCS SCHEME

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22SCN/SAM/SCS/SDS/SAD/VSA/VSC/VCS/SCR/ISS11

First Semester M.Tech Degree Examination, Dec.2023/Jan.2024

Mathematical Foundation of Computer Science

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1			M	L	C												
Q.1	a.	Define vector space and given an example.	08	L1	CO1												
	b.	Prove that : i) $\alpha 0 = 0$, for all α in F ii) $0v = 0$ for all v in V iii) $\alpha(u - v) = \alpha u - \alpha v$, for all $\alpha \in F$ and for all u, v in V iv) $\alpha v = 0 \Rightarrow \alpha = 0$ or $v = 0$, $\alpha \in F, v \in V$.	12	L2	CO1												
OR																	
Q.2	a.	If W_1 and W_2 are two subspaces of a vector space $V(F)$, prove that their sum $W_1 + W_2$ is a subspace of $V(F)$.	7	L2	CO1												
	b.	Define the following terms, i) Linearly independent ii) Basis and dimension iii) Linear transformation.	7	L2	CO1												
	c.	If u, v, w be vector spaces over the field F and $T_1 : v \rightarrow w, T_2 : u \rightarrow v$ be two linear transformations prove that $T_1 T_2$ is a linear transformation u to w .	6	L2	CO1												
Module – 2																	
Q.3	a.	Define orthogonality with example and prove that x is orthogonal to y and y orthogonal to z . If for the vector $x = (1, 2, 3)^T, y = (-3, -6, 5)^T, z = (0, 5, 6)^T$ in \mathbb{R}^3 .	10	L2	CO2												
	b.	Use the Gram-Schmidt orthogonal process to construct an orthonormal set of vectors from the linearly independent set $\{x_1, x_2, x_3\}$, where $x_1 = (1, 1, 0)^T, x_2 = (0, 1, 1), x_3 = (1, 0, 1)^T$.	10	L2	CO2												
OR																	
Q.4	a.	Find the least – squares solution of the inconsistent system $Ax = b$ for : $A = \begin{bmatrix} 4 & 0 \\ 0 & 2 \\ 1 & 1 \end{bmatrix}, b = \begin{bmatrix} 2 \\ 0 \\ 11 \end{bmatrix}$.	10	L2	CO2												
	b.	Find the St-line of best fit to the data : <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr> <td>y</td><td>4</td><td>6</td><td>3</td><td>5</td><td>7</td></tr> </table>	x	1	2	3	4	5	y	4	6	3	5	7	10	L2	CO2
x	1	2	3	4	5												
y	4	6	3	5	7												
Module – 3																	
Q.5	a.	Find the eigen values and eigen vectors of $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$.	10	L2	CO3												
	b.	Find a QR factorization of $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$.	10	L2	CO3												

OR

Q.6	a.	Find a singular value decomposition of $A = \begin{bmatrix} 1 & -1 \\ -2 & 2 \\ 2 & -1 \end{bmatrix}$.	10	L2	CO3
	b.	Compute the same mean and the co-variance of matrix $\begin{bmatrix} 1 & 4 & 7 & 8 \\ 2 & 2 & 8 & 4 \\ 1 & 13 & 1 & 5 \end{bmatrix}$.	10	L2	CO3

Module – 4

Q.7	a.	Define the testing hypothesis and the nine items of a sample gave the values 45, 47, 50, 52, 45, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5?	10	L2	CO4
	b.	Define goodness of fit for λ^2 . Distribution and the theory predicts the proportions of beans in the four groups G_1, G_2, G_3, G_4 should be in the ratio 9 : 3 : 3 : 1. In expt with 1600 beans the number in the groups were 882, 313, 287 and 118. Does the experimental result support the theory?	10	L2	CO4

OR

Q.8	a.	Explain the analysis of variance of one way classification.	10	L2	CO4
	b.	Two independent samples of sizes 9 and 8 gave the sum of squares of deviations from their respective means as 160 and 91 respectively. Can the samples be regarded as drawn from the two normal population with same variance? (Given $F_{0.05}(8, 7) = 3.73$, $F_{0.05}(7, 8) = 3.50$).	10	L2	CO4

Module – 5

Q.9	a.	Define Fourier series and find the Fourier series of $f(x) = x - x^2$ in $(-\pi, \pi)$	10	L2	CO5
	b.	Prove that $\int_{-l}^l f(x) ^2 dx = l \left\{ \frac{1}{2} a_0^2 + \sum_{x=1}^{\infty} (a_x^2 + b_x^2) \right\}$ using Parseval's formula.	10	L2	CO5

OR

Q.10	a.	Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2, & x \leq 1 \\ 0, & x > 1 \end{cases}$ Hence evaluate $\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$.	10	L3	CO5s
	b.	Find the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$. Hence derive Fourier sine transform of $d(x) = \frac{x}{1+x^2}$.	10	L2	CO5

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22SCN/SCS/SAM/SAD/SDS/VSC/VSA/SCR12

First Semester M.Tech. Degree Examination, Dec.2023/Jan.2024

Fundamentals of Data Sciences

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks, L: Bloom's level, C: Course outcomes.

Module – 1				M	L	C
Q.1	a.	Explain Data Science and big data assumptions.		10	L2	CO1
	b.	What is Datafication and the current landscape.		10	L2	CO1
OR						
Q.2	a.	Illustrate Drew Conway's representation of data science.		10	L2	CO1
	b.	Explain Data Scientist profile.		10	L2	CO1
Module – 2						
Q.3	a.	Explain the significance of Exploratory data analysis.		10	L2	CO2
	b.	Explain Data Science process with neat block diagram.		10	L2	CO2
OR						
Q.4	a.	Explain machine learning Algorithms in Data Science and what are broad generalizations for consideration.		10	L2	CO2
	b.	Explain Linear Regression in Data Science.		10	L2	CO2
Module – 3						
Q.5	a.	Why is Linear Regression a poor choice for filtering?		10	L2	CO2
	b.	Exemplify Naïve Baye's algorithm appraising Three diagrams to build intuition.		10	L3	CO2
OR						
Q.6	a.	Explain Logistic Regression and problem of classifier selection.		10	L2	CO2
	b.	Write down the differences between Logit versus Inverse – Logit and show underlying mathematics in M6D Logistic Regression.		10	L2	CO2
Module – 4						
Q.7	a.	Explain feature generation, Feature extraction and wrappers in Data Science.		10	L2	CO3
	b.	As a Data scientist what should be selection criteria in Feature extraction process.		10	L3	CO3

OR					
Q.8	a.	Explain dependency of Decision tree in Data Science Domain.	10	L2	CO3
	b.	Explain working of Random Forest Algorithm.	10	L2	CO3
Module – 5					
Q.9	a.	Explain commonly used terminologist in Social network.	10	L2	CO4
	b.	Explain the working of MapReduce Technique.	10	L2	CO4
OR					
Q.10	a.	Enlist the basic principles of Data visualization.	10	L1	CO4
	b.	What is data clustering in Data science Domain?	10	L2	CO4

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22SCS/SCN13

First Semester M.Tech. Degree Examination, Dec.2023/Jan.2024

Advances in Computer Networks

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1			M	L	C
Q.1	a.	With a supporting diagram, describe the process of cost effective resource sharing.	10	L1	CO1
	b.	What is the need of Layering? Describe the TCP/IP architecture used for internet based applications.	10	L1	CO1
OR					
Q.2	a.	What do you mean by Delay X Bandwidth product? Explain how it is influencing High – Speed Networks.	10	L3	CO2
	b.	Explain Reliable Transmission Strategy with a brief explanation of any of the Automatic Repeat Request (ARQ) algorithms.	10	L3	CO2
Module – 2					
Q.3	a.	What is the need of DHCP? Explain its working with suitable diagrammatic representation.	10	L2	CO3
	b.	Give the details of forwarding tables used in datagram and virtual circuit switching. Illustrate source routing with a diagram.	10	L2	CO3
OR					
Q.4	a.	How do you describe Virtual Private Network (VPN)? Justify your answer with an IP tunnel as a virtual link.	10	L1	CO1
	b.	Explain Address Resolution Protocol (ARP) for mapping IP addresses into Ethernet addresses.	10	L1	CO1
Module – 3					
Q.5	a.	Describe Routing Information Protocol (RIP), with an example network running on it. Also describe its RIP _{v2} packet format briefly.	10	L1	CO1
	b.	Define The Open Shortest Path First Protocol (OSPF) features to the basic link – state algorithm along with its header format.	10	L1	CO1
OR					
Q.6	a.	Discuss the challenges in Inter domain Routing and mention how to overcome that using BGP (Border Gateway Protocol).	10	L2	CO3
	b.	Describe the features of IPV ₆ and header with a neat block diagram.	10	L1	CO1

Module – 4					
Q.7	a.	Describe Simple Demultiplexer along with its header format. Also explain the message queue strategy of UDP (User Datagram Protocol).	10	L2	CO3
	b.	What is End – to – End issues? Explain how TCP addresses these issues.	10	L2	CO3
OR					
Q.8	a.	Describe the process of TCP oriented reliable byte streaming with the connection establishment / termination implemented to control the flow.	10	L3	CO2
	b.	Define Triggering Transmission with an example of Silly Window Syndrome.	10	L2	CO3
Module – 5					
Q.9	a.	What do you mean by Congestion – Avoidance Mechanism? Explain the RED (Random Early Detection) mechanism for Congestion – Avoidance.	10	L2	CO3
	b.	Mention Domain Hierarchy with respect to the DNS (Domain Name System) to identify hosts.	10	L1	CO1
OR					
Q.10	a.	Discuss the process of Network Management using SNMP. (Simple Network Management Protocol) with its specialized request / reply procedure.	10	L2	CO3
	b.	Define Source – Based Congestion Avoidance in detail.	10	L2	CO3

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22SCS/SCN14

First Semester M.Tech. Degree Examination, Dec.2023/Jan.2024

Internet of Things and Applications

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1				M	L	C
Q.1	a.	What does the term “Internet of things” denote? Mention the technical challenges on those which IoT relies on?	10	L1	CO1	
	b.	Discuss the typical requirement of distributed control/M2M.	10	L3	CO1	
OR						
Q.2	a.	Discuss the scope of Internet of Things.	10	L3	CO1	
	b.	With a neat diagram, illustrate the taxonomy of applications in the M2M context.	10	L3	CO1	
Module – 2						
Q.3	a.	List the properties and requirements of M2M applications.	10	L3	CO2	
	b.	With a suitable diagram, explain M2M in 3-GPP architecture.	10	L2	CO2	
OR						
Q.4	a.	Why the IoT standards of the underlying technologies are important? Mention few areas in which standardization required?	10	L3	CO2	
	b.	Write a short note on : i) IETF IPv6 over low power WPAN ii) ZigBee IP (ZIP)	10	L2	CO2	
Module – 3						
Q.5	a.	With a neat sketch, describe the interview of Zigbee protocol stack?	10	L2	CO3	
	b.	What are capabilities of IPV6 protocol? Write and explain the IPV6 pocket structure.	10	L2	CO3	
OR						
Q.6	a.	What is NFC? Explain how the communication between interrogator and NFC device takes place?	10	L2	CO3	
	b.	Describe the IPv6 tunneling technique illustrating with the suitable diagram.	10	L2	CO3	
Module – 4						
Q.7	a.	Write the domain model of the home intrusion detection system.	10	L2	CO4	
	b.	Explain the deployment design of the weather monitoring system.	10	L2	CO4	

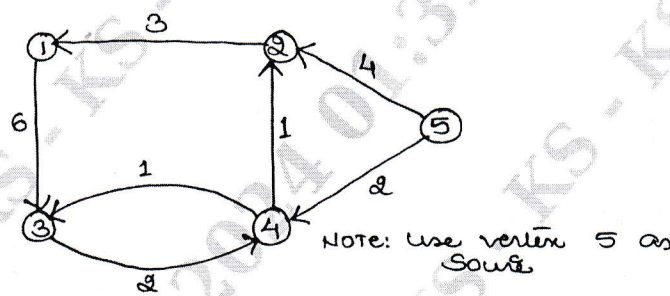
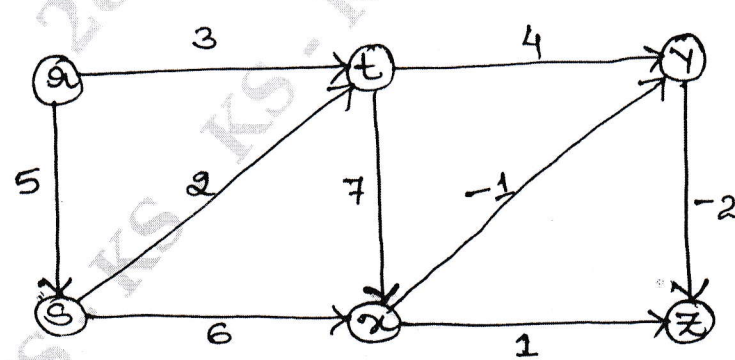
OR					
Q.8	a.	Explain the information model, controls service and service specification for the smart parking system? Illustrate with the suitable diagrams.	10	L2	CO4
	b.	Write a program in python for the controller native service for smart parking.	10	L3	CO4
Module – 5					
Q.9	a.	Explain the functions of the key processes of Hadoop with the necessary diagram.	10	L2	CO4
	b.	What is Hadoop YARN? Explain the key components of YARN.	10	L2	CO4
OR					
Q.10	a.	How does a Hadoop Map Reduce workflow for batch analysis of IoT data works? Explain.	10	L3	CO4
	b.	What are various high level tools for data analysis supported by apache spark? Discuss the components of spark cluster with a suitable diagram.	10	L3	CO4

First Semester M.Tech Degree Examination, Dec.2023/Jan.2024 Advanced Algorithms

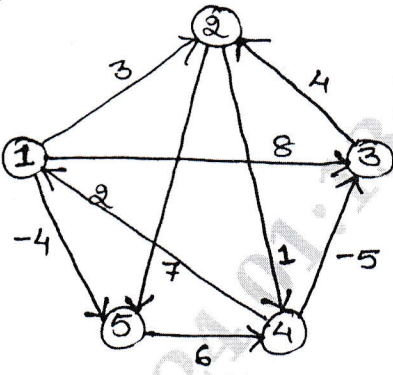
Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Explain the following asymptotic notations : 0 , Ω , θ with suitable examples.	10	L2	CO1
	b.	Apply recursion Tree method to find solution to the recurrence $T(n) = 3T(n/4) + Cn^2$. Use the substitution method to verify your answer.	10	L2	CO1
OR					
Q.2	a.	Define amortized analysis. Explain accounting method with an example.	10	L2	CO1
	b.	Define master theorem. Solve $T(n) = T(2n/3) + 1$ using the same.	10	L2	CO1
Module – 2					
Q.3	a.	Write Bellman – Ford algorithm for solving single – source shortest paths problems. Trace it for the following graph. Refer Fig.Q3(a).	10	L2	CO1
		 <p style="text-align: center;">Fig.Q3(a)</p>			
	b.	Find the shortest path from the source vertex 'r' to the remaining vertices in DAG, using DAG shortest path algorithm. Refer Fig.Q3(b).	10	L2	CO1
		 <p style="text-align: center;">Fig.Q3(b)</p>			

OR

Q.4	a.	Explain the Johnson's algorithm and apply the same for the following graph : Refer Fig.Q4(a).	10	L2	CO1
		 <p>Fig.Q4(a)</p>			
	b.	Describe how to find maximum bipartite matching for a given graph, considering suitable example.	6	L2	CO1
	c.	Define FFT and DFT.	4	L1	CO1

Module – 3

Q.5	a.	Define group. Prove that the system (\mathbb{Z}_n^*, \cdot) is a finite abelian group.	10	L2	CO2
	b.	Explain Chinese remainder theorem. Find all possible solutions for the set equations : $x \equiv 4 \pmod{5}$, $x \equiv 5 \pmod{11}$.	10	L2	CO2

OR

Q.6	a.	Write RSA public key cryptosystem algorithm and solve the following problem with $p = 11$, $q = 29$, $\eta = 319$ and $c = 3$ find the value of d and encrypt the message 100.	10	L2	CO2
	b.	Give extended Euclid algorithm to find GCD of integers and apply the algorithm for (99, 78).	10	L2	CO2

Module – 4

Q.7	a.	Write a Robin – Karp string matching algorithm. search for a pattern 31415 in the text string 2359023141526739921 with $q = 13$.	10	L2	CO2
	b.	Show the comparison the naïve string matcher makes from pattern $P = 0001$ in the text $T = 00001000101$.	10	L2	CO2

OR

Q.8	a.	Write Finite – Automata – Matcher algorithm and construct the string – matching automata for the pattern $P = aabab$ and illustrate its operation on text string $T = aaababaabaabab$.	10	L2	CO2
	b.	Write Boyer – Moore algorithm for string matching problem. Illustrate it on the following input : Text T : which_Finally_Halts__ at _ that Pattern P : at _ that.	10	L2	CO2

Module – 5

Q.9	a.	Explain Monte – Carlo and Las Vegas algorithm with appropriate examples.	10	L2	CO3
	b.	Explain in detail the Miller – Rabin randomized primality testing algorithm.	10	L2	CO3

OR

Q.10		Write a note on probabilistic algorithm and randomizing deterministic algorithms.	20	L2	CO3
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22RMI16

First Semester M.Tech. Degree Examination, Dec.2023/Jan.2024

Research Methodology and IPR

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Describe the different types of Research, clearly pointing out the difference between an experiment and a survey.	10	L2	CO1
	b.	List and explain four qualities of a good Research.	10	L1	CO1
OR					
Q.2	a.	With a neat diagram, describe the different steps involved in a Research process.	15	L2	CO1
	b.	List and explain five techniques involved in defining a Research problem.	5	L2	CO1
Module – 2					
Q.3	a.	Explain the meaning and significance of a Research design.	10	L2	CO2
	b.	List and explain the features of a good Research design.	10	L2	CO2
OR					
Q.4	a.	What are the steps involved to conduct literature review for research and explain each one briefly.	15	L2	CO2
	b.	Explain the research design in case of hypothesis – testing research studies.	5	L2	CO2
Module – 3					
Q.5	a.	What do you mean by 'Sample Design'? What points should be taken into consideration by a Researcher in developing a sample design for the Research project?	10	L3	CO2
	b.	Mention the characteristics of good research sample design and brief about the different types of sample designs.	10	L2	CO2
OR					
Q.6	a.	Enumerate the different methods of collecting data. Which one is the most suitable for conducting enquiry regarding family welfare programme in India? Explain its merits and demerits.	10	L3	CO2
	b.	Brief about Research case study method and its limitations.	10	L3	CO2
Module – 4					
Q.7	a.	What is Hypothesis? What characteristics it must possess in order to be a good research hypothesis?	10	L2	CO3

	b.	Distinguish between the following : i) Simple hypothesis and Composite hypothesis. ii) Null hypothesis and Alternative hypothesis.	10	L3	CO3
OR					
Q.8	a.	What is Chi – Square test? Explain its significance in statistical analysis.	10	L1	CO3
	b.	State five conditions that should be satisfied before Chi – Square test can be applied.	10	L2	CO3
Module – 5					
Q.9	a.	Write a brief note on the ‘task of Interpretation’ in the context of Research Methodology.	10	L3	CO3
	b.	Describe the precautions that the researcher should take while interpreting his/her findings of research.	10	L3	CO3
OR					
Q.10	a.	Explain the following three main features of TRIPS. (<u>T</u> rade_ <u>R</u> elated aspects of <u>I</u> ntellectual <u>P</u> roperty Right <u>s</u>) : i) Standards. ii) Enforcement. iii) Dispute settlement.	10	L2	CO3
	b.	Write short notes on : i) Patent Cooperation Treaty (PCT). ii) World Intellectual Property Organisation (WIPO).	10	L2	CO3

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