

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	a) Describe the modes of failure of mechanical components.	4M	CO1	K2
	b) The principal stresses induced at a point in a machine component made of steel 50C4 ($S_{yt} = 460 \text{ N/mm}^2$) are as follows: $\sigma_1 = 200 \text{ N/mm}^2$, $\sigma_2 = 150 \text{ N/mm}^2$, $\sigma_3 = 0$. Calculate the factor of safety by (i) The maximum shear stress theory and (ii) The distortion energy theory..	10M	CO1	K3
(OR)				
2.	a) How will you find out allowable stress for ductile parts using factor of safety?	4M	CO1	K3
	b) Explain any four theories of failures.	10M	CO1	K3
<u>UNIT-II</u>				
3.	Determine the diameter of a tensile member of circular cross-section. The following data are given: Maximum tensile load = 25 kN; Maximum compressive load = 15 kN, Ultimate tensile strength = 600 MPa; Yield point = 390 MPa, Endurance limit = 290 MPa, Factor of safety = 4 and Stress concentration factor = 2.2. Assume Soderberg line as failure criterion.	14M	CO2	K2
(OR)				
4.	A bolted joint is used to connect two components. The combined stiffness of the two components is twice the stiffness of the bolt. The initial tightening of the nut results in a preload of 10 kN in the bolt. The external force of 7.5 kN creates further tension in the bolt. The bolt is made of plain carbon steel 30C8 ($S_{yt} = 400 \text{ N/mm}^2$ and the factor of safety is 3. There are coarse threads on the bolt. Calculate the tensile stress area of the bolt and specify a suitable size for the bolt.	14M	CO2	K3
<u>UNIT-III</u>				
5.	a) Which plane is subjected to maximum shear stress in case of parallel fillet welds?	4M	CO3	K3
	b) A circular shaft, 75 mm in diameter, is welded to the support by means of a circumferential fillet weld. It is subjected to a torsional moment of 3000 N-m. Determine the size of weld, if the maximum shear stress in the weld is not to exceed 70 N/mm ² .	10M	CO3	K3
(OR)				

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|----|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|
| 6. | a) | Distinguish between hot and cold riveting. | 4M | CO3 | K1 |
| | b) | A double-riveted double-strap butt joint is used to connect two plates, each of 12 mm thickness by means of 16 mm diameter rivets having a pitch of 48 mm. The rivets and plates are made of steel. The permissible stresses in tension, shear and compression are 80, 60 and 120 N/mm ² respectively. Determine the efficiency of the joint. | 10M | CO3 | K3 |

UNIT-IV

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|----|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|
| 7. | a) | Explain the role of equivalent torsional moment and equivalent bending moment to design of shafts. | 4M | CO3 | K1 |
| | b) | A centrifugal pump is driven by a 10 kW power 1440 rpm electric motor. There is a reduction gearbox between the motor and the pump. The pump shaft rotates at 480 rpm. The design torque is 150% of the rated torque. The motor and pump shafts are made of plain carbon steel 40C8 ($S_{yt} = 380$ N/mm ²) and the factor of safety is 4. Assume ($S_{sy} = 0.5S_{yt}$). Calculate: (i) diameter of motor shaft; and (ii) diameter of pump shaft. | 10M | CO3 | K3 |

(OR)

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|----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|
| 8. | a) | Compare taper key and parallel key with appropriate diagrams. | 4M | CO4 | K1 |
| | b) | Following specifications are given for a rigid coupling: outer diameter of flanges = 160 mm; diameter of recess = 95 mm; number of bolts = 6; preload of each bolt = 10 kN, coefficient of friction = 0.15 speed of rotation = 100 rpm. The bolts are fitted in large clearance holes. Calculate the power transmitting capacity of the coupling. | 10M | CO4 | K3 |

UNIT-V

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|----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|
| 9. | a) | What are the applications of cotter joint. | 4M | CO5 | K2 |
| | b) | Two rods are connected by means of a knuckle joint. The axial force P acting on the rods is 25 kN. The rods and the pin are made of plain carbon steel 45C8 ($S_{yt} = 380$ N/mm ²) and the factor of safety is 2.5. The yield strength in shear is 57.7% of the yield strength in tension. Calculate (i) diameter of the rods and (ii) diameter of the pin. | 10M | CO5 | K3 |

(OR)

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|-----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|
| 10. | a) | List out the functions of springs? | 4M | CO5 | K1 |
| | b) | It is required to design a helical compression spring subjected to a force of 500 N. The deflection of the spring corresponding to this force is approximately 20 mm. The spring index should be 6. The spring is made of cold-drawn steel wire with ultimate tensile strength of 1000 N/mm ² . The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength ($G = 81370$ N/mm ²). Design the spring and calculate:
(i) wire diameter; (ii) mean coil diameter;
(iii) number of active coils; (iv) total number of coils;
(v) free length of the spring; and (vi) pitch of the coils.
Assume a gap of 1 mm between adjacent coils under maximum load condition. Spring has square and ground ends. | 10M | CO5 | K3 |

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		<u>UNIT-I</u>	Marks	CO	BTL
1.	a)	Define AI. Explain the problems of Artificial Intelligence with examples.	7	1	K2
	b)	Explain how an AI agent playing a Tic-Tac-Toe game can determine the best move using minimax algorithm.	7	1	K2
(OR)					
2.	a)	Compare goal-based agents and utility-based agents with examples.	7	1	K2
	b)	Design an intelligent learning agent for a chatbot that interacts with its environment, processes user input, learns from user feedback, and improves its responses over time.	7	1	K3
<u>UNIT-II</u>					
3.	a)	Explain Simulated Annealing and its advantages over Hill Climbing.	7	2	K2
	b)	Consider a graph with 5 nodes: A, B, C, D, E with given edge weights and heuristic values. Apply A* search to find the shortest path from A to E, detailing how cost (g(n)) and heuristic (h(n)) are used at each step.	7	2	K3
(OR)					
4.	a)	Explain the working of the AO* algorithm with an example.	4	2	K2
	b)	Explain the working of Depth-first search(DFS) and Breadth-first search (BFS) with valid examples.	10	2	K2
<u>UNIT-III</u>					
5.	a)	Explain the backtracking approach for solving CSPs and its advantages.	7	3	K2
	b)	Apply the Min-Max algorithm to a given two-player game tree and determine the best move for the maximizing player.	7	3	K3
(OR)					
6.	a)	Describe the 8-queens problem as a CSP and explain how constraints are applied.	7	3	K2
	b)	Apply the graph colouring algorithm to colour a given graph using the minimum number of colours.	7	3	K3
<u>UNIT-IV</u>					
7.	a)	Given that a person tests positive for a rare disease with a 1% prevalence rate and the test has a 95% accuracy, calculate the probability that the person has the disease(Use Bayes theorem).	7	4	K3
	b)	Analyze the differences between rule-based and probabilistic reasoning approaches, discussing their strengths and weaknesses.	7	4	K3
(OR)					
8.	a)	Given a set of training examples for playing tennis based on weather conditions such as Outlook (Sunny, Overcast, Rainy), Temperature (Hot, Mild, Cool), Humidity (High, Normal), and Wind (Weak, Strong), apply the Find-S algorithm to determine the most specific hypothesis. Consider only the positive instances where Play Tennis = Yes and show step-by-step calculations leading to the final hypothesis.	7	4	K3
	b)	Discuss the impact of learning system taxonomy on the choice of machine learning algorithms for different problem domains.	7	4	K2
<u>UNIT-V</u>					
9.	a)	Explain the architecture of an expert system with a neat diagram.	7	5	K2
	b)	Compare the functionalities of MYCIN, DART, and XOON expert systems with suitable examples.	7	5	K2
(OR)					
10.	a)	Define meta-knowledge and explain its role in expert systems.	7	5	K2
	b)	Explain the roles of expert system in Knowledge Acquisition.	7	5	K3

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UNIT-I

- | | | Marks | CO | Blooms Level |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|--------------|
| 1. | a) Describe the constructional details of an attraction-type moving iron instrument with the help of a neat diagram. Derive the equation for deflection if spring control is used and comment upon the shape of scale. | (7M) | CO1 | L2 |
| | b) How is the voltage range of a PMMC instrument extended with the help of series resistor? Derive the expression for series resistor | (7M) | CO1 | L3 |
| (OR) | | | | |
| 2. | a) Derive the torque equation of a moving iron instrument and further comment up on the nature of scale. | (7M) | CO1 | L2 |
| | b) A PMMC instrument has a coil of dimensions 15 mm × 12mm. The flux density in the air gap is 1.8×10^{-3} wb/m ² and the spring constant is 0.14×10^{-6} N-m/rad. Determine the number of turns required to produce an angular deflection of 90° when a current of 5 mA is flowing through the coil. | (7M) | CO1 | L3 |

UNIT-II

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|-------------|---------------------------------------------------------------------------------------------------------------|------|-----|----|
| 3. | a) Define the following terms i) Transformation ratio (ii) Nominal ratio and apply these terms for CT and PT. | (7M) | CO2 | L2 |
| | b) Explain the procedure to measurement active and reactive powers in unbalanced systems? | (7M) | CO2 | L2 |
| (OR) | | | | |
| 4. | a) Obtain the phasor diagram of a current transformer using its equivalent circuit diagram. | (7M) | CO2 | L2 |
| | b) Explain the extension of ranges of watt meters using instrument transformers with help of neat diagrams | (7M) | CO2 | L2 |

UNIT-III

5. a) Describe the principle of working of an induction type energy meter with neat sketch. (7M) CO3 L2
- b) An energy meter is designed to have 80 revolutions of the disc per unit of energy consumed. Calculate the number of revolutions made by the disc when measuring the energy consumed by a load carrying 30 A at 230 V and 0.6 power factor. Find the percentage error if the meter actually makes 330 revolutions. (7M) CO3 L3

(OR)

6. a) Draw and describe the relevant phasor diagram and derive how the number of revolutions in a single phase induction type energy meter is proportional to the energy consumed. (7M) CO3 L2
- b) Explain the working of a single-phase dynamometer-type power-factor meter (7M) CO3 L2

UNIT-IV

7. a) Describe the working of hay's bridge for measurement of inductance. Derive the equations for balance condition (7M) CO4 L2
- b) Derive an equation for measurement of low resistance using Kelvin double bridge (7M) CO4 L2

(OR)

8. a) Derive the equation of balance for Maxwell Inductance Bridge and also draw the phasor diagram. (7M) CO4 L2
- b) Derive an expression for the unknown resistance measured using the loss of charge method (7M) CO4 L2

UNIT-V

9. a) How the transducers are classified based on the principle of operation? (7M) CO5 L2
- b) Explain with the help of suitable diagrams, how a D.C. Potentiometer can be used for calibration of voltmeter. (7M) CO5 L2

(OR)

10. a) Write down the construction and working principle of a thermocouple. Compare different thermocouple materials (7M) CO5 L2
- b) Explain how thermistor can be used for temperature measurement. (7M) CO5 L2
- What are the advantages and uses of the LVDT?

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	<u>UNIT-I</u>	Marks	CO	Blooms Level
1. a)	Explain response of an RC Low pass circuit for Square input?	7M	CO1	L2
b)	Prove that a RC high pass circuit acts as differentiator?	7M	CO1	L2
	(OR)			
2. a)	Explain two level clipping using diodes with necessary diagrams?	7M	CO1	L2
b)	With the help of neat circuit diagram explain the working of a negative clamping circuit	7M	CO1	L2
	<u>UNIT-II</u>			
3. a)	Draw the block diagram representing a typical OP-Amp and explain the function of each block	7M	CO2	L2
b)	Explain the AC characteristics of an OP-Amp	7M	CO2	L2
	(OR)			
4. a)	Explain an inverting amplifier and derive the expression for gain	7M	CO2	L2
b)	What are the ideal characteristics of an operational amplifier?	7M	CO2	L1
	<u>UNIT-III</u>			
5. a)	How an op-amp can act as a summing amplifier and an averaging circuit explain with neat sketch	7M	CO3	L1
b)	Explain about V-I converter?	7M	CO3	L2
	(OR)			
6. a)	Explain an op-amp can act as a Schmitt Trigger to generate square wave with relevant diagrams	7M	CO3	L2
b)	Show an op-amp can act as an integrator with neat circuit diagram	7M	CO3	L1
	<u>UNIT-IV</u>			
7. a)	Explain about first order high pass butter worth filter and also draw its frequency response.	7M	CO4	L2
b)	Recall the pin diagram of a 555 timer IC and explain significance of pins	7M	CO4	L1
	(OR)			
8. a)	With a neat diagram explain the wide band pass filter and also draw the frequency response.	7M	CO4	L2
b)	List the basic building blocks of PLL and explain importance of each block	7M	CO4	L1
	<u>UNIT-V</u>			
9. a)	Explain the basic working principle of a binary-weighted resistor DAC and derive expression for output-analog voltage.	7M	CO5	L2
b)	Explain about R-2R Ladder DAC and derive expression for output-analog voltage?	7M	CO5	L2
	(OR)			
10. a)	Recall the basic circuit of parallel comparator type A/D converter and explain its operation	7M	CO5	L1
b)	With a clear block diagram explain the data conversion procedure for dual slope ADC	7M	CO5	L2

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		<u>UNIT-I</u>	Marks	CO	BTL
1.	a)	Discuss different types of database system applications with suitable examples.	7	1	1
	b)	Define data abstraction in database systems. Explain the three levels of abstraction with examples.	7	1	1
		(OR)			
2.	a)	What is the function of a storage manager in a database system? Explain its components in detail.	7	1	2
	b)	Explain the steps involved in query processing. How does query optimization improve database performance?	7	1	2
		<u>UNIT-II</u>			
3.	a)	What are views? Discuss the advantages of views with Examples.	7	2	3
	b)	Explain the use of the DROP, DELETE, and TRUNCATE commands in SQL. How are they different?	7	2	2
		(OR)			
4.	a)	Explain the division operation in relational algebra with a real-life example.	7	2	2
	b)	Compare Inner Join, Left Outer Join, Right Outer Join, and Full Outer Join in relational algebra.	7	2	2
		<u>UNIT-III</u>			
5.	a)	What are SQL constraints? Explain their importance in database design with examples.	7	3	1
	b)	Discuss GROUP BY and HAVING clauses with aggregate functions in SQL. Provide examples.	7	3	2
		(OR)			
6.	a)	How does SQL handle NULL values? Explain its effect on joins, comparisons, and aggregate functions with examples.	7	3	2
	b)	Explain how triggers help in implementing event-driven actions. Provide an example using a BEFORE UPDATE trigger.	7	3	3
		<u>UNIT-IV</u>			
7.	a)	Explain the concept of dependency preserving decomposition. Why is it important?	7	4	2
	b)	Explain BCNF with an example. How does it differ from 3NF?	7	4	2
		(OR)			
8.	a)	What is serializability? Explain conflict serializability and view serializability .	7	4	2
	b)	How is locking implemented in databases to ensure concurrent transaction safety?	7	4	3
		<u>UNIT-V</u>			
9.	a)	Compare Shadow Paging and Log-Based Recovery in terms of implementation and efficiency.	7	5	3
	b)	What are locks? Explain two-phase locking and how it is different from strict two-phase locking.	7	5	2
		(OR)			
10.	a)	Differentiate between primary index and secondary index with examples.	7	5	1
	b)	What is tree-based indexing? How does it improve query performance?	7	5	2

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		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	a) Describe the scope of geology in civil engineering projects.	7	1	K2
	b) Explain the physical properties of Olivine and Calcite	7	1	K2
(OR)				
2.	a) Discuss the physical properties of Feldspar and Kyanite minerals	10	1	K2
	b) Define mineral and list the properties of mineral to identify the same	4	1	K1
<u>UNIT-II</u>				
3.	Explain the structures and textures of igneous rocks	14	2	K2
(OR)				
4.	a) Explain the properties of quartzite and marble	7	2	K2
	b) Explain the properties of granite and gneiss	7	2	K2
<u>UNIT-III</u>				
5.	a) What is a fold? What are its different types?	7	3	K2
	b) Explain the effects of fold in civil engineering structure	7	3	K2
(OR)				
6.	a) What is unconformity and explain its types and effects.	7	3	K2
	b) Explain the following terms:	7	3	K2
	□ Outcrop			
	□ Fold			
	□ Joint			
<u>UNIT-IV</u>				
7.	a) Explain different types of dams	4	4	K2
	b) Explain the geological considerations for the successful construction of the dam	10	4	K2
(OR)				
8.	Explain the geological considerations for successful Tunnelling	14	4	K2
<u>UNIT-V</u>				
9.	a) What are precautions to be considered for construction in seismic areas	7	5	K2
	b) Explain the seismic zones of India	7	5	K2
(OR)				
10.	a) What are landslides, and what are their causes	7	5	K2
	b) Illustrate the seismic refraction Method.	7	5	K2

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		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	a) What is a Multidimensional Data Model ? Explain the key components of this model, including facts, dimensions, and measures, with an example.	7	1	2
	b) Describe the three-tier architecture of a Data Warehouse. How do the different tiers contribute to efficient data management?	7	1	2
(OR)				
2.	a) What are the major steps involved in Data Warehouse Implementation ? Discuss the challenges faced during implementation.	7	1	2
	b) Compare ROLAP, MOLAP, and HOLAP . Discuss their advantages and disadvantages.	7	1	2
<u>UNIT-II</u>				
3.	a) Describe different types of data used in Data Mining. How does structured and unstructured data impact the data mining process?	7	2	2
	b) Explain the concept of Data Quality in Data Mining. What are the key measures of data quality, and how do they affect the mining process?	7	2	2
(OR)				
4.	a) Define Dimensionality Reduction . Explain its advantages.	7	2	2
	b) What is Discretization and Binarization in Data Pre-processing? Explain their role in improving data mining algorithms.	7	2	2
<u>UNIT-III</u>				
5.	a) Compare classification and clustering . How do they differ in terms of data analysis and applications?	7	3	2
	b) Discuss different methods for expressing attribute test conditions in a Decision Tree. How do they impact the tree structure?	7	3	2
(OR)				
6.	a) Explain model overfitting? What strategies can be used to prevent it?	7	3	2
	b) Explain Random Subsampling and Cross-Validation techniques. How do they help in improving model reliability?	7	3	2
<u>UNIT-IV</u>				
7.	a) Define Support, Confidence, and Lift in Association Rule Mining. How do they help in evaluating association rules?	7	4	2
	b) Explain the Apriori Algorithm step by step with an example.	7	4	2
(OR)				
8.	a) Explain the process of Rule Generation in Association Rule Mining. How are strong rules generated?	7	4	2
	b) Explain the FP-Growth Algorithm with an example. How does it differ from the Apriori Algorithm?	7	4	2
<u>UNIT-V</u>				
9.	a) Explain the different types of clusters formed in clustering algorithms with suitable diagrams.	7	5	2
	b) Compare Single-linkage, Complete-linkage, and Average-linkage hierarchical clustering methods.	7	5	2
(OR)				
10.	a) Compare DBSCAN and K-means clustering . When should DBSCAN be preferred?	7	5	2
	b) Explain the Basic Agglomerative Hierarchical Clustering Algorithm with an example.	7	5	2

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	<u>UNIT-I</u>	Marks	CO	Blooms Level
1.	a. Classify the bricks and summarize the salient features of the first, second and third class bricks?	05	01	02
	b. Classify the types of cement and summarize the properties of Hydraulic Cement and Ordinary Portland Cement (OPC)?	05	01	02
	(OR)			
2.	a. Explain the objectives, merits and demerits of Ready Mix Concrete?	05	01	02
	b. Summarize the good qualities of a brick?	05	01	02
	<u>UNIT-II</u>			
3.	a. Explain the building byelaws with reference to open space requirements and plinth area requirements.	05	02	02
	b. Write short notes on Floor Area Ratio (FAR), how it is related to height of the building. Explain?	05	02	02
	(OR)			
4.	a. Explain the objectives and principles of building bye-laws?	05	02	02
	b. Classify the buildings as per National Building Code?	05	02	02
	<u>UNIT-III</u>			
5.	a. Show the nominal dimensions of various building components?	05	03	02
	b. Explain what considerations; the grouping of various units in residential buildings is made.	05	03	02
	(OR)			
6.	a. Determine the estimation of Peak Discharge for the residential colonies	05	03	05
	b. What do you understand by superstructure and explain the following: i) Plinth ii) Plinth Beam iii) Damp Proof Course (DPC)	05	03	02
	<u>UNIT-IV</u>			
7.	Show what are the usual requirements take into consideration for planning of a public (Educational) building?	10	04	02
	(OR)			
8.	Draw the line plan of a hospital with the given site measurement 15mx10m?	10	04	03
	<u>UNIT-V</u>			
9.	a. Summarize the CBRI recommendations for obtaining optimum orientation of a building?	05	05	02
	b. Illustrate the Header and Stretcher brick bonds with a neat sketch?	05	05	02
	(OR)			
10.	a. Explain what do you mean by Prefabricated buildings and summarize their merits and demerits?	05	05	02
	b. Summarize the functions of doors and give the dimensions for general sizes of residential doors?	05	05	02
	<u>UNIT-VI</u>			
11.	Draw the single room office building section and elevation with suitable dimensions?	10	06	03
	(OR)			
12.	Draw the line diagram of plan and elevation for single room residential building with suitable dimensions?	10	06	03

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<u>UNIT-I</u>				
1.	Determine g.c.d of 595 and 252, and express the linear combination of 595 and 252	10	CO1	L3
(OR)				
2.	Prove that $9^n - 8^n - 1$ is divisible by 8	10	CO1	L3
<u>UNIT-II</u>				
3.	Find the remainder in the division of 3^{40} by 23	10	CO2	L3
(OR)				
4.	Solve the congruence $259x \equiv 5 \pmod{11}$	10	CO2	L3
<u>UNIT-III</u>				
5.	Define Euler-Fermate theorem and Show that $n^5 - n$ is divisible by 30	10	CO3	L3
(OR)				
6.	Find all integers that leaves the remainders 1 or 2 when they divided by each of 3, 4 & 5.	10	CO3	L3
<u>UNIT-IV</u>				
7.	Determine the number of divisors and sum divisors of 9504	10	CO4	L3
(OR)				
8.	Define Mobius function . Determine $\mu(11), \mu(15), \mu(17), \mu(20)$	10	CO4	L3
<u>UNIT-V</u>				
9.	Define order of integer and primitive root. hence find order of 3(mod7) and primitive root of 6.	10	CO5	L3
(OR)				
10.	Determine whether 888 is quadratic residue of 1999 or not	10	CO5	L3
<u>UNIT-VI</u>				
11.	Using Caesar cipher method , To encrypt the message “ THIS MESSAGE IS TOP SECRET ” by using transformation $C \equiv P + 3 \pmod{26}$	10	CO6	L3
(OR)				
12.	To decrypt the cipher text message “FEXENZMBMKJNHMGMYZMN” using the transformation $C \equiv 7P + 10 \pmod{26}$	10	CO6	L3

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<u>UNIT-I</u>			
1. What is vector? Explain vectors and arrays.	10	1	L1
(OR)			
2. Explain Dynamic memory allocation and Pointers with example program.	10	1	L2
<u>UNIT-II</u>			
3. Define polymorphism with example programs.	10	2	L1
(OR)			
4. Write programs for Single, Multiple, Multilevel inheritances.	10	2	L2
<u>UNIT-III</u>			
5. Find time complexity for Matrix Multiplication. Explain in detail.	10	3	L3
(OR)			
6. Describe asymptotic notations in detail with example.	10	3	L2
<u>UNIT-IV</u>			
7. Define queue? Explain all operations for queue with example program.	10	4	L3
(OR)			
8. Write a program for double ended queue?	10	4	L2
<u>UNIT-V</u>			
9. What are the types of commands in SQL. Explain with queries.	10	5	L1
(OR)			
10. Explain different types of functions in SQL with queries	10	5	L3
<u>UNIT-VI</u>			
11. What are 9i joins? Explain with queries.	10	6	L1
(OR)			
12. Explain about Normal Forms.	10	6	L3

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		<u>UNIT-I</u>			
1.	a	Discuss reference variables and pointers in C++.	5	1	L6
	b	Build a C++ code for the following problem.	5	1	L3
		K-diff Pairs in an Array			
		Given an array of integers nums and an integer k, return the number of unique k-diff pairs in the array.			
		Example:			
		Input: nums = [3,1,4,1,5], k = 2			
		Output: 2			
		(OR)			
2.	a	Demonstrate user defined functions in C++.	5	1	L2
	b	Build a C++ code for the following problem.	5	1	L3
		2-sum problem:			
		Given an array of integers nums and an integer target, return indices of the two numbers such that they add up to target.			
		You may assume that each input would have exactly one solution,			
		and you may not use the same element twice.			
		You can return the answer in any order.			
		Example:			
		Input: nums = [2,7,11,15], target = 9			
		Output: [0,1]			
		Because nums[0] + nums[1] == 9, we return [0, 1].			
		<u>UNIT-II</u>			
3.		Demonstrate polymorphism in C++ with suitable examples.	10	2	L2
		(OR)			
4.		Discuss exception handling in C++.	10	2	L6
		<u>UNIT-III</u>			
5.	a	How can we measure the efficiency of an algorithm? Explain.	5	3	L1
	b	Find the time complexity for the recursive function given below.	5	3	L3
		<pre> void test(int n) { if(n>1){ test(n-1); for(i=0; i<n; i++) cout << i; test(n-1); } } </pre>			

(OR)

6.	a	Explain Characteristics of an algorithm.	5	3	L1
	b	Find the time complexity for the recursive function given below.	5	3	L3
<pre> void test(int n) { if(n>1){ test(n/2); for(i=0; i<n; i=i+1) cout << i; } } </pre>					

UNIT-IV

7.		Discuss about Vectors STL container in C++ and their functions with examples. Also explain the difference between vector and array in C++.	10	4	L1
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(OR)

8.		Discuss about Maps STL container, types of maps and their functions with example.	10	4	L1
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UNIT-V

9.		Explain about Backtracking. Write a C++ solution Path with Maximum Gold problem.	10	5	L2,L3
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Statement: In a gold mine grid of size m x n, each cell in this mine has an integer representing the amount of gold in that cell, 0 if it is empty. Return the maximum amount of gold you can collect under the conditions:

- Every time you are located in a cell you will collect all the gold in that cell.
- From your position, you can walk one step to the left, right, up, or down.
- You can't visit the same cell more than once.
- Never visit a cell with 0 gold.
- You can start and stop collecting gold from any position in the grid that has some gold.

Input: grid = [[0,6,0],[5,8,7],[0,9,0]]

Output: 24

(OR)

10.		Discuss Recursion. Write a C++ solution to generate all permutations of characters in a given string.	10	5	L2,L3
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UNIT-VI

11.	a	Demonstrate the approach of Sieve of Eratosthenes.	5	6	L2
	b	Build a C++ solution for Rabbits in Forest.	5	6	L3

Statement: There is a forest with an unknown number of rabbits. We asked n rabbits "How many rabbits have the same color as you?" and collected the answers in an integer array answers where answers[i] is the answer of the ith rabbit.

Given the array answers, return the minimum number of rabbits that could be in the forest.

Input: answers = [1,1,2]

Output: 5

(OR)

12.	a	Demonstrate Extended Euclidean algorithm	5	6	L2
	b	Write a C++ solution for Ugly number.	5	6	L3

Statement: An ugly number is a positive integer whose prime factors are limited to 2, 3, and 5. Given an integer n, return true if n is an ugly number.

Input: n = 6 **Output:** true

Explanation: $6 = 2 \times 3$

Time: 3 Hours

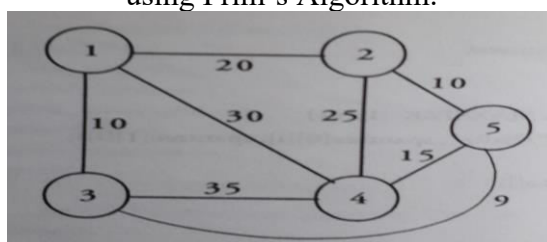
Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	a) Define a Data Structure. Explain the operations of Data Structure.	5M	CO1	K2
	b) Define a Time complexity and Space complexity.	5M	CO1	K2
(OR)				
2.	Explain the Asymptotic Notations(O , Ω , Θ).Find the time complexity of Linear search.	10M	CO1	K2
<u>UNIT-II</u>				
3.	a) Write a Linear Search Algorithm with example.	5M	CO2	K2
	b) Write a Bubble sort Algorithm.	5M	CO2	K2
(OR)				
4.	Explain selection sort. Write selection sort algorithm and time complexity of Selection sort.	10M	CO2	K3
<u>UNIT-III</u>				
5.	a) Definition of a Stack. Write an Application of Stack.	5M	CO3	K2
	b) Define a Queue. Explain the operations of Queue.	5M	CO3	K2
(OR)				
6.	Write an Algorithm for conversion of Infix to postfix expression with example.	10M	CO3	K3
<u>UNIT-IV</u>				
7.	a) Comparison between Arrays and Linked list	5M	CO4	K2
	b) Write an Algorithm to insert a node to the beginning of a singly linked list?	5M	CO4	K2
(OR)				
8.	Demonstrate the following Deletion operations on single linked list with example . a) At the beginning of the list b) at the end of the list c) at any given position	10M	CO4	K2
<u>UNIT-V</u>				
9.	a) Explain the various binary tree representations with example.	5M	CO5	K2
	b) Explain the different Binary Tree Traversal Techniques.	5M	CO5	K2
(OR)				
10.	Define a Binary search tree. Construct the Binary Search Tree in step by step for the below given list {10, 14, 16, 8,17, 6, 23, 60 , 5 , 18, 27, 36, 12, 87, 65 , 50}.	10M	CO5	K3
<u>UNIT-VI</u>				
11.	a) Define a Graph. Explain the representation of Graph.	5M	CO6	K2
	b) Construct a minimum cost spanning tree for given weighted graph using Prim's Algorithm.	5M	CO6	K3

**(OR)**

12. Write a Graph Traversal Algorithms (DFS,BFS) with example. 10M CO6 K2

AR18

CODE: 18CST208

SET-1

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)**

II B. Tech II Semester Supplementary Examinations, July,2025

**Design & Analysis of Algorithms
(Common to CSE and IT Branches)**

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

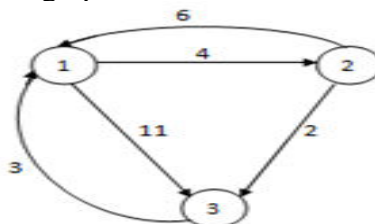
1. a) Calculate space and time complexity for matrix multiplication algorithm. 6M
b) Show that $4n^2 + 2n + 10 = O(n^2)$. 6M
- (OR)
2. Explain about the asymptotic notations with suitable examples. 12M

UNIT-II

3. a) Show the result of running Merge sorting technique on the sequence 38,27,43,3,9,82,10. 6M
b) Prove that the worst case time complexity of the QuickSort is $O(n^2)$. 6M
- (OR)
4. a) Write a greedy algorithm to find optimal solution to the knapsack problem. 6M
b) State Job sequencing with deadlines problem. Find the optimal sequence to the instance when $n=5$, profits(p_1, p_2, p_3, p_4, p_5) = (20,15,10,5,1) and deadlines d_1, d_2, d_3, d_4, d_5 = (2,2,1,3,3) 6M

UNIT-III

5. a) Find the minimum number of operations required for the following chain matrix multiplication using dynamic programming. $A(30,40) * B(40,5) * C(5, 15) * D(15, 6)$. 6M
b) What is principle of optimality? Explain how travelling sales person problem uses the dynamic programming technique with example. 6M
- (OR)
6. a) Find an optimal solution for the dynamic programming 0/1 knapsack instance for $n=3$, $m=6$, profits are (p_1, p_2, p_3) = (1,2,5), weights are (w_1, w_2, w_3)=(2,3,4). 6M
b) Describe the all-pairs shortest paths algorithm and find the shortest paths between all pairs of nodes in the given graph. 6M



UNIT-IV

7. a) What is connectivity in a graph? How connected graphs are different from other graphs? 6M
b) Write an algorithm to find Bi-connected components of a graph, 6M
- (OR)**
8. a) Briefly explain 8-queens problem using backtracking. Explain its application. 6M
b) Draw the state space tree for m coloring when $n=3$ and $m=3$. 6M

UNIT-V

9. Apply the least cost branch and bound method to solve the TSP for the following cost matrix. Draw a state space tree and find the optimum cost of the tour? 12M

$$\begin{bmatrix} \infty & 11 & 10 & 9 & 6 \\ 8 & \infty & 7 & 3 & 4 \\ 8 & 4 & \infty & 4 & 8 \\ 11 & 10 & 5 & \infty & 5 \\ 6 & 9 & 5 & 5 & \infty \end{bmatrix}$$

(OR)

10. a) Explain the classes of NP-Hard and NP-Complete. 6M
b) Discuss about deterministic and non-deterministic algorithms. 6M

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Explain the process of compilation. 7 M
- b) Explain the Art of Language Design along with the categories of Programming Language 7 M

(OR)

2. a) Explain in brief about regular Expressions and context -free Grammars . 7 M
- b) Explain the Derivation of parse trees . 7 M

UNIT-II

3. a) **Explain the role** of Semantic Analyzer. 7 M
- b) Explain in detail about Evaluating Attributes about Action Routines 7 M

(OR)

4. Explain in brief about Object Lifetime and principal storage allocation mechanisms. 14 M

UNIT-III

5. a) Define Data type .Write the differences between Records (Structures) and Variants (Unions). 7 M
- b) Define Recursion. Explain it with an example. 7 M

(OR)

6. Explain in detail about expression evaluation with suitable examples. 14M

UNIT-IV

7. What is exception handling? Explain in detail about Exception Propagation with suitable example 14 M

(OR)

8. Explain in detail about Review of stack Layout, Calling Sequences 14 M

UNIT-V

9. a) What is multiple inheritance. Explain in detail with an example. 7 M
- b) What is Encapsulation. Explain in detail with an example. 7 M

(OR)

10. a) Explain about Dynamic Method Binding with example. 7 M
- b) What is Object Oriented programming .List out all the Object Oriented Programming features 7 M