

DIGITAL LOGIC AND COMPUTER ORGANIZATION
(Common to CSE(AIML) & CSE (DS) Branches)**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
UNIT-I				
1.	a) A 12-bit binary number is given as: $(1011\ 0110\ 1101)_2$ Convert it into octal and hexadecimal. Subtract $(2D3)_{16}$ from this number using 2's complement method. Verify your result in decimal.	7M	1	K3
	b) Determine r's and (r-1)'s complement for the subtraction between $(4567)_{10} - (8901)_{10}$, where $r=10$.	7M	1	K3
(OR)				
2.	a) (i) $(101110111011)_2 = (?)_8$ (ii) $(1110111101)_2 = (?)_{16}$ (iii) $(79)_{10} = (?)_2$	7M	1	K3
	b) (i) $ABC + ABC\bar{C} + A\bar{B}C$ Minimize the Boolean function using Theorems. (ii) $A\bar{B} + \bar{A}B + ABC\bar{C} + \bar{A}\bar{B}C$ Minimize the function using Theorem	7M	1	K3
UNIT-II				
3.	a) The Boolean function $F(A, B, C, D) = \Sigma(2, 3, 4, 5, 7, 9, 11, 14) + d(0, 6, 13, 15)$. Minimize SOP using K-map.	7M	2	K3
	b) Design a 4-bit Binary Adder.	7M	2	K3
(OR)				
4.	a) $\Pi(2, 7, 9, 11) + d(1, 5, 13)$ Minimize using K-Map.	7M	2	K3
	b) Explain about full adder Circuit.	7M	2	K3
UNIT-III				
5.	a) Explain the difference between combinational and sequential circuits.	7M	3	K3
	b) Design a 3-bit asynchronous (ripple) counter using T flip-flops	7M	3	K3
(OR)				
6.	a) (i) Convert T-Flip Flop from JK-Flip Flop. (ii) Convert D-Flip Flop from JK-Flip Flop.	7M	3	K3
	b) Design and Explain about Universal Shift Register.	7M	3	K3
UNIT-IV				
7.	a) Explain immediate, direct, indirect, register, and register indirect addressing modes with examples	7M	4	K2
	b) Design a 4-bit ALU capable of performing: addition, subtraction, AND, OR, and XOR. Draw ALU logic diagram. Show control signals required for each operation.	7M	4	K2
(OR)				
8.	a) Explain the difference between Computer Architecture and Computer Organisation.	7M	4	K2
	b) Explain about Instruction pipelining with suitable example.	7M	4	K2
UNIT-V				
9.	a) Compare I/O bus and memory bus. Explain why some systems use a common bus while others have separate buses for memory and I/O.	7M	5	K2
	b) Compare primary memory and auxiliary memory in terms of speed, cost, and volatility.	7M	5	K2
(OR)				
10.	a) Explain about Cache memory & Virtual memory mapping	7M	5	K2
	b) Explain about Modes of Transfer with Interrupt driven I/O.	7M	5	K2

Time: 3 Hours**Max Marks: 70**

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	<u>UNIT-I</u>	Marks	CO	Blooms Level
1.	a) Define viscosity. Explain how viscosity vary with temperature.	7	CO1	remember
	b) Measure the pressure in the pipe if the left leg of a U – tube mercury manometer is connected to a pipe-line conveying water, the level of mercury in the leg being 0.6m below the center of pipe-line, and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45m above that in the left leg and the space above mercury in the right leg contains Benzene (specific gravity 0.88) to a height of 0.3m.	7	CO1	Apply
	(OR)			
2.	a) State and prove Hydrostatic law.	7	CO1	Understand
	b) Define surface tension. Derive expression for the pressure (i) within a droplet of water (ii) inside a soap bubble.	7	CO1	Remember
	<u>UNIT-II</u>			
3.	a) Explain about i) Stream function and ii) velocity potential.	7	CO2	Understand
	b) A metallic cube 30 cm side and weighing 450 N is lowered into a tank containing a two-fluid layer of water and mercury. Determine the position of block at mercury-water interface when it has reached equilibrium.	7	CO2	Apply
	(OR)			
4.	a) Derive continuity equation.	7	CO2	analyse
	b) Two velocity components are given in the following cases, find the third component such that they satisfy the continuity equation. $u = x^3 + y^2 + 2z^2$; $v = -x^2 y - yz - xy$.	7	CO2	apply
	<u>UNIT-III</u>			
5.	a) Derive the expression for discharge through a venturimeter.	7	CO3	analyse
	b) A piping system consists of three pipes arranged in series; the lengths of the pipes are 1200 m, 750 m and 600 m and diameters 750 mm, 600 mm and 450 mm respectively. (i) Transform the system to an equivalent 450 mm diameter pipe, and (ii) Determine an equivalent diameter for the pipe, 2550 m long.	7	CO3	apply

(OR)

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|----|----|--|---|-----|------------|
| 6. | a) | Explain Reynold's experiment for the classification of flows. | 7 | CO3 | understand |
| | b) | The following data relate to an orificemeter: Diameter of the pipe = 300 mm, Diameter of the orifice = 150 mm, Reading of the differential manometer = 500 mm of mercury, Sp. gravity of oil = 0.9, Co-efficient of discharge of meter = 0.64. Determine the rate of flow. | 7 | CO3 | apply |

UNIT-IV

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|----|----|--|---|-----|------------|
| 7. | a) | Prove that the force exerted by a jet of water on a fixed semi-circular plate in the direction of the jet when the jet strikes at the center of the semi-circular plate is two times the force exerted by the jet on a fixed vertical plate. | 7 | CO4 | evaluate |
| | b) | Explain the heads and efficiencies of turbines. | 7 | CO4 | understand |

(OR)

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|----|----|---|---|-----|------------|
| 8. | a) | Explain the layout of a hydroelectric power plant with a neat sketch. | 7 | CO4 | understand |
| | b) | A Pelton wheel has to be designed for the following data: Power to be developed = 6000kW; Net head available = 300m; Speed = 550 rpm; Ratio of jet diameter to wheel diameter = 1/10; and overall efficiency = 85%. Find the number of jets, diameter of the jet, diameter of the wheel and the quantity of water required. | 7 | CO4 | apply |

UNIT-V

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|----|----|---|---|-----|------------|
| 9. | a) | Explain pumps in series and pumps in parallel. | 7 | CO5 | understand |
| | b) | A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine:
(i) Vane angle at inlet,
(ii) Work done by impeller on water per second, and
(iii) Manometric efficiency. | 7 | CO5 | apply |

(OR)

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|-----|----|--|---|-----|------------|
| 10. | a) | Explain the working of a single stage centrifugal pump with neat sketch. | 7 | CO5 | understand |
| | b) | A double acting reciprocating pump has piston of diameter 250 mm and piston rod of diameter 50mm which is on one side only. Length of piston stroke is 350mm and speed of crank moving the piston is 60 rpm. The suction and delivery heads are 4.5 m and 18m respectively. Determine the discharge capacity of the pump and the power required to operate the pump. | 7 | CO5 | apply |

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

UNIT-I

- | | | Marks | CO | BTL |
|----|--|-------|-----|-----|
| 1. | a) Define an algorithm. Discuss its characteristics and explain various mathematical or asymptotic notations to analyze the performance of an algorithm. | 7 | CO1 | L2 |
| | b) What is the significance of analyzing the performance of algorithms? Discuss the role of worst-case, best-case, and average-case analyses in evaluating algorithm efficiency. | 7 | CO5 | L3 |

(OR)

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|----|--|---|-----|----|
| 2. | a) What is performance analysis of an algorithm? Discuss the factors affecting the performance of an algorithm and explain how time and space complexities are measured. | 7 | CO1 | L3 |
| | b) Write a recursive algorithm for binary search and also bring out its efficiency | 7 | CO5 | L3 |

UNIT-II

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|----|--|---|-----|----|
| 3. | a) Explain Strassen's Matrix Multiplication algorithm and compare it with conventional matrix multiplication in terms of complexity. | 7 | CO2 | L2 |
| | b) Solve the following job sequencing with deadlines problem: (D1, D2, D3, D4) = (2, 1, 2, 3) and (P1, P2, P3, P4) = (5, 8, 6, 5) | 7 | CO2 | L3 |

(OR)

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|----|--|---|-----|----|
| 4. | a) Write an algorithm based on divide-and-conquer strategy to search an element in a given list. Assume that the elements of list are in sorted order. | 7 | CO2 | L2 |
| | b) Explain the general principle of Greedy method and also list the applications of Greedy method. | 7 | CO2 | L2 |

UNIT-III

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|----|---|---|-----|----|
| 5. | a) Write an algorithm for 0/1 Knapsack problem using Dynamic programming. | 7 | CO3 | L2 |
| | b) Obtain reduced cost matrix for travelling sales person problem. Consider the instance define by the cost matrix: | 7 | CO3 | L3 |

$$\begin{bmatrix}
 \infty & 5 & 1 & 10 & 6 \\
 1 & \infty & 4 & 12 & 7 \\
 3 & 6 & \infty & 4 & 16 \\
 7 & 1 & 3 & \infty & 9 \\
 16 & 12 & 7 & 6 & \infty
 \end{bmatrix}$$

(OR)

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|----|----|---|---|-----|----|
| 6. | a) | Let the dimensions of A,B,C,D respectively be 10X5, 5X15, 15X8, 8X20 generate matrix product chains that produces minimum number of matrix multiplications using dynamic programming. | 7 | CO3 | L3 |
| | b) | What is the principle difference between the divide and conquer technique and dynamic programming technique? | 7 | CO3 | L3 |

UNIT-IV

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|----|----|--|---|-----|----|
| 7. | a) | What are the differences between FIFO and LC branch and bound solutions? | 7 | CO4 | L2 |
| | b) | A company needs to select projects under a limited budget of 15 units. The available projects have the following profit and cost:
P1: profit = 20, cost = 5
P2: profit = 30, cost = 10
P3: profit = 25, cost = 12
P4: profit = 15, cost = 8
Apply Branch and Bound for 0/1 Knapsack to choose the projects maximizing profit. | 7 | CO4 | L3 |

(OR)

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|----|----|---|---|-----|----|
| 8. | a) | Compare BFS and DFS algorithm with an example graph and denote its time complexities. | 7 | CO4 | L2 |
| | b) | A directed acyclic graph (DAG) representing course prerequisites is given below:
Course A → B, A → C, B → D, C → D, D → E.
Perform a Topological Sort and list the valid order(s) of courses. | 7 | CO4 | L3 |

UNIT-V

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|----|----|--|---|-----|----|
| 9. | a) | How to find the existence of Hamiltonian cycle in graph? Write the algorithm and explain with suitable example. | 7 | CO5 | L2 |
| | b) | Write a backtracking algorithm to solve sum of subsets problem with m=35, w= {20, 18, 15, 12, 10, 7, 5} to the variable tuple size formulation | 7 | CO5 | L3 |
- (OR)**
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|-----|----|---|---|-----|----|
| 10. | a) | Distinguish between backtracking and branch – and bound techniques. | 7 | CO5 | L2 |
| | b) | Give the solution to the 8-queens problem using backtracking? | 7 | CO5 | L3 |

SIGNALS AND SYSTEMS
(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time: 3 Hours

Max Marks: 70

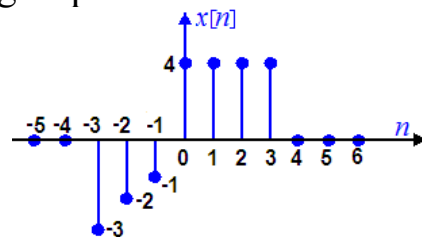
Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Show the even and odd components of the following sequence.



- b) Represent the following sequences graphically

(a) $u[n-4]$ (b) $u[n+2]$ (c) $u[-n-3]$ (d) $u[-n+3]$

(OR)

2. a) Illustrate the following classification of DT sequences with examples
(i) Static versus Dynamic systems. (ii) Time variant versus Time-invariant system
- b) For each of the following systems, determine whether the system is stable, causal, linear and time-invariant.
- (i) $y[n] = 2x[n] + 1$ (ii) $y[n] = x^2[n]$
- (iii) $y[n] = x[-n - 2]$

UNIT-II

3. a) Explain the properties of convolution
- b) Solve $y(t) = x(t) * h(t)$, given $x(t) = e^{-at} u(t)$, $h(t) = u(t)$

(OR)

4. a) Find the step response whose impulse response is
 $h(t) = u(t + 1) - u(t - 1)$
- b) Find the Fourier Transform of the signal $x(t) = [u(t + 2) - u(t - 2)]$ using the Fourier integral

UNIT-III

5. a) State and Prove the properties of the following using Fourier Transforms. 6M 3 Understanding
(i) Time shifting property
(ii) Frequency shifting property
- b) (i) Find the Fourier Transform of the function $x(t) = e^{-at}u(t)$ 8M 3 Applying
(ii) Find the Fourier Transform of the unit step function.

(OR)

6. a) Describe the conditions for the existence of Fourier series of a signal 4M 3 Understanding
- b) (i) Find the Fourier Transform of the function $x(t) = e^{3t}u(t) + 5\delta(t)$ 10M 3 Applying
(ii) Find the Fourier Transform of the function $x(t) = 2e^{-2t}u(t) - 5e^{-3t}u(t)$

UNIT-IV

7. a) State and Prove the Linearity Property in Laplace Transforms. Find the Laplace transform of the signal $x(t) = e^{-2t}u(t) + e^{-3t}u(t)$ using linearity property. 7M 4 Applying
- b) State and prove any three properties of the Laplace Transform. 7M 4 Understanding

(OR)

8. a) State and prove initial and final value theorems for Laplace Transform? 7M 4 Understanding
- b) Find the Inverse Laplace Transform of $X(s) = \frac{10e^{-3s}}{(s-2)(s+2)}$ 7M 4 Applying

UNIT-V

9. a) What is sampling? Explain different types of sampling techniques? 7M 5 Understanding
- b) Find the Z-Transform of (a) $x[n] = 2^n u[n-2]$ 7M 5 Applying
(b) $x[n] = \left(\frac{1}{4}\right)^n u[-n]$

(OR)

10. State and prove any four properties of z-transform 14M 5 Understanding

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

- | | | Marks | CO | BTL |
|----|---|-------|----|-----|
| 1. | a) Transform the vector $10\vec{a}_x$ at Q(x= -3, y = 2, z = 4) to the spherical coordinates. | 7M | 1 | K2 |
| | b) Find the total charge in a volume defined by six planes for which $1 \leq x \leq 2, 2 \leq y \leq 3, 3 \leq z \leq 4$ and electric flux density $\vec{D} = 4x\vec{a}_x + 3x^2\vec{a}_y + 2z^3\vec{a}_z$ C/m ² . | 7M | 1 | K3 |

(OR)

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|----|--|----|---|----|
| 2. | a) Derive the expression for electric field intensity E due to the infinite straight line along with Z axis using Gauss's law. | 7M | 1 | K3 |
| | b) Write and prove the Maxwell's first equation. | 7M | 1 | K2 |

UNIT-II

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|----|--|----|---|----|
| 3. | a) Derive an expression for electric field intensity due to an electric dipole. | 7M | 2 | K1 |
| | b) A parallel plate capacitor has a plate area of 1.5 m ² and a plate separation of 5 mm. There are two dielectrics in between the plates. The first dielectric has a thickness of 3 mm with a relative permittivity of 6 and second has a thickness of 2 mm with a relative permittivity of 4. Find the capacitance. | 7M | 2 | K3 |

(OR)

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|----|--|----|---|----|
| 4. | a) Derive the expression for capacitance in parallel plate capacitor. | 7M | 2 | K3 |
| | b) Explain and derive the boundary conditions for a dielectric - dielectric. | 7M | 2 | K4 |

UNIT-III

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|----|---|----|---|----|
| 5. | a) Derive an expression for magnetic field straight long wire using ampere circuit law. | 7M | 3 | K2 |
| | b) State and explain Biot-Savart's law. | 7M | 3 | K3 |

(OR)

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|----|----|---|----|---|----|
| 6. | a) | Two long parallel wires separated 2 m apart carry currents of 50 A and 100 A respectively in the same direction. Determine the magnitude and direction of the force between them per unit length. | 7M | 3 | K3 |
| | b) | Derive an expression for torque produced on a rectangular current loop if placed in a magnetic field \vec{B} . Show that $\vec{\tau} = \vec{m} \times \vec{B}$. | 7M | 3 | K4 |

UNIT-IV

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|----|----|--|----|---|----|
| 7. | a) | Derive the self-inductance of a solenoid. | 7M | 4 | K2 |
| | b) | A solenoid of 500 turns has a length of 50 cm and the radius of 10 cm. A steel rod of circular cross-section is fitted in the solenoid coaxially. Relative permeability of steel is 3000. A dc current of 10 A is passed through solenoid. Compute inductance of the system. | 7M | 4 | K3 |

(OR)

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|----|----|---|----|---|----|
| 8. | a) | Explain the terms self inductance and mutual inductance. | 7M | 4 | K2 |
| | b) | Find inductance per unit length of a coaxial cable if radius of inner and outer conductors is 1 mm and 3 mm respectively. Assume relative permeability unity. | 7M | 4 | K2 |

UNIT-V

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|----|----|---|----|---|-----|
| 9. | a) | Show that the ratio of the amplitude of the conduction current and displacement current density is $\sigma/\omega\epsilon$ for the applied field $E = E_{\max} \cos\omega t$. Where ϵ = permittivity of medium. | 7M | 5 | K4 |
| | b) | Write the Maxwell's equations in point form and integral form for the time varying fields. | 7M | 5 | K2r |

(OR)

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|-----|----|---|----|---|----|
| 10. | a) | State the Faraday's law of electromagnetic induction and derive the expression for the transformer e.m.f. | 7M | 5 | K2 |
| | b) | Explain the Poynting theorem and Poynting vector. | 7M | 5 | K2 |

FLUID MECHANICS AND HYDRAULIC MACHINERY**(Mechanical Engineering)****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

UNIT-I

- | | | Marks | CO | BTL |
|----|---|-------|----|-----|
| 1. | a) Define the following fluid properties (i) weight density (ii) compressibility (iii) Bulk modulus and | 6 | 1 | 1 |
| | b) Three litres of Newtonian fluid weigh 23.7 N. Find out the mass density, specific weight, specific volume, specific gravity and dynamic viscosity of fluid if kinematic viscosity is $7.1 \times 10^{-7} \text{ m}^2/\text{s}$ | 8 | 1 | 3 |

(OR)

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|----|--|---|---|---|
| 2. | a) Define the following terms (i) Path line, (ii) Streamline, (iii) Streak line | 5 | 1 | 1 |
| | b) Derive an expression for continuity for three-dimensional flow and reduce it for steady, incompressible two-dimensional flow. | 9 | 1 | 2 |

UNIT-II

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|----|---|---|---|---|
| 3. | a) Explain briefly the various heads and forces acting on a flowing fluid. Also give a brief discussion on equations of motion. | 7 | 2 | 1 |
| | b) A pipe of diameter 0.2 m carries oil (specific gravity = 0.85) at the rate of 100 litres per second and the pressure at a point P is 19.62 kN/m ² (gauge). If the point P is 3 m above the datum line, then determine the total energy at point P in metres of oil. | 7 | 2 | 3 |

(OR)

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|----|---|---|---|---|
| 4. | a) Define the coefficient of discharge of venturimeter and coefficient of contraction of orifice meter | 6 | 2 | 1 |
| | b) A venture meter having an inlet diameter of 0.3 m is fitted in a horizontal pipeline to measure the flow of water. If the water flow rate through the venture meter is 0.3 m ³ /s and the pressure of water in the pipe is 285 kPa, then determine the least throat diameter of the venture meter to avoid any cavitation. Take atmospheric pressure as 10.34 m of water and assume that cavitation occurs when the absolute pressure head falls below 2.5 m (abs). | 8 | 2 | 3 |

UNIT-III

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|----|---|---|---|---|
| 5. | a) What is a compound pipe? What will be the loss of head when pipes are connected in series? | 5 | 3 | 1 |
|----|---|---|---|---|

b)	Two pipes each of length 300 m are available for connecting to a reservoir from which a flow of $0.06 \text{ m}^3/\text{s}$ is required. If the diameters of the two pipes are 0.15 m and 0.25 m, respectively, then find the ratio of the head lost when the pipes are connected in series to the head lost when they are connected in parallel. Neglect the minor losses and take the friction coefficient as $f=0.0025$ in Darcy's formula.	9	3	3
(OR)				
6. a)	Explain the head loss due to sudden contraction in a fluid flow in a pipe with a diagram	8	3	1
b)	A jet of water with diameter 0.1 m strikes on a curved moving vanes at the centre attached to the circumference of a wheel with a velocity of 15 m/s. The linear velocity of the vane is 5 m/s in the direction of the jet. Assuming that the vane is smooth, find (i) the force exerted on the vane in the direction of the jet, (ii) work done per second.	6	3	3
<u>UNIT-IV</u>				
7. a)	Classify the hydraulic turbines	6	4	2
b)	Explain the construction, working of a Francis turbine.	8	4	3
(OR)				
8. a)	Compare main characteristic curves and operating characteristic curves.	5	4	2
b)	A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at the inlet is 1.2 m and the flow area is 0.4 m^2 . The angles made by the absolute and relative velocities at the inlet are 20° and 60° , respectively with the tangential velocity. If whirl at the outlet is zero, then determine (i) the volume flow rate, (ii) power developed and (iii) hydraulic efficiency.	9	4	3
<u>UNIT-V</u>				
9. a)	Discuss the significance of manometric efficiency of a centrifugal pump	6	5	6
b)	A centrifugal pump is required to deliver $0.03 \text{ m}^3/\text{s}$ of water to a height of 25 m through a 12 cm diameter pipe and 110 m long. Determine the power required to drive the pump if its overall efficiency is 72%. Take coefficient of friction $f=0.001$ for the pipe line.	8	5	3
(OR)				
10. a)	Give comparisons between centrifugal and reciprocating pumps.	4	5	2
b)	A single acting reciprocating pump, running at 50 rpm, delivers $0.01 \text{ m}^3/\text{sec}$ of water. The diameter of piston is 20 cm and stroke length 40 cm. Determine (a) the theoretical discharge of the pump (b) Co-efficient of discharge (c) slip and percentage of slip of the pump.	10	5	1

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

- | | | Marks | CO | BTL |
|----|---|-------|----|-----|
| 1. | a) Draw the schematic of a four-stroke SI engine and explain each stroke in detail. | 5 | 1 | 1 |
| | b) Distinguish between SI and CI engines. | 5 | 1 | 1 |

(OR)

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|----|--|---|---|---|
| 2. | a) Draw the valve timing diagram for 4-stroke diesel engine. | 5 | 1 | 2 |
| | b) Discuss in detail the application of various types of IC engines. | 5 | 1 | 1 |

UNIT-II

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|----|---|---|---|---|
| 3. | a) Compare and contrast solid, liquid and gaseous fuels in terms of energy density, mode of handling, and typical applications. | 5 | 2 | 2 |
| | b) A fuel has gross calorific value (GCV, higher heating value) = 44,000 kJ/kg. Combustion produces water vapor whose latent heat (per kg fuel) is 2,500 kJ (condensable). Compute the net calorific value (NCV, LHV). If engine's indicated thermal efficiency based on GCV is 38%, compute indicated thermal efficiency based on NCV. | 5 | 2 | 4 |

(OR)

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|----|---|---|---|---|
| 4. | a) An SI engine consumes fuel at 0.0045 kg/s and draws inlet air at 0.66 kg/s. Compute actual A/F ratio and state if mixture is lean or rich compared to stoichiometric 14.7:1. | 5 | 2 | 4 |
| | b) An engine has indicated power (IP) = 120 kW. Measured frictional power (FP) = 18 kW. Compute: a) brake power (BP); b) mechanical efficiency. Also, if fuel input causes indicated thermal efficiency $\eta = 40\%$, what is the brake thermal efficiency? | 5 | 2 | 4 |

UNIT-III

5. a) Explain the stages of combustion in SI engine with neat sketch. 5 3 2
b) How does turbulence affect the flame speed in SI engines? Mention other parameters influencing it. 5 3 2

(OR)

6. a) What variables affect the ignition delay period in CI engines? Explain briefly. 5 3 2
b) Differentiate between knocking in SI and CI engines. 5 3 2

UNIT-IV

7. a) Derive the expression for work done by a jet of water on a stationary inclined flat plate. 5 4 3
b) Write short notes on classification of hydraulic turbines. 5 4 1

(OR)

8. a) Explain the construction and working of a Kaplan turbine. 5 4 1
b) Derive the expression for work done by water on the runner of a Francis turbine. 5 4 3

UNIT-V

9. a) Define a centrifugal pump, Explain the working of a single-stage centrifugal pump. 5 5 2
b) A centrifugal pump delivers water at the rate of 40 L/s against a head of 25 m. The impeller diameter is 0.35 m and rotates at 1500 rpm. Calculate the work done per second by the impeller. 5 5 4

(OR)

10. a) Explain the main characteristic curves of a centrifugal pump with neat sketches. 5 5 2
b) A centrifugal pump has NPSH available = 6 m, and NPSH required = 4 m. Will the pump operate safely without cavitation? Justify with calculation. 5 5 4

UNIT-VI

11. a) Explain the principle of operation of a reciprocating compressor with a neat sketch. 5 6 1
b) Explain briefly the causes and remedies of cavitation in reciprocating pumps. 5 6 2

(OR)

12. a) Derive an expression for the theoretical discharge of a single acting reciprocating pump. 5 6 3
b) What is the optimal pressure ratio in multi-stage compression? Derive the condition. 5 6 3

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

	<u>UNIT-I</u>	Marks	CO	BTL
1. Draw the line diagram of TPP and Explain the functions of various components.		10	1	Understand
(OR)				
2. Explain the operation of a hydro power plant with a neat diagram.		10	1	Understand
<u>UNIT-II</u>				
3. a) Explain the operation of a Gas power plant with neat sketch.		5	2	Understand
b) Illustrate the solar power generation with neat block diagram		5	2	Understand
(OR)				
4. a) Explain moderators, control rods and coolants		5	2	Understand
b) Explain different types of reactors with neat sketch		5	2	Understand
<u>UNIT-III</u>				
5. a) Compare DC and AC distribution system.		5	3	Understand
b) A 2-wire d.c distributor cable AB is 2 km long and supplies load of 100A, 150A, 200A and 50A situated at 500m, 1000m, 1600m and 2000m from the feeding point A. Each conductor has a resistance of 0.01Ω per 1000m. Calculate the p.d at each load point if a p.d of 300V is maintained at point A.		5	3	Apply
(OR)				
6. a) Explain any one method of solving A.C distribution system with a phasor diagrams.		5	3	Understand
b) A single phase distributor 2 KM long supplies a load of 120 A at 0.8 p.f lagging at its far end and a load of 80 A at 0.9 p.f lagging at its mid point. Both power factors are referred to the voltage at the far end. The resistance and reactance per KM (go and return) are 0.05Ω and 0.1Ω respectively. If the voltage at the far end is maintained at 230 V, calculate (i) voltage at the sending end (ii) phase angle between voltages at the two ends.		5	3	Apply

UNIT-IV

7. a) Compare Indoor and Outdoor substations. 5 4 Understand
b) Explain about components in substation. 5 4 Understand
- (OR)**
8. a) Explain about Bus-Bar arrangement in substation. 5 4 Understand
b) Write any five advantages of Gas Insulated Substation. 5 4 Understand

UNIT-V

9. a) Define Load Curve. Explain the importance of a load duration curve. 5 5 Understand
b) A maximum demand of 1200 KW. The annual load factor of 60% and plant capacity factor is 50%. Determine plant capacity and reserve capacity of the plant. 5 5 Apply
- (OR)**
10. a) Explain any three types of loads on electric power system. 5 5 Understand
b) It has been desired to install a diesel power station to supply power in a suburban area having the following particulars:
(i) 1000 houses with average connected load of 1.5 kW in each house. The demand factor and diversity factor being 0.4 and 2.5 respectively. (ii) 10 factories having overall maximum demand of 90 kW. (iii) 7 tubewells of 7 kW each and operating together in the morning. The diversity factor among above three types of consumers is 1.2. What should be the minimum capacity of power station ? 5 5 Apply

UNIT-VI

11. a) Explain the concepts of costs of Generation 5 6 Understand
b) A generating station has an installed capacity of 50,000 kW and delivers 220×10^6 units per annum. If the annual fixed charges are Rs 160 per kW installed capacity and running charges are 4 paise per kWh, determine the cost per unit generated. 5 6 Apply
- (OR)**
12. a) Explain two part and power factor tariff methods 5 6 Understand
b) A supply is offered on the basis of fixed charges of Rs 30 per annum plus 3 paise per unit or alternatively, at the rate of 6 paise per unit for the first 400 units per annum and 5 paise per unit for all the additional units. Find the number of units taken per annum for which the cost under the two tariffs becomes the same. 5 6 Apply

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

	<u>UNIT-I</u>	Marks	CO	Blooms Level
1. a)	Represent $(645)_{10}$ in gray code and 2421 code	5M	CO1	Apply
b)	Encode the binary word 1011 into even parity hamming code.	5M	CO1	Apply
	(OR)			
2. a)	Perform 2's complement subtraction on the following binary numbers 110111-101110	5M	CO1	Apply
b)	Convert the following	5M	CO1	Apply
	i) $(126)_8 = ()_{16}$ ii) $(1011101)_2 = ()_{10}$			
	<u>UNIT-II</u>			
3. a)	Define about SOP and POS with examples.	5M	CO2	Understand
b)	State and prove Demorgans theorem	5M	CO2	Understand
	(OR)			
4. a)	Convert given SOP to Canonical SOP $F(A,B,C,D)=A+BCD$	5M	CO2	Apply
b)	Minimize the given function using K-map method $\Sigma m(0,1,2,8,10,12,14,15)$	5M	CO2	Apply
	<u>UNIT-III</u>			
5. a)	Design BCD to Excess-3 code converter	5M	CO3	Apply
b)	Design a full adder with logic gates	5M	CO3	Apply
	(OR)			
6. a)	Design BCD adder and explain with help of an example	5M	CO3	Apply
b)	Design 4 bit carry look ahead adder	5M	CO3	Apply
	<u>UNIT-IV</u>			
7. a)	Design a 2 bit magnitude comparator	5M	CO4	Apply
b)	Design 16x1 multiplexer using 8x1 multiplexer	5M	CO4	Apply
	(OR)			
8. a)	Design a 3 to 8 decoder using logic gates	5M	CO4	Apply
b)	Implement $f(a,b,c)=\Sigma m(1,2,4,7)$ using 8x1 multiplexer	5M	CO4	Apply
	<u>UNIT-V</u>			
9. a)	Draw logic diagram for JK flip-flop and derive it's characteristic equation	5M	CO5	Apply
b)	Explain about SR flip-flop.	5M	CO5	Understand
	(OR)			
10. a)	Convert SR flip-flop to T flip-flop	5M	CO5	Apply
b)	Design a 3bit Johnson counter	5M	CO5	Apply
	<u>UNIT-VI</u>			
11. a)	Write the syntax for entity and architecture with example.	5M	CO6	Understanding
b)	Write VHDL code for full adder.	5M	CO6	Apply
	(OR)			
12. a)	Write VHDL code for XOR gate.	5M	CO6	Apply
b)	Write VHDL code for 8x1 multiplexer.	5M	CO6	Apply

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

		<u>UNIT-I</u>	Marks	CO	BTL
1.	a)	What is the need of object oriented programming? Explain java Buzzwords.	7M	1	2
	b)	What are the different primitive data types in java? Give their sizes in bits. How they are different from reference data types?	3M	1	2
		(OR)			
2.	a)	With a neat diagram, explain the Java Virtual Machine architecture	5M	1	2
	b)	Discuss declaration, allocation and accessing array elements in java with matrix addition example.	5M	1	2
		<u>UNIT-II</u>			
3.	a)	Write a java program to illustrate "Constructor Overloading".	5M	2	3
	b)	When to use a Static variable in JAVA programming? Explain the importance of Static Variable with a JAVA program	5M	2	4
		(OR)			
4.	a)	What are objects and how they are created from Class? Explain the dynamic initialization of objects using constructors.	5M	2	2
	b)	Explain various access specifiers supported by Java with an example.	5M	2	2
		<u>UNIT-III</u>			
5.	a)	What is meant by Inheritance and why it is important in Object Oriented Programming? Explain different types of inheritance supported in JAVA with example programs	10M	3	2
		(OR)			
6.	a)	Explain the use of 'super' keyword with an example.	5M	3	2
	b)	What is an Interface? Give the general form of an Interface and also discuss the implementation details of Interface	5M	3	2
		<u>UNIT-IV</u>			
7.	a)	What is the role of 'finally' keyword in exception handling? Explain with an example.	5M	4	2
	b)	What are the various types of exceptions available in Java? Also discuss on how they are handled?	5M	4	3
		(OR)			
8.	a)	Explain user defined exception with an example.	10M	4	3
		<u>UNIT-V</u>			
9.	a)	What is multithreading? In how many ways Java implements multithreading? Explain one of these ways with suitable example	7M	5	3
	b)	With a neat sketch, explain the lifecycle of a Thread in JAVA programming	3M	5	4
		(OR)			
10.	a)	What is meant by Thread Synchronization in JAVA programming? Why it is important? Explain with suitable example program.	7M	5	4
	b)	Discuss how to set the priority to threads? What are the different ranges.	3M	5	4
		<u>UNIT-VI</u>			
11.	a)	What is an applet? Create an applet to draw rectangle and square.	5M	6	5
	b)	Design an Applet displaying circle based on the user inputs for the radius and fill the circle with the given color.	5M	6	6
		(OR)			
12.	a)	Explain the different stages in the life cycle of an Applet	5M	6	2
	b)	How to pass the parameters to an Applet? Explain with example	5M	6	3

AR18

CODE: 18EET206

SET-1

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

II B. Tech I Semester Supplementary Examinations, November, 2025

ELECTRICAL MACHINES-I

(ELECTRICAL AND ELECTRONICS ENGINEERING)

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) Define commutation. Explain the process of commutation in dc generators with neat sketches. 6M
 - b) Distinguish between self and separately excited dc generators. How are self-excited dc generators classified? Give their circuit diagrams. 6M
- (OR)**
2. a) Derive an expression for EMF equation in DC machines? 6M
 - b) An 8 pole, lap-connected DC generator has 12 coils with 8 turns per coil. It is driven at 1800 rpm. If the flux per pole is 30mwb, calculate the emf generated. If the machines are wave connected find the speed at which it is to be driven to generate the same emf as calculated with lap connected. 6M

UNIT-II

3. a) What are the conditions to build up of emf in dc shunt generator? 6M
 - b) The magnetization characteristics of a shunt generator at 1000rpm. is as follows:

OC Volts	62.5	107.5	155.0	196.5	231.0	256.0	275.0	287.5
Field Amperes	1.0	2.02	3.0	4.0	5.0	6.0	7.0	8.0

 6M
- Estimate the no-load terminal voltage of the machine when run at 800 rpm with 30Ω field circuit resistance.
- (OR)**
4. a) Explain D.C shunt motor characteristics. 6M
 - b) A 6 pole, lap wound shunt motor has 500 conductors in the armature. The resistance of armature path is 0.05Ω . The resistances of shunt field winding are 25Ω . Find the speed of the motor when it takes 120A from dc mains of 100V supply. Flux per pole is 2×10^{-2} wb. 6M

UNIT-III

5. a) Describe and compare various methods of speed control of dc motors? 6M
 - b) A DC shunt motor runs at 750 rpm from 250 V supply and is taking a full load line current of 60 A. Its armature and field resistances are 0.4Ω and 125Ω respectively. Assuming 2 V brush drop and negligible armature reaction effect, calculate the no load speed for a no-load line current of 6 A and resistance to be added in series with armature circuit to reduce the full load speed to 600 rpm. 6M
- (OR)**
6. a) Derive the condition for maximum efficiency of a D.C. machine. 6M
 - b) The following readings are obtained when performing a brake test on DC shunt motor. Spring Balances are 8 Kgs and 30 Kgs. Diameter of the drum is 42 cm. Speed of the motor is 1000 rpm, applied voltage is 220 volts line current is 50A calculate output power and efficiency. 6M

UNIT-IV

7. a) Explain briefly the action of a transformer and show that the voltage ratio of the primary and secondary windings is the same as their turn's ratio. 6M
- b) A single-phase transformer has 400 primary and 1000 secondary turns. The net cross-sectional area of the core is 60 cm². If the primary winding be connected to a 50 Hz supply at 500 V, calculate i) the peak value of the flux density in the core, and ii) the voltage induced in the secondary winding. 6M

(OR)

8. a) What are the different losses in a transformer? Derive the Maximum efficiency of the transformer. 6M
- b) Find the All-day efficiency of a transformer having a maximum efficiency of 98% at 15 KVA at unity power factor and loaded as follows: 12 hours-2KW at 0.5 pf lag, 6 hours-2KW at 0.8 pf lag, 6 hours- at no load. 6M

UNIT-V

9. a) With circuit diagrams explain Open Circuit & Short Circuit tests conducted on single phase transformer. 6M
- b) Calculate the full load efficiency & the secondary terminal voltage of a transformer with 4KVA 200/400V 1-phase 50HZ for unity and 0.8 lagging from the following results 6M

O.C test: 200V	0.8A	70Watts
S.C Test: 20V	10A	60Watts.

(OR)

10. a) Explain the significance of vector groupings of transformers? 6M
- b) Two transformers A and B are joined in parallel to the same load. Determine the current by each transformer having given open circuit EMF 6600V for A and 6400V for B. leakage impedances in terms of secondary 0.3+j3 ohms for A and 0.2+j1 ohms for B. The load impedance is 8+j6 ohms. 6M

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

- | | <u>UNIT-I</u> | Marks | CO | BTL |
|-------|---|-------|-----|------------|
| 1. a) | Two horizontal plates are kept 12.5 mm apart. The space between the plates is filled with a fluid of viscosity 14 poise. Determine the shear stress in the oil, if the upper plate moves with a velocity of 2.5 m/s. | 6 | CO1 | Apply |
| b) | Distinguish Newtonian and non-Newtonian fluids. How do they differ in terms of stress-strain relationship? | 4 | CO1 | Understand |
| (OR) | | | | |
| 2. a) | Explain the terms total pressure and centre of pressure. | 4 | CO1 | Understand |
| b) | A circular plate of diameter 1.5 m is submerged vertically in water. The top edge of the plate is 2 m below the free surface. Calculate the total pressure on the plate and the position of the center of pressure. | 6 | CO1 | Apply |
| (OR) | | | | |
| 3. a) | Define buoyancy. Explain the conditions of equilibrium for a floating body. | 4 | CO2 | Understand |
| b) | Calculate the metacentric height of a vessel with a waterline length of 10 m, breadth of 4 m, and draft of 1.5 m. The center of gravity is 1.2 m above the keel, and the volume of displacement is 24 m ³ . | 6 | CO2 | Apply |
| (OR) | | | | |
| 4. a) | Derive the continuity equation for a three-dimensional incompressible flow. | 6 | CO2 | Analyze |
| b) | A fluid flow is described by the velocity field $V = (2x - y)i + (3y + z)j - 4zk$. Determine if the flow is irrotational. | 4 | CO2 | Apply |
| (OR) | | | | |
| 5. a) | Explain Reynold's experiment with the help of diagram? | 4 | CO3 | Understand |
| b) | Water is flowing through a pipe of diameter 200 mm with a velocity of 3 m/s. Solve for the head lost due to friction for a length of 5 m if the co-efficient of friction is given as $f = 0.02 + (0.09/Re^{0.3})$, where, Re is the Reynolds number. Take kinematic viscosity of water as 0.01 stokes. | 6 | CO3 | Apply |
| (OR) | | | | |
| 6. a) | How is the rate of flow in a pipe measured using a Venturi meter? Recall its components and working principle | 4 | CO3 | Understand |
| b) | A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm ² and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through the venturimeter. Take Cd = 0.98. | 6 | CO3 | Analyze |

UNIT-IV

7. a) Discuss the significance of Froude number and how flows are classified based on it. 5 CO4 Understand
b) Derive, for a most economic rectangular channel section, the hydraulic radius is equal to half the depth of flow. 5 CO4 Analyze

(OR)

8. a) Discuss the concept of specific energy and alternate depths. 4 CO4 Understand
b) A trapezoidal channel with a bed width of 4 m and side slopes of 1.5H:1V carries a certain discharge 6 CO4 Analyze
i. Based on observations, if the critical depth of flow is estimated as 1.7 m, calculate the discharge in the channel.
ii. If this discharge is observed to be flowing at a depth of 2.5 m at a certain section, estimate the Froude number at that section.

UNIT-V

9. a) What is a hydraulic machine? Differentiate between a turbine and a pump. 3 CO5 Understand
b) A pelton wheel turbine has to be designed for the following data 7 CO5 Evaluate
Power to be developed = 6000 kW
Net head available = 300 m
Speed = 550 r.p.m
Ratio of jet diameter to wheel diameter = 1 : 10
Overall efficiency = 85%

Find i) number of jets ii) diameter of the jet iii) diameter of the wheel iv) the quantity of water required

(OR)

10. a) Define and write down the expressions for 8 CO5 Understand
i. Hydraulic Efficiency
ii. Mechanical Efficiency
iii. Volumetric Efficiency
iv. Overall Efficiency
b) Explain the purpose of surge tanks in hydropower installations. 2 CO5 Understand

UNIT-VI

11. a) Explain with a neat sketch, the components and working principle of a single-stage centrifugal pump. 5 CO6 Understand
b) Derive the expression for minimum starting speed of a centrifugal pump. 5 CO6 Analyze

(OR)

12. a) Classify centrifugal pumps and write short notes about them. 4 CO6 Understand
b) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. 6 CO6 Analyze

**Electronic Circuits Analysis
(Electronics and Communication Engineering)****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) Explain RC phase shift oscillator with neat sketch. 6M
b) Explain Hartley oscillator with neat sketch. 6M

(OR)

2. a) Derive the oscillation condition for LC circuits 6M
b) State and derive Barkhausen criterion for the oscillations. 6M

UNIT-II

3. a) State and explain Millers theorem 5M
b) Draw the CE amplifier derive the expression for its R_i and A_v . 7M

(OR)

4. a) Draw the CC amplifier and derive the expression for A_i , R_i , A_v , Y_o . 6M
b) Derive the expression for voltage gain of a common source FET amplifier 6M

UNIT-III

5. a) Derive the expression for the bandwidth of a multi stage amplifier. 6M
b) Derive the overall current gain and overall input impedance of a Darlington pair Amplifier. 6M

(OR)

6. a) Draw the frequency response and analysis of two stage RC coupled Amplifier. 8M
b) Give the different coupling methods of multi stage amplifiers. 4M

UNIT-IV

7. a) Derive the expression for CE short circuit Current gain 6M
b) Draw the hybrid- π model of common emitter configuration and describe each Component in the π -model. 6M

(OR)

8. a) Derive the expressions for the following hybrid Π conductance 6M
i) g_m ii) $g_{b'e}$ iii) $g_{b'c}$
b) Derive for the Current Gain of hybrid – π model of CE amplifier with Resistance Load. 6M

UNIT-V

9. a) Explain single tuned amplifier with neat sketch. 6M
b) Explain double tuned amplifier with neat sketch. 6M

(OR)

10. a) Derive an expression for tuning frequency of a single tuned amplifier in terms of Quality factor and bandwidth of the amplifier? 6M
b) Draw the circuit diagram the working of a transformer coupled class 'A' power amplifier 6M