
M23BMATS401

Maharaja Education Trust (R), Mysuru
MAHARAJA INSTITUTE OF TECHNOLOGY MYSORE
An Autonomous Institute, affiliated Visvesvaraya Technological University, Belagavi
Belawadi, Srirangapatna Taluk, Mandya – 571 477
Approved by AICTE, New Delhi |Recognized by Govt. of Karnataka|

MODEL QUESTION PAPER
IV Semester B.E -Semester End Examinations
Mathematics -IV for Computer Science and Engineering Stream

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

Answer any five full questions choosing one complete question from each module.

Sl. No.	Questions	Marks	CO	RBT Level
	Module 1			
1 a)	Write the significance of correlation coefficient `r`	4	1	L2
b)	Find Karal Pearson`s coefficient of correlation and regression lines for the data x: 5, 7, 8, 10, 11, 13, 16 y: 33, 30, 28, 20, 18, 16, 9	8	1	L2
c)	The pressure p and volume v of a gas are related by the equation $pv^{\gamma} = k$ where γ and k are constants. Fit this equation to the following data. x: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 y: 1.62, 1.00, 0.75, 0.62, 0.52, 0.46	8	1	L2
	OR			
2 a)	Two lines of regression are $5y - 8x + 17 = 0$ and $2y - 5x + 14$, find i) the means values of x and y. ii)the coefficient of correlation between x and y.	4	1	L2
b)	Fit a parabola $y = ax^2 + bx + c$ to the given data x: 0, 1, 2, 3, 4 y: -4, -1, 4, 11, 20	8	1	L3
c)	Find rank correlation coefficient to the following data x: 68, 64, 75, 50, 64, 80, 75, 40, 55, 64 y: 62, 58, 68, 45, 81, 60, 68, 48, 50, 70	8	1	L3
	Module 2			
3 a)	Test for convergence of the series: $\frac{1}{1.2} + \frac{1}{3.4} + \frac{1}{5.6} + \dots\dots$	4	2	L2
b)	Find Fourier series of $f(x) = 2\pi x - x^2$ in $[0,2\pi]$. Hence deduce $\sum_1^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$. Sketch the graph of f(x)	8	2	L2
c)	Obtain the Fourier series up to Second harmonics for the function f(x) x: 0, 1, 2, 3, 4, 5 $f(x)$: 9, 18, 24, 28, 26, 20	8	2	L2
	OR			

<table>
<tr><td>4 a)</td><td>Define convergence, divergence and oscillation of infinite series with example</td><td>4</td><td>2</td><td>L2</td></tr>
<tr><td>b)</td><td>Obtain the Fourier series for the function $f(x) = \begin{cases} \pi x & : 0 \le x \le 1 \\ \pi(2-x) & : 1 \le x \le 2 \end{cases}$ and deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$</td><td>8</td><td>2</td><td>L2</td></tr>
<tr><td>c)</td><td>Compute the constant term and first two harmonics of the Fourier series of f(x)
<table>
<tr><td>x</td><td>0</td><td>60</td><td>120</td><td>180</td><td>240</td><td>300</td><td>360</td></tr>
<tr><td>$f(x)$</td><td>1.0</td><td>1.4</td><td>1.9</td><td>1.7</td><td>1.5</td><td>1.2</td><td>1.0</td></tr>
</table></td><td>8</td><td>2</td><td>L3</td></tr>
<tr><td colspan="5">Module 3</td></tr>
<tr><td>3 a)</td><td>Define random variable? Give example.</td><td>4</td><td>3</td><td>L2</td></tr>
<tr><td>b)</td><td>An irregular six faced die is thrown and the expectation that in 10 thrown it will give 5 even numbers is twice the expectations that it will give 4 even numbers. How many times in 10,000 sets of 10 thrown would you expect it to give no even number?</td><td>8</td><td>3</td><td>L3</td></tr>
<tr><td>c)</td><td>Calculate the mean and SD of a normal distribution in which 31% are under 45 and 8% are over 64. Given (A(0.5) = 0.19 A(1.4) = 0.42</td><td>8</td><td>3</td><td>L3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>6. a)</td><td>The finite probability distribution of x is given by the following table
<table>
<tr><td>x</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>$f(x)$</td><td>k</td><td>2k</td><td>3k</td><td>4k</td><td>3k</td><td>2k</td><td>k</td></tr>
</table>
Find: (i) the value of k (ii) $p(x \le 1)$</td><td>4</td><td>3</td><td>L3</td></tr>
<tr><td>b)</td><td>Find the Mean, Variance and Standard deviation of Binomial distribution.</td><td>8</td><td>3</td><td>L2</td></tr>
<tr><td>c)</td><td>The Joint probability distribution for random variables X and Y is given below:
<table>
<tr><td>x / y</td><td>-2</td><td>-1</td><td>4</td><td>5</td></tr>
<tr><td>1</td><td>0.1</td><td>0.2</td><td>0</td><td>0.3</td></tr>
<tr><td>2</td><td>0.2</td><td>0.1</td><td>0.1</td><td>0</td></tr>
</table>
Determine the (i) Marginal distribution of x and y (ii) co-variance of x and y (iii) correlation between x and y</td><td>8</td><td>3</td><td>L2</td></tr>
<tr><td colspan="5">Module 4</td></tr>
<tr><td>7.a)</td><td>Define Sampling variable and Central limit theorem</td><td>4</td><td>4</td><td>L3</td></tr>
<tr><td>b)</td><td>In a rural area where no development was undertaken, 600 out of a sample of 800 farmers were independent. In other area, where development work was in progress, 700 out of a sample of 1000 formers were indepted . Would you consider that the latter area is enjoying greater prosperity as indepted by a lower percentage of indepted? ($Z_{0.05} = 1.645$)</td><td>8</td><td>4</td><td>L3</td></tr>
<tr><td>c)</td><td>The weights of 10 people of a locality are found to be 70, 67,62, 68, 61, 68, 70, 64, 64, 68, kgs. It is reasonable to believe that the average weights of the people of locality greater than 64kg? $[t_{0.05} = 2.26 \ for \ 9 \ d.f]$</td><td>8</td><td>4</td><td>L3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>8. a)</td><td>The daily wages in rupees of skilled workers in two cities are as follows
<table>
<tr><td>City</td><td>Sample size</td><td>variance</td></tr>
<tr><td>A</td><td>16</td><td>25</td></tr>
<tr><td>B</td><td>13</td><td>32</td></tr>
</table>
Test at 5% level the equality of variances of the wage's distribution in the two cities. (F0.05 = 2.48)</td><td>4</td><td>4</td><td>L3</td></tr>
</table>

b)	Below are given the gain in weights (in lbs) of pigs fed on two diets A and B Gain in weight Diet A: 25, 32, 30, 34, 24, 14, 32, 24, 30, 31, 35, 25 Diet B: 44, 34, 22, 10, 47, 31, 40, 30, 32, 35, 18, 21, 35, 29, 22 Test at 5% level of significance if the two diets differ significantly as regard their effect on increase in weight $[t_{0.05} = 2.06 \ for \ 25 \ d.f]$	8	4	L3
c)	Genetic theory state that children having parent of blood type M and the other of blood type N, will always be one of three types M, MN, N and that the proportion of these types on an average be 1:2:1. the report states that one of the 30 children having one M parent and one N parent, 30% are found to be of type M, 45% are found to be of type MN, and the remainder of type N, test the theory by chi square test. $[\chi^2_{0.05} = 11.07 \ for \ 5 \ d.f]$	8	4	L3
	Module 5			
9. a)	What is ANOVA? Write the principles of experimentation in ANOVA	4	5	L3
b)	To test the significance of the variation of the retail prices of a commodity in 3 cities 4 shops were chosen at random in each city & prices observed in rupees were as follows. Bombay: 16, 8, 12, 14 Kolkata: 14, 10, 10, 16 Delhi: 4, 10, 8, 8 To the data indicates that the prices in 3 cities are significantly different or not at 5%.	8	5	L3
c)	Analyse the variance in the following Latin square of yields (in kgs) of paddy where A, B, C, D denote the different methods of cultivation D122, A121, C123, B122 B124, C123, A122, D125 A120, B119, D120, C121 C122, D123, B121, A122 Examine whether the different methods of cultivation have given significantly different yields.	8	5	L3
	OR			
10a)	Explain Latin square design briefly.	4	5	L3
b)	Three varieties of coal were analysed by 4 chemists and the ash contents in the varieties was found as A: 8, 5, 5, 7 B: 7, 6, 4, 4 C: 3, 6, 5, 4 Discuss the significance of the difference between a) Chemists, b) Varieties of coal in respect of ash content.	8	5	L3
c)	The flowing data shows the number of worms Quarantined from the GI areas of four groups of muskrats in a carbon tetrachloride anthelmintic study. Conduct two-way ANOVA test. I: 33, 32, 26, 14, 30 II: 41, 38, 40, 23, 21 III: 12, 35, 46, 22, 11 IV: 38, 43, 25, 13, 26	8	5	L3

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IV Semester B.E Semester End Examinations
MODEL QUESTION PAPER

Duration: 1 hr. **Max. Marks: 50**

Subject: BIOLOGY FOR ENGINEERS

SERIES A

Note: Answer all the questions, each question carries one mark.

SI No.	Questions	CO's
1	What is the basic structural and functional unit of life? a) Organ b) Tissue c) Cell d) Molecule	1
2	Proteins are synthesized in: a) Golgi apparatus b) Ribosomes c) Mitochondria d) Lysosomes	1
3	Carbohydrates are stored in the liver as: a) Starch b) Glycogen c) Glucose d) Sucrose	1
4	The cell membrane is primarily composed of: a) Proteins and carbohydrates b) Lipids and proteins c) DNA and RNA d) Enzymes and vitamins	1
5	The smallest unit of protein structure is: a) Amino acid b) Nucleotide c) Polysaccharide d) Lipid	1
6	Which molecule is responsible for carrying genetic information in cells? a) Proteins b) Carbohydrates c) DNA d) Lipids	1
7	What type of bond joins amino acids in proteins? a) Glycosidic bond b) Peptide bond c) Hydrogen bond d) Ionic bond	1
8	DNA is composed of units called: a) Amino acids b) Nucleotides c) Monosaccharides d) Lipids	1
9	Which molecule is produced during glycolysis? a) Oxygen b) Carbon dioxide c) Glucose d) Pyruvate	1
10	What is the primary function of enzymes in biological systems? a) Transport oxygen b) Regulate cell growth c) Catalyze chemical reactions d) Store genetic information	1
11	The function of the cytoskeleton is to: a) Store genetic material b) Provide structural support to the cell c) Regulate cell division d) Produce proteins	1
12	Which organelle is involved in cellular digestion? a) Lysosome b) Mitochondria c) Chloroplast d) Peroxisome	1
13	Enzymes act as: a) Hormones b) Structural components c) Catalysts d) Energy molecules	1
14	Lipids primarily function as: a) Enzymes b) Energy reserves c) Hormones d) Genetic material	1
15	Nucleic acids are responsible for: a) Storing genetic information b) Providing energy c) Catalyzing reactions d) Forming cell membranes	1
16	Which organelle is known as the "control center" of the cell? a) Nucleus b) Golgi apparatus c) Endoplasmic reticulum d) Lysosomes	1
17	Which organelle is responsible for energy production in cells? a) Nucleus b) Mitochondria c) Golgi apparatus d) Lysosomes	1
18	Which vitamin is essential for blood clotting? a) Vitamin A b) Vitamin D c) Vitamin K d) Vitamin E	1
19	Which organelle modifies and packages proteins? a) Ribosome b) Lysosome c) Golgi apparatus d) Endoplasmic reticulum	1
20	Which type of cell would most likely contain large amounts of smooth endoplasmic reticulum (ER)? a) Muscle cell b) Liver cell c) Nerve cell d) Red blood cell	1
21	Which biomolecule is used as a primary fuel source during cellular respiration? a) Nucleic acids b) Carbohydrates c) Lipids d) Proteins	2
22	What is the primary function of enzymes in food processing? a) Enhance flavor b) Aid in digestion c) Speed up biochemical reactions d) Store nutrients	2

23	Which vitamin is fat-soluble and important for vision? a) Vitamin A b) Vitamin B c) Vitamin C d) Vitamin K	**2**
24	Polyhydroxyalkanoates (PHA) are primarily used for: a) Biodegradable plastics b) Protein synthesis c) Hormone production d) Drug delivery	**2**
25	Which of the following biomolecules is primarily responsible for providing energy to the body? a) Proteins b) Lipids c) Carbohydrates d) Nucleic acids	**2**
26	Which lipid is commonly used as biodiesel? a) Cholesterol b) Saturated fat c) Unsaturated fat d) Vegetable oil	**2**
27	Which biomolecule is used in the formation of hair and nails? a) Carbohydrates b) Proteins c) Lipids d) Nucleic acids	**2**
28	The use of nucleic acids in vaccines is primarily to: a) Provide energy b) Act as a catalyst c) Store genetic information d) Aid in digestion	**2**
29	What is the role of lipids in insulating neurons? a) Transport messages b) Store energy c) Form the myelin sheath d) Synthesize proteins	**2**
30	Which natural polymer is a primary source of bioplastics: a) Cellulose b) Proteins c) Lipids d) Starch	**2**
31	The study of plant burrs has inspired which type of bioengineering product? a) Adhesives b) Water filters c) Bioplastics d) Solar panels	**3**
32	Biodegradable plastics are often inspired by which natural polymer? a) Cellulose b) Spider silk c) Chitin d) Keratin	**3**
33	The echolocation ability of bats inspired the development of: a) Sonar systems b) MRI scanners c) Drug delivery devices d) Artificial photosynthesis	**3**
34	The structure of bird wings has influenced: a) Aircraft aerodynamics b) Insulation materials c) Water purification systems d) Drug development	**3**
35	Spider silk inspires bioengineering materials for: a) High-strength composites b) Solar panels c) Waterproof fabrics d) Prosthetics	**3**
36	Which bioinspired material mimics the water-repellent surface of lotus leaves? a) Self-cleaning fabrics b) Antibacterial coatings c) Biodegradable plastics d) Adhesives	**3**
37	What principle inspired the development of self-healing materials? a) Blood clotting b) Cell division c) Photosynthesis d) Animal regeneration	**3**
38	The structure of honeycombs is applied in bioengineering for: a) Aircraft design b) Biodegradable plastics c) Artificial organs d) Drug delivery systems	**3**
39	Sharkskin's antibacterial surface property is mimicked for: a) Self-cleaning materials b) Lightweight fabrics c) Protective coatings d) Medical implants	**3**
40	Which animal's beak inspired the design of high-speed trains? a) Hummingbird b) Kingfisher c) Penguin d) Falcon	**3**
41	What is one key benefit of scaffolds in tissue engineering? a) Supporting tissue regeneration and growth b) Enhancing oxygen delivery c) Stabilizing artificial organs d) Synthesizing biofuels	**4**
42	Artificial photosynthesis is designed to: a) Convert sunlight into energy b) Replace damaged DNA c) Generate bioelectricity from bacteria d) Improve drug delivery mechanisms	**4**
43	Bioremediation refers to: a) Using microorganisms to clean environmental pollutants b) Developing sustainable plastics c) Enhancing photosynthesis for energy production d) Printing organs for transplantation	**4**
44	Which bioengineering technology is used to create artificial tissues for drug testing? a) Bioprinting b) Bioimaging c) Electrical tongue d) Bioremediation	**4**
45	AI-assisted imaging software in bioengineering improves: a) Accuracy of medical imaging b) Biodegradable plastic production c) Regeneration of damaged tissues d) Protein synthesis in cells	**4**
46	Bioimaging is primarily used for: a) Capturing images of the body's internal structures b) Monitoring environmental changes c) Printing tissues and organs d) Developing prosthetic devices	**4**
47	DNA origami is used for: a) Designing nanoscale structures for drug delivery b) Synthesis of artificial tissues c) Regulating immune responses d) Recycling biological waste	**4**
48	What is the role of bioconcrete in construction? a) Self-repairing cracks b) Reducing building costs c) Improving thermal resistance d) Generating electricity	**4**
49	Bioprinting technologies allow for: a) Manufacturing living tissues and organs b) Synthesizing proteins for medical use c) Producing energy-efficient materials d) Filtering water with microorganisms	**4**
50	Artificial intelligence in bioengineering is applied to: a) Diagnose diseases b) Design energy-efficient buildings c) Perform DNA sequencing d) Generate biofuels	**4**

ANSWER - A

1. c) Cell
2. b) Ribosomes
3. b) Glycogen
4. b) Lipids and proteins
5. a) Amino acid
6. c) DNA
7. b) Peptide bond
8. b) Nucleotides
9. d) Pyruvate
10. c) Catalyze chemical reactions
11. b) Provide structural support to the cell
12. a) Lysosome
13. c) Catalysts
14. b) Energy reserves
15. a) Storing genetic information
16. a) Nucleus
17. b) Mitochondria
18. c) Vitamin K
19. c) Golgi apparatus
20. b) Liver cell
21. b) Carbohydrates
22. c) Speed up biochemical reactions
23. a) Vitamin A
24. a) Biodegradable plastics
25. c) Carbohydrates
26. d) Vegetable oil
27. b) Proteins
28. c) Store genetic information to stimulate immune response
29. c) Form the myelin sheath
30. a) Cellulose
31. c) Bioplastics
32. a) Cellulose
33. a) Sonar systems
34. a) Aircraft aerodynamics
35. a) High-strength composites
36. a) Self-cleaning fabrics
37. a) Blood clotting
38. a) Aircraft design
39. c) Protective coatings
40. b) Kingfisher
41. a) Supporting tissue regeneration and growth
42. a) Convert sunlight into energy
43. a) Using microorganisms to clean environmental pollutants
44. a) Bioprinting
45. a) Accuracy of medical imaging
46. a) Capturing images of the body’s internal structures
47. a) Designing nanoscale structures for drug delivery
48. a) Self-repairing cracks
49. a) Manufacturing living tissues and organs
50. c) Perform DNA sequencing

M23BCS402

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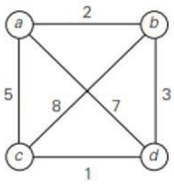
IV Semester B.E Semester End Examinations

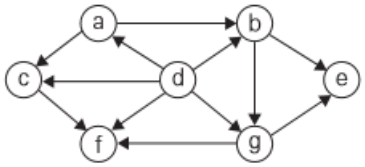
June /July 2025

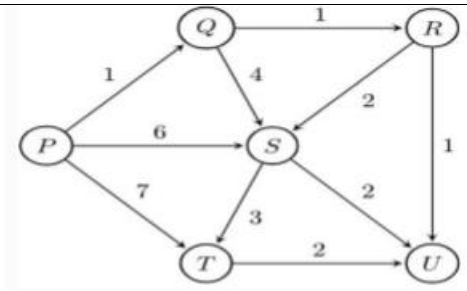
ANALYSIS AND DESIGN OF ALGORITHMS

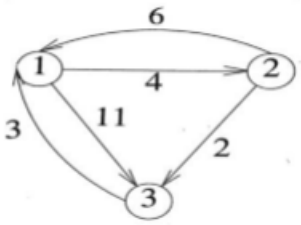
Duration: **3 hrs** Max. Marks: **100**

Answer five full questions choosing one complete question from each module.

Sl. No.	Questions	Marks	CO	RBT Level
	Module 1			
1 a)	Briefly explain the fundamentals of algorithmic problem solving	**6**	**1**	**L2**
b)	What are the general plan for analyzing the time efficiency of recursive algorithms.	**6**	**1**	**L2**
c)	Design an algorithm to find factorial using recursion. Also write the mathematical analysis.	**8**	**1**	**L4**
	OR			
2 a)	What are asymptotic notations? Explain each with an example.	**6**	**1**	**L2**
b)	Illustrate Bruteforce string matching method with an example.	**6**	**1**	**L2**
c)	Design and analyze an algorithm to find a given key from a list using Sequential search technique.	**8**	**1**	**L4**
	Module 2			
3 a)	Apply Quick Sort algorithm to the given list, **S, O, R, T, I, N, G** in alphabetical order. Draw the tree of the recursive calls made.	**8**	**2**	**L3**
b)	Write an algorithm to sort given elements using merge sort. Obtain its time complexity for best case, average case and worst case.	**6**	**2**	**L4**
c)	Apply exhaustive search for travelling salesman problem to the given graph in Fig. 	**6**	**2**	**L3**

	OR			
4 a)	Apply Strassen's algorithm for matrix multiplication to multiply the following matrices. $\begin{bmatrix} 1 & 0 & 2 & 1 \\ 4 & 1 & 1 & 0 \\ 0 & 1 & 3 & 0 \\ 5 & 0 & 2 & 1 \end{bmatrix} * \begin{bmatrix} 0 & 1 & 0 & 1 \\ 2 & 1 & 0 & 4 \\ 2 & 0 & 1 & 1 \\ 1 & 3 & 5 & 0 \end{bmatrix}$	**8**	**2**	**L3**
b)	Design an algorithm to sort elements using Insertion Sort technique. Obtain its time complexity for best case, average case and worst case.	**6**	**2**	**L4**
c)	Apply the DFS based algorithm to solve the topological sorting problem for the following graph. 	**6**	**2**	**L3**
	Module 3			
5 a)	Define AVL Trees. Explain its four rotation types with example.	**6**	**3**	**L2**
b)	Define 2-3trees. Construct 2-3 tree for the list **A,L,G,O,R,I,T,H,M**	**8**	**3**	**L3**
c)	Design comparisons counting sort algorithm. Obtain its efficiency.	**6**	**3**	**L4**
	OR			
6 a)	Define heap. Explain the properties of heap along with its representation.	**6**	**3**	**L2**
b)	Define heap. Construct heap by performing Heap sort for the given list **10,28,60,5,30,17,44.**	**8**	**3**	**L3**
c)	Design Horspool's algorithm for string matching. Obtain its time complexity.	**6**	**3**	**L4**
	Module 4			
7a)	Define minimum cost spanning tree. Write Prim's algorithm to find minimum cost spanning tree. Obtain its time efficiency.	**6**	**3**	**L4**
b)	Apply single source shortest path algorithm to the given graph by considering 'P' as source vertex.	**8**	**3**	**L3**



c)	Solve the instance 7,2,1,12,5 of the coin row problem.	**6**	**3**	**L3**
	OR			
8 a)	Define transitive closure. Write Warshall's algorithm to compute transitive closure. Obtain its time efficiency.	**6**	**3**	**L4**
b)	Find the all pairs shortest paths for the given graph using Floyd's algorithm. 	**8**	**3**	**L3**
c)	Construct the Huffman tree for the following data. symbols: A, B, C, D, E frequency: 0.1, 0.1, 0.2, 0.2, 0.4	**6**	**3**	**L3**
	Module 5			
9 a)	Explain the following: (i) Class P (ii) Class NP (iii) NP Complete Problem (iv) NP Hard Problem.	**6**	**4**	**L2**
b)	Solve the given instance of sum of subset problem S={5,10,12,13,15,18} d=30. Construct a state space tree.	**8**	**5**	**L3**
c)	Draw a binary decision tree for searching a four element sorted list by binary search. Explain in detail.	**6**	**5**	**L3**
	OR			
10a)	With an example, Explain Sahni's approximation algorithm for Knapsack problem.	**6**	**4**	**L2**
b)	Solve the given instance of 0/1 Knapsack problem using Branch and Bound technique. Given: Knapsack Capacity (m) = 16 ITEM / WEIGHT / VALUE 1 / 10 / $100 2 / 7 / $63 3 / 8 / $56 4 / 4 / $12	**8**	**5**	**L3**

c)	With the help of state space tree, Explain N-queens problem with example.	**6**	**5**	**L3**

M23BCS403

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III Semester B.E Semester End Examinations
(Model Question Paper)
Microcontroller

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

Answer five full questions choosing one complete question from each module.

Sl. No.	Questions	Marks	CO	RBT Level
	Module1			
1 a)	Explain the architecture of 8051microcontroller with block diagram.	**10**	**1**	**L2**
b)	Discuss the operation of various ports of 8051 with block diagram.	**10**	**1**	**L2**
	OR			
2 a)	Describe the following a) ALE b) SFR c) crystal oscillator d) PSW	**10**	**1**	**L2**
b)	Explain internal RAM organization of 8051 microcontroller.	**7**	**1**	**L2**
	Module2			
3 a)	Identify various addressing modes available in 8051 microcontroller.	**10**	**3**	**L3**
b)	Develop an ALP to add and subtract 10 bytes of data with comments and result.	**10**	**3**	**L3**
	ORL2			
4 a)	Make use of addressing modes to explain following instruction: a) MOVC A,@A+DPTR b) RLC A c) ADDC A, @Rp d) MUL AB	**10**	**3**	**L3**
b)	Develop an ALP to transfer 10 bytes of data from external RAM location starting with 2000h to internal RAM starting from 30h.	**10**	**3**	**L3**
	Module3			
5 a)	Explain jump instruction ranges with block diagram and apply the same to find factorial of a number.	**10**	**3**	**L3**
b)	Utilize the concept of stack to explain the operation of call and subroutine.	**10**	**3**	**L2**
	OR			
6 a)	Apply the addressing modes to explain the following jump instructions: a) SJMP radd b) CJNE @R_0 , #10, radd c) JNB b, radd d) DJNZ R_0, radd	**10**	**3**	**L3**
b)	Explain the concept of interrupt in 8051 with IE and IP register format.	**10**	**3**	**L2**
	Module4			
7a)	Describe the architectural features of ARM microcontroller with block	**10**	**3**	**L2**

	diagram.			
b)	Explain the ARM based embedded hardware device with block diagram.	**10**	**3**	**L2**
	OR			
8 a)	Explain the abstraction levels of embedded software.	**10**	**3**	**L2**
b)	Discuss the operation of CPSR in ARM microcontroller and highlight its importance.	**10**	**3**	**L2**
	Module5			
9 a)	Apply the load and store architecture to explain 3 stage and 5 stage pipelining in ARM microcontroller.	**10**	**4**	**L3**
b)	Identify various memory hierarchial levels in ARM microcontroller	**10**	**4**	**L3**
	OR			
10a)	Utilize the concept of memory and explain how main memory is directly mapped to cache memory.	**10**	**4**	**L3**
b)	Identify various cache policies and explain cache hit and miss rate available in ARM microcontroller.	**10**	**4**	**L3**

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M23BCB403

Maharaja Education Trust (R), Mysuru

MAHARAJA INSTITUTE OF TECHNOLOGY MYSORE

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IV Semester B.E Semester End Examinations

June /July 2025

FINANCIAL MANAGEMENT

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

Answer five full questions choosing one complete question from each module.

Sl. No.	Questions	Marks	CO	RBT Level
	Module 1			
1 a)	Explain the scope of financial management.	**8**	**1**	**L2**
b)	Explain the role and responsibilities of Financial Manager.	**6**	**1**	**L2**
c)	Discuss the objectives of Financial Management.	**6**	**1**	**L2**
	OR			
2 a)	Explain the types and steps in portfolio management.	**8**	**1**	**L2**
b)	Explain the concept of risk and returns.	**6**	**1**	**L2**
c)	Define portfolio management. Explain the components and types of portfolio management.	**6**	**1**	**L2**
	Module 2			
3 a)	Mr. Ramu. deposits Rs.20,000/- in a bank at 12% interest rate. Compute how much shall it grow at of 5 years, if interest is compounded annually, semi-annually and quarterly and monthly.	**8**	**2**	**L3**
b)	Compute the present value of the following cash stream if the discount rate is 12% Year / Cash inflow: 1 / 1000; 2 / 900; 3 / 800; 4 / 700; 5 / 600; 6 / 500	**6**	**2**	**L3**
c)	Compute the present value of Rs. 5,000/- a) Received for one year from now b) Received at the end of five years c) Received at the end of fifteen years Assume time preference rate is 5%.	**6**	**2**	**L3**
	OR			
4 a)	The alpha company Ltd., is considering the purchase of a new machine. Two alternative machine A & B have been suggested, each costing Rs.5,00,000/- cash inflows expected to be as follows. Year / Machine A / Machine B: 1 / 40,000 / 1,20,000; 2 / 1,20,000 / 1,60,000; 3 / 1,60,000 / 2,00,000; 4 / 2,40,000 / 1,20,000; 5 / 1,60,000 / 80,000; 6 / 1,80,000 / 1,00,000	**8**	**2**	**L3**

	The company has a target return on capital 10% and on this basis you are required to calculate the profitability of machine and state which alternative you consider financially preferable.			
b)	Calculate the present value of Rs.10,000/- receivable after 8 years if the rate of discount is i)10% ii)12% iii) 15% iv) 20%.	**6**	**2**	**L3**
c)	The cash flow from the capital expenditure is Rs 1000per year for 3 years cash flow occurring at the end of the year the discount rate is 10 % calculate the present value of the annuity for 3 years.	**6**	**2**	**L3**
	Module 3			
5 a)	A firm whose cost of capital is considering for an project costing Rs.1,00,000 respectively. Following are the cash inflows: Year 1 2 3 4 5 Cash flow 20,000 30,000 40,000 50,000 60,000 Calculate the NPV at 10% and IRR for project by 20 and 29%..	**8**	**3**	**L3**
b)	A company is considering an investment proposal to install new milling controls at cost of Rs.50,000. The facility has a expectancy of 5 years without any salvage value. The firm used SLM of depreciation and the same is used for tax purposes. The tax rate is assumed to be 35%. The estimated cash flow before depreciation and tax (CFBDT) from the investment proposals are as follows: Year 1 2 3 4 5 CFBDT 10,000 10,692 12,769 13,462 20,385 Calculate i)Payback period ii) ARR iii) NPV @ 10% iv) PI..	**6**	**3**	**L3**
c)	A project requires Rs 20,000 as initial investment and it will generate annual cash inflow for 5 years are Rs 6,000,Rs 8000,Rs 5000,Rs 4000 and Rs 4,000,find the pay back period..	**6**	**3**	**L3**
	OR			
6 a)	PQR Ltd., is considering the purchase of machinery. Two alternative machinery 1,2 are suggested costing Rs.5,00,000 Cash inflow are expected to be as follows: Year 1 2 3 4 5 Machine 1 45,000 1,30,000 1,50,000 2,50,000 1,70,000 Machine 2 1,30,000 1,70,000 2,10,000 1,30,000 90,000 Calculate i) NPV @ 12% ii) Profitability index.	**8**	**3**	**L3**
b)	A company is considering to invest a project requiring a capital outlay of Rs.2,00,000/-. Cash flow before depreciation and tax is as follows: Year 1 2 3 4 5 Cash flow 1,20,000 1,30,000 1,00,000 1,10,000 60,000 The depreciation may be taken as 20% on straight line method. The income tax rate is 40%. Calculate payback period, ARR and NPV @10%.	**6**	**3**	**L3**
c)	The company initial investment in a project as Rs.1,00,000 and the expected cash inflow during the project are as follows: Year 1 2 3 4 5 Cash flow 20,000 30,000 40,000 50,000 30,000 The cost of capital is 12%. Calculate the following i)NPV ii) PI iii) PBP iv) ARR.	**6**	**3**	**L3**
	Module 4			
7a)	The Sanika Ltd., has the following capital structure Common shares (20,000 p/s) 40,00,000 10% preference shares 14% debentures 10,00,000 30,00,000 The share of the company sells for Rs.20. It is expected that the company will pay next year a dividend of Rs.2 per share which will grow @ 7%.	**6**	**4**	**L3**

<table>
<tr><td></td><td>Total 80,00,000 Assume 50% tax rate. Compute weighted average cost of capital based on the existing capital structure.</td><td></td><td></td><td></td></tr>
<tr><td>b)</td><td>Explain the factors that affecting the weighted average cost of capital.</td><td>6</td><td>4</td><td>L2</td></tr>
<tr><td>c)</td><td>A company issues at Rs 10,00,000,13% debenture at a discount of 5%.the debenture redeemable after 5 years at a premium of 5% company applied 50% tax rate. calculate before tax and after tax cost of debt..</td><td>8</td><td>4</td><td>L3</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>8 a)</td><td>Explain the factors that affecting the weighted average cost of capital</td><td>6</td><td>4</td><td>L2</td></tr>
<tr><td>b)</td><td>Explain the classification of cost..</td><td>6</td><td>4</td><td>L3</td></tr>
<tr><td>c)</td><td>Following is the capital structure of a company
<table>
<tr><th>Particulars</th><th>Amount</th></tr>
<tr><td>Equity capital</td><td>4,00,000</td></tr>
<tr><td>10% preference share capital</td><td>2,00,000</td></tr>
<tr><td>Retained earnings</td><td>1,00,000</td></tr>
<tr><td>5% debentures</td><td>3,00,000</td></tr>
<tr><td>Total</td><td>10,00,000</td></tr>
</table>
The cost of equity capital of the company is 15% and retained earnings 8%. Assume tax rate of 50%. Calculate the weighted average cost of capital.</td><td>8</td><td>4</td><td>L3</td></tr>
<tr><td colspan="5">Module 5</td></tr>
<tr><td>9 a)</td><td>From the following information estimate the networking capital requirement and allow 10% contingency.
<table>
<tr><td>Particular</td><td>Amount per unit</td></tr>
<tr><td>Raw material</td><td>80</td></tr>
<tr><td>Direct labor</td><td>30</td></tr>
<tr><td>Overheads</td><td>60</td></tr>
<tr><td>Total cost of production</td><td>170</td></tr>
</table>
Additional information:
a) Selling price Rs.200 per unit
b) Level of activity 1,04,000 units
c) Work in progress (100% raw material), 50% of other cost average 2 weeks.
d) Raw material in stock average for 4 weeks
e) Finished goods in stock average for 4 weeks
f) Debtors credit allowed to debtors 8 weeks
g) Creditors credit allowed by supplier 4 weeks
h) Lag in payment of wages 1.5 weeks
i) Cash at bank Rs.25,000/-
Production is carried out throughout the year all sales are in credit basis.</td><td>8</td><td>5</td><td>L3</td></tr>
<tr><td>b)</td><td>Explain the concept of debentures..</td><td>6</td><td>5</td><td>L2</td></tr>
<tr><td>c)</td><td>Define working capital. Explain the nature of working capital..</td><td>6</td><td>5</td><td>L2</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>10a)</td><td>Vinay engineering company Pvt. Ltd request you to prepare a statement showing working capital requirement for a level of activity at 1,56,000 units of production.
<table>
<tr><td>Particular</td><td>Amount per unit</td></tr>
<tr><td>Raw material</td><td>90</td></tr>
<tr><td>Direct labor</td><td>40</td></tr>
<tr><td>Overheads</td><td>75</td></tr>
<tr><td>Total cost of production
profit</td><td>205
60</td></tr>
<tr><td>Selling price per unit</td><td>265</td></tr>
</table></td><td>8</td><td>5</td><td>L3</td></tr>
</table>

	a) Raw material are in stock on average for one month b) Material are in process (50% complete) on average for 4 weeks c) Finished goods are in stock on average for one month d) Credit allowed by suppliers in one month e) Time lag in payment from debtors is 2 months f) Average lag in payment of wages is 1.5 weeks g) Average lag in payment of overheads is 1 month 20% of the output is sold against cash. Cash in hand are expected to be Rs.60,000. It is to be assumed that the production is carried evenly throughout the year and time period of 4 weeks is equivalent to be a month.			
b)	Explain the following:- a)trade credit b)commercial banks	**6**	**5**	**L2**
c)	Explain the long term source of finance.	**6**	**5**	**L2**

M23BCS405

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VI Semester B.E Semester End Examinations

June/July 2025

BUSINESS COMMUNICATION

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

Answer five full questions choosing one complete question from each module.

Sl. No.	Questions	Marks	CO	RBT Level
	Module 1			
1 a)	Discuss the various elements of communication?	**10**	**1**	**L1**
b)	**Read the case study and answer the questions given below:** *At UP Institute of Technology & Science (UPITS), a number of professors in the engineering and science departments and a chief librarian from the Massachusetts Institute of Technology in the United States worked as visiting faculty under the MIT–Ford Foundation–UPITS collaboration for two years. The Indian faculty and their families were happy to have the guests on campus. There were frequent parties and family get-togethers, which resulted in many friendships among the hosts and the visitors.* *One day, professor and head of the mechanical engineering department, Dr. Mathur, went to the central library to discuss the possibility of procuring certain international books and journals for UPITS with the visiting German library chief, James Wandel. Dr. Mathur reached about a half hour later than the pre-arranged time. The door was shut, but he opened it and walked in, pulled up a chair to move it closer, sat down, leaned over the desk, extended his hand, and said, 'Hi! How are you this morning, Wandel'?* *Dr. Mathur was surprised to see a frown on Mr. Wandel's face and felt further confused to hear the question, 'By the way, are you my boss'?* *'No', said Dr. Mathur.* *'Then, please know my name is James Wandel's,* *'I am sorry; I didn't mean to be impolite or rude to you. I just wanted to address you in a more friendly way. I am indeed very sorry Mr. James'.* *Mr. Wandel was visibly annoyed. 'Yes, what do you want'? He asked curtly.* *'No, nothing. I am sorry', said Dr. Mathur and left Mr. Wandel's office completely puzzled and disappointed.* **Questions to Answer:** i. What went wrong in this exchange? ii. Was Mr. James Wandel right in his reaction? iii. What can one learn from this case about business and professional interactions?	**10**	**1**	**L3**
	OR			

2 a)	Discuss the importance of communication in management and how communication is used by managers?	**10**	**1**	**L1**
b)	There are times when teachers are too busy to listen to their students' difficulties. Students find them preparing the next day's lecture, correcting scripts, or discussing college problems with other teachers. ***Geeta,*** a 2nd year student, finds herself approaching her program coordinator, who seldom encourages students to discuss their personal problems or any course-related questions or concerns. The teacher brushes her off saying she is too busy. · ***Geeta:*** *Madam?* · ***Ms Srivastava:*** *Yes?* · ***Geeta:*** *Can I talk to you just for a minute? I need your help.* · ***Ms Srivastava:*** *Not now, Geeta. I am marking papers.* · ***Geeta:*** *Can I see you after my class, please?* · ***Ms Srivastava:*** *Not today. I have to attend the faculty meeting and then I have to prepare tomorrow's lecture. And I also have to enter these marks in the grades sheet. Today, I am too busy. Why don't you go to* ***Rita*** *madam?* · ***Geeta:*** *Madam, I had actually first gone to* ***Rita*** *madam. She also told me she was not free. She was very busy with the college's Annual Day function preparations.* · ***Ms Srivastava:*** *Yes, Geeta, we all are very busy till the end of this month.* **Questions to Answer** **i.** Discuss the barriers to sympathetic listening as shown by the responses of the teacher to Geeta. **ii.** What, according to you, is the real reason for the teacher's inability to listen to Geeta? Are they really too busy to listen to students' problems? **iii.** *'I am too busy'.* What does this statement show about the nature of the responses of some teachers?	**10**	**1**	**L3**
	Module 2			
3 a)	Discuss the guidelines both Do's and Don'ts for effective reading?	**10**	**2**	**L1**
b)	Engage yourself in a conversation with your family member/s in connection with the heritage walk to SOMANATHAPURA temple. Describe about the visit with your family member/s in a conversation with at least 8 exchanges.	**10**	**2**	**L3**
	OR			
4 a)	Discuss the process of effective speaking?	**10**	**2**	**L1**
b)	With your own example, comprehend the comparative advantages and limitations of oral and written communication?	**10**	**2**	**L3**
	Module 3			
5 a)	Describe in detail the process of listening and Describe some internal factors that act as barriers to proper listening?	**10**	**3**	**L1**
b)	Interpret the following postures. What do they signify? i. Arms folded across the chest while discussing a problem with a friend. ii. Staring with half-closed eyes iii. Pointing at someone with the index finger. vi. Leaning over the desk of a subordinate while talking to him.	**10**	**3**	**L3**

	v. Looking at the clock while someone is talking.			
	OR			
6 a)	Discuss the purpose of writing and how to achieve clarity in business writing?	**10**	**3**	**L1**
b)	Write your story for the given moral **"ALWAYS BELIEVE IN YOURSELF"** with Word count of not more than 400 words (Demonstration of writing skill)?	**10**	**3**	**L3**
	Module 4			
7a)	What is the primary purpose of social media users and elaborate your experience of social media usage?	**10**	**4**	**L1**
b)	The department has organized a day long state level technical fest. Prepare a report of the same to be submitted to the college council?	**10**	**4**	**L3**
	OR			
8 a)	Discuss the significance of graphics and diagrammatic representations in a report. Illustrate your answer with some examples?	**10**	**4**	**L1**
b)	Write a letter to the consumer forum against the dealer who has charged you more than the MRP on the product you have brought from him?	**10**	**4**	**L3**
	Module 5			
9 a)	What is an interview and explain the different types of interviews?	**10**	**4**	**L1**
b)	You are applying for the job of a sales officer for ABCD company. Prepare an imaginary curriculum vitae for the same?	**10**	**4**	**L3**
	OR			
10a)	What is research? Briefly explain the steps in scientific research?	**10**	**4**	**L1**
b)	Mr. Jon Hauser, President of A&E Education in Germany, visited a management institute in Chennai. After an informal meeting with the principal director, they moved to a large seminar hall equipped with a multimedia projection system. Jon proposed to give a presentation on his Learning Management System model. He spoke for about 40 minutes, covering the worldwide processes of educational administration and e-management. His presentation used PowerPoint and was visually supported by graphic data— charts, graphs, and diagrams. At places, he was difficult to follow because of the unusual accent in which English is spoken by a German. However, the elaborate visual aids helped him put his point across successfully. The PowerPoint slides were in the form of bullet points outlining the structure of the presentation. During the discussion at the end of Jon's presentation, the principal director opined that the international model discussed would need to be customized with specific local content, and went on to share his own software model of Learning Management System. Jon appreciated the new insight, and they agreed to collaborate and integrate the models for marketing the software to educational institutions across India. Questions to answer: 1. Does the size of the venue affect the quality of the presentation? 2. Discuss the benefits of using PowerPoint and visual aids when giving a presentation to a foreign audience? 3. What were Jon's presentation objectives? Was he successful in achieving them?	**10**	**4**	**L3**

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IV Semester B.E

Model Paper

INTRODUCTION TO CYBERSECURITY

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

Answer five full questions choosing one complete question from each module.

Sl. No.	Questions	Marks	CO	RBT Level
	Module 1			
1 a)	Define Cybersecurity. Justify the aspects of CIA triad in Cybersecurity with a suitable example for each.	**10**	**1**	**L3**
b)	Explain different types of web based and system attacks.	**10**	**1**	**L2**
	OR			
2 a)	While explaining the need for computer forensics, enumerate 2 differences between data, information and evidence.	**10**	**1**	**L3**
b)	Explain any 5 different approaches used in Email Forensics.	**10**	**1**	**L2**
	Module 2			
3 a)	Explain different layers of cybersecurity. In securing which layer will nmap come into use?	**10**	**1**	**L2**
b)	Imagine a bank is under cyberattack. Illustrate with example how the cybersecurity triad aspects will be compromised and how you plan to remediate for the same.	**10**	**2**	**L3**
	OR			
4 a)	Differentiate between security vulnerability, threat and attack give examples to suitably justify the differentiators.	**10**	**1**	**L3**
b)	Explain digital forensics lifecycle. Define data, information and evidence.	**10**	**2**	**L2**
	Module 3			
5 a)	Describe types of different mobility with respect to the digital devices and discuss their implications.	**10**	**1**	**L3**
b)	Explain 5 different challenges faced by organization with respect to the mobile devices.	**10**	**2**	**L2**
	OR			
6 a)	Discuss 5 popular types of attacks against mobile networks and analyze how they can be avoided	**10**	**1**	**L3**
b)	Explain the process of Credit Card transactions in the wireless era.	**10**	**2**	**L2**
	Module 4			
7a)	What are the two different categories of web-threats for an organization. And further in the same context mention 8 top issues which keeps the IT managers engaged in an organization.	**10**	**2**	**L2**
b)	Discuss the operating guidelines for implementing mobile device security policies.	**10**	**3**	**L2**
	OR			
8 a)	Explain the various internal costs of an organization with respect to a cyber incident. Which of the internal cost type has maximum share and why?	**10**	**2**	**L2**
b)	Explain the various physical security countermeasures for laptops that can be taken by an organization.	**10**	**3**	**L2**
	Module 5			
9 a)	Explain the aspects of data linking and data profiling with one example for each.	**10**	**3**	**L3**
b)	List and explain 5 most typical reasons why organizations use social media marketing to promote their products and services	**10**	**3**	**L3**
	OR			
10a)	Explain privacy in the domains of: i) medical ii) finance	**10**	**3**	**L3**
b)	Explain in detail the seven stage attack of Ransomware.	**10**	**3**	**L3**

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M23BCS407A

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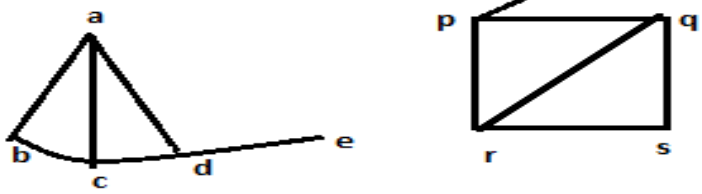
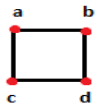
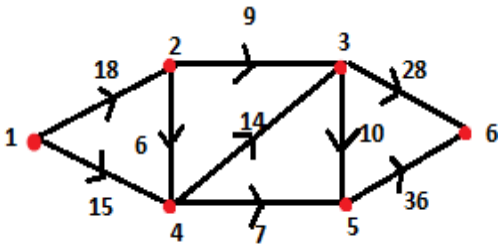
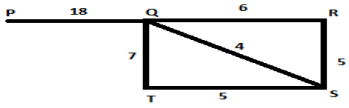
IV Semester B.E -Semester End Examinations
MODEL QUESTION PAPER - I
Graph Theory and Combinatoric's

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

Answer five full questions choosing one complete question from each module.

Sl. No.	Questions	Marks	CO	RBT Level
	Module 1			
1 a)	Define the following terms with example each (i) Regular graph (ii) Sub graph (iii) Planar and non planar graphs (iv) Graph coloring (v) chromatic number	10	1	L2
b)	Define Isomorphism? Verify whether the following graphs are isomorphic 	10	1	L2
	OR			
2 a)	(i) Explain Konigsberg bridge problem (ii) State and prove Hand shaking property	6+4	1	L2
b)	(i) Find the chromatic polynomial for the given graph  (ii) Prove that Kuratowski's first graph is non planar	6+4	1	L3
	Module 2			
3 a)	(i) Prove that a tree with n vertices will have n-1 edges (ii) How many edges must a planar graph have, if it has 7 regions and 5 vertices. Draw one such graph.	6+4	1	L2
b)	Define minimal spanning tree. Using Dijkstra's algorithm find the shortest path and its weight from vertex 1 to each of the vertices in the weighted directed network shown below	10	2	L2

				
OR				
4 a)	Construct an optimal prefix code for the symbols a, b, c, d, e, f, g, h, I, j that occurs with the respective frequencies 78, 16, 30, 35, 125, 31, 20, 50, 80, 3.	10	1	L2
b)	State max-flow and min-cut theorem. Find the maximum flow from the vertex P to vertex S in the network shown below by identifying the cutest of minimum, capacity 	10	2	L2
Module 3				
5 a)	Define permutation and combination. Find the number of permutations of the letter of the word " MISSISSIPPI". How many of these Begin with the letter I, (ii) Begin and end with S (iii) Has all the I's together	10	3	L2
b)	(i) How many numbers greater than 1000000 can be formed by using the digits 1, 2, 2, 2, 4, 4, 0 (ii) Find the co-efficient of $a^3b^2cd^2$ in the expansion of $(2a - b + 3c - 2d)^8$	6+4	2	L3
OR				
6. a)	Among the first 1000 positive integers (i) Determine the integers which are not divisible by 5, nor by 7, nor by 9 (ii) Determine the integers which are divisible by 5, but not by 7, not by 9	10	1	L3
b)	In how many ways one can distribute 8 identical marbles in 4 distinct containers such that (i)No container is empty (ii) 4th container has an odd number of marbles in it.	10	3	L2
Module 4				
7.a)	(i) Find the sequence generated by the function $f(X) = (1 + 3x)^{\frac{1}{3}}$ (ii) Determine the coefficient of x^{10} in $x^2(1 - x)^{10}$	6+4	1	L3
b)	Using generating function, find the number of partitions of n=6.	10	4	L3
OR				
8. a)	(i) Find the generating function for the sequence 8, 26, 54, 92, . . . (ii) Determine the sequence for the given exponential generating function $e^{2x} - 3x^3 + 5x^2 + 7x$	6+4	1	L3
b)	(i) In how many ways can 12 oranges be distributed among 3 childrens A, B, C so that A gets atleast 4 , B and C gets atleast 2 but C gets no more than 5? (ii) Prove that $P_d(n) = P_o(n)$ for every positive integer n.	6+4	1	L3

Module 5				
9. a)	(i) Solve the recurrence relation $a_n - 3a_{n-1} = 5 \times 7^n$ for $n \geq 1$ given that $a_0 = 2$. (ii) Solve the recurrence relation $a_{n+1} = 4a_n$ for $n \geq 0$, given that $a_0 = 3$.	6+4	2	L3
b)	Find the general solution of the recurrence relation $S(k) - 3S(k-1) - 4S(k-2) = 4^k, \quad k \geq 2$.	10	2	L3
OR				
10.a)	Solve the recurrence relation $a_n + a_{n-1} - 6a_{n-2} = 0 \; for \; n \geq 2$, given that $a_0 = -1 \; and \; a_1 = 8$.	10	2	L3
b)	Find the recurrence relation and the initial condition for the sequence 0, 2, 6, 12, 20, 30, 42, . . . Hence find the general term of the sequence.	10	2	L3

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M23BCS407B

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MODEL QUESTION PAPER- 1
Fourth Semester B.E Degree Examination
Linear Algebra

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

Note: 1. Answer five full questions choosing *atleast one* complete question from each module.
2. M: Marks, L: Bloom`s Level, C: Course outcome

Sl.	Questions	M	C	L
	Module 1			
1 a)	Solve the system of equation $2x + 3y + 2z = 2$, $3x + 6y + z = -6$, $10x + 3y + 4z = 16$ by LU decomposition method	**10**	**1**	**L3**
b)	Define Hermitian matrix & Express the matrix A=$\begin{bmatrix} 1+i & 2 & 5-5i \\ 2i & 2+i & 4+2i \\ -1+i & -4 & 7 \end{bmatrix}$ as a sum of Hermitian & skew Hermitian matrix	**10**	**1**	**L2**
	OR			
2 a)	Find the inverse of $\begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ by Gauss elimination method	**10**	**1**	**L2**
b)	i) Solve the system of equation $3x + y + z = 8$, $2x - 3y - 2z = -5$, $7x + 2y - 5z = 0$ by Cramers rule ii) Prove that the matrix A=$\begin{bmatrix} -i & 3+2i & -2-i \\ -3+2i & 0 & 3-4i \\ 2-i & -3-4i & -2i \end{bmatrix}$ is skew hermition matrix	**10**	**1**	**L2**
	Module 2			
3 a)	Prove that sum of two subspaces is a subspace	**6**	**1**	**L2**
b)	Define Linearly independent and dependent sets. Show that the set S = {(1, 2, 4), (1, 0, 0), (0, 1, 0), (0, 0, 1)} is linearly dependent	**7**	**1**	**L2**
c)	Find the dimension of the subspace H = $\left\{ \begin{bmatrix} A - 3B + 6C \\ 5A + 4D \\ B - 2C - D \\ 5D \end{bmatrix} A, B, C, D \; in \; R \right\}$	**7**	**1**	**L1**
	OR			
4 a)	Prove that $w = \{(x, y, z) / ax + by + cz = 0\}$ is a subspace of V(R^3)	**6**	**1**	**L2**
b)	Find the bases for NulA and ColA of the matrix A = $\begin{bmatrix} 1 & 3 & -1 & 3 \\ -2 & 1 & -5 & 8 \\ 0 & 1 & -1 & 2 \\ 4 & 0 & 8 & -12 \end{bmatrix}$	**7**	**1**	**L1**
c)	Determine whether the matrix A=$\begin{bmatrix} 3 & -1 \\ 1 & -2 \end{bmatrix}$ is a linear combination of $\begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$, $\begin{bmatrix} 1 & 1 \\ -1 & 0 \end{bmatrix}$ & $\begin{bmatrix} 1 & -1 \\ 0 & 0 \end{bmatrix}$	**7**	**1**	**L3**

	Module 3			
5 a)	Prove that the mapping $T: V_2(R) \to V_2(R)$ defined by $T(x,y) = (3x + 2y, 3x - 4y)$ is linear transformation	**6**	**2**	**L2**
b)	Let $T: R^3 \to R^3$ over a field R defined by $T(x,y,z) = (3x, x - y, 2x + y + z)$,find $g(T)$ where $g(x) = x^3 - 3x^2 - x + 3$. Is 'T' a root of $g(x)$.	**7**	**1**	**L2**
c)	Prove that the linear transformation T:$R^3 \to R^3$ given by T(e_1)= $e_1 + e_2$, T(e_2)= $e_1 - e_2 + e_3$ & T(e_3)= $3e_1 + 4e_3$ is non-singular where { e_1, e_2, e_3} is the standard basis	**7**	**2**	**L3**
	OR			
6 a)	Find Range and Null space for the transformation T:$R^3 \to R^3$ defined by $T(x,y,z) = (x + 2y - z, y + z, x + y - 2z)$.	**6**	**2**	**L1**
b)	Let $T: V_3(R) \to V_3(R)$ be given by $T(x,y,z) = (y, -x, 2z)$, obtain the formula for $T^3 - 2T^2 + T - 2I$	**7**	**1**	**L1**
c)	Find the matrix of a linear transformation $T: R^2 \to R^3$ given by $T(1,1) = (0,1,2)$, $T(-1,1) = (2,1,0)$	**7**	**2**	**L1**
	Module 4			
7a)	State & prove i) Triangular inequality, ii) Cauchy's Schwaz inequality	**10**	**2**	**L2**
b)	Apply the Gram-Schmidt orthogonalization process to find an orthonormal basis for the subspace spanned by the vectors $v_1 = (2,2,1)$ $v_2 = (1,3,1)$, $v_3 = (1,2,2)$. Also find the orthogonal projection of v_1 onto v_2.	**10**	**3**	**L3**
	OR			
8 a)	The set S = $\{u_1, u_2, u_3\}$ is an orthogonal set where $u_1 = \begin{bmatrix}3\\1\\1\end{bmatrix}$, $u_2 = \begin{bmatrix}-1\\2\\1\end{bmatrix}$, $u_3 = \begin{bmatrix}-1/2\\-2\\7/2\end{bmatrix}$ is an orthogonal basis for $\mathbb{R}^3$. Express the vector y = $\begin{bmatrix}6\\1\\-8\end{bmatrix}$ as a linear combination of the vectors in S	**10**	**2**	**L2**
b)	Find the QR-decomposition of the matrix A=$\begin{bmatrix}1 & 2 & 5\\-1 & 1 & -5\\-1 & 4 & -3\\1 & -4 & 7\\1 & 2 & 1\end{bmatrix}$	**10**	**3**	**L1**
	Module 5			
9 a)	Diagonalize the matrix A=$\begin{bmatrix}-2 & 2 & -3\\2 & 1 & -6\\-1 & -2 & 0\end{bmatrix}$ & also find A^4	**10**	**3**	**L1**
b)	Obtain the orthogonal transformation of the Quadratic form $8x^2 + 7y^2 + 3z^2 - 12xy + 4xz - 8yz$. Also find its rank, index, signature & nature of the quadratic from	**10**	**1**	**L3**
	OR			
10a)	Find the Singular value decomposition of the matrix $\begin{bmatrix}-2 & 3\\-1 & 6\\2 & 6\end{bmatrix}$	**10**	**3**	**L1**
b)	Find the maximum & minimum values of Q(x)=$3x^2 + 2y^2 + 2z^2 + 2xy + 2xz + 4yz$ subjected to the condition XX^T=1	**10**	**1**	**L1**

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