

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)
Sub_Code: MEPC2006

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Basic Manufacturing Processes

BRANCH(S): MECH, MMEAM

Time: 3 Hours

Max Marks: 100

Q.Code: V719

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Define the casting process and state one advantage over machining.
- What is the function of a riser in casting?
- Define the weldability of a material.
- What is the purpose of flux in welding?
- Define the rolling and extrusion process.
- What is the difference between drop forging and press forging?
- What is deep drawing in sheet metal working?
- Define the coining operation.
- What is explosive forming?
- What is the basic principle of wire drawing? What factors affect the wire drawing process?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Describe the sand moulding process in detail, including preparation of mould, core making, and pouring.
- Explain different types of pattern allowances and their purposes with suitable examples.
- Explain the solidification of castings and discuss how directional solidification is achieved.
- Explain the working principle of Gas Tungsten Arc Welding (GTAW) and discuss its advantages and limitations.
- Describe the principle and working of resistance welding. Discuss factors affecting weld quality.
- Explain various welding defects, their causes, and remedies.
- Explain the types of rolling mills and their applications in metal forming.
- Describe the smith forging and drop forging processes and compare them in terms of productivity and accuracy.

- i) Explain the principle and working of hydrostatic extrusion and discuss its advantages over conventional extrusion.
- j) With neat sketches differentiate between direct and indirect extrusion?
- k) Describe the wire drawing process, including die design considerations and process variables.
- l) Describe the process of deep drawing, giving examples of products manufactured by this process.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** a) Describe different types of moulding sands and additives, highlighting their properties and applications in casting. How are the properties of moulding sand tested? (6)
- b) Explain the working principles and features of cupola, induction, and electric arc furnaces used in foundries. (6)
- c) Describe the investment casting processes with neat sketches. (4)
- Q4** a) Explain the principles and working of Shielded Metal Arc Welding (SMAW) and Gas Metal Arc Welding (GMAW). Compare their characteristics and applications. (6)
- b) Describe the principle and applications of thermit welding and plasma arc welding. (6)
- c) Discuss various non-destructive testing (NDT) methods used for inspection of welds. (4)
- Q5** a) Explain the mechanics of rolling, including pressure distribution, slip, and forward/backward slip phenomena. (6)
- b) Describe different types of extrusion processes and compare their characteristics. (6)
- c) Discuss the defects in forging processes, their causes, and methods to prevent them. (4)
- Q6** a) Explain the mechanics and stages of deep drawing, including factors affecting drawability and common defects. (6)
- b) Describe the principle and working of explosive forming and its industrial applications. (6)
- c) Explain with a sketch how collapsible tubes used for toothpaste are manufactured. (4)

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B.Tech
PCAC2009

4th Semester Regular/Back Examination: 2025-26

Big Data Integration and Management

BRANCH(S): AEIE, AI, BIOMED, CIVIL, CSE, CSEAI, ECE, EEE, ELECTRICAL, ETC, MECH

Time: 3 Hours

Max Marks: 100

Q.Code: V426

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Define Big Data and explain any two characteristics of Big Data.
- Differentiate between structured and semi-structured data with examples.
- What is the role of data modeling in Big Data management?
- What is MongoDB? Why is it suitable for Big Data applications?
- List any two data retrieval operations commonly performed in Big Data systems.
- Define machine learning and mention its importance in Big Data.
- Differentiate between supervised and unsupervised learning.
- Define data ingestion in Big Data systems.
- Define cloud-based Big Data platform.
- What is meant by data consistency?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Discuss various data genres used in Big Data systems with suitable examples.
- Explain the process of handling streaming sensor data in Big Data environments.
- Compare traditional DBMS and Big Data Management Systems with suitable examples.
- Discuss the features and applications of AsterixDB and HP Vertica.
- Explain the role of Impala in Big Data processing.
- Describe the steps involved in Big Data Integration.
- Explain various techniques used for processing Big Data efficiently.
- Describe methods for retrieving Big Data from distributed systems.
- Explain the stages involved in Data Exploration and Data Preparation.
- Discuss different types of machine learning problems with suitable examples.
- Describe the architecture and working of a Big Data Management System for an online game.

- I) Discuss Regression, Cluster Analysis, and Association Analysis techniques used in Big Data analytics.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Design a Big Data Infrastructure Plan for a smart city sensor monitoring system. Explain the selection of data models, streaming data handling techniques, and information system design. **(16)**
- Q4** Explain the machine learning process for Big Data analytics. Discuss data exploration, data preparation, and evaluation of machine learning models in detail. **(16)**
- Q5** Compare DBMS-based and non-DBMS-based approaches to Big Data processing. Discuss the role of Neo4j, Redis, and SparkSQL in modern Big Data environments. **(16)**
- Q6** Discuss scalable machine learning algorithms on Spark with suitable examples. Explain, how open-source tools can be used to construct models that learn from Big Data. **(16)**

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Course: B. Tech / IDD (B. Tech & M. Tech)

Sub_Code: CSPC2005

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Computer Organization and Architecture

BRANCH(S): AI, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, IT

Time: 3 Hours

Max Marks: 100

Q. Code: V570

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Explain functions of the following registers.
MAR, IBR, IP, SP
- Differentiate between Computer Organization and Computer Architecture?
- What will be the range of n -bit binary number if the number is represented in Signed 1's complement representation and Signed 2's complement representation?
- Represent $(2.5)_{10}$ in single precision IEEE floating point format.
- What is Interrupt initiated I/O? Explain with example.
- What do you mean by Random access? Is it different from Direct access? Justify your answer with proper example.
- For single instruction execution whether Pipeline system is better than non-pipeline system? Justify your answer.
- In a pipelined machine, if different instructions may need the same piece of hardware at same clock, then which type of hazard will be encountered?
- What is the use of Dirty bit in case of Cache write? Explain properly.
- What do you mean by Locality of Reference? Explain different types of Locality of reference with example.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- What is an Instruction cycle? Draw the flow diagram of an Instruction cycle and explain.

- b) What is Booth multiplication algorithm? Is it advantageous than general multiplication algorithm? Perform the multiplication $9X - 8$ step by step using above algorithm.
- c) Evaluate the expression $X = (A + B) / (C + D * E)$ using One address and Two address Instruction format.
- d) Design a RAM cell using Flip-Flop and Logic gates. Explain Read and Write operations of that RAM cell.
- e) What is DRAM? Explain the working principles of DRAM with cell diagram.
- f) What is an Interface? Why is it required to connect devices in computer system? Explain properly.
- g) Distinguish and differentiate between CISC and RISC architecture.
- h) What is DMA data transfer? Explain the DMA data transfer with neat diagram. Differentiate between Cycle stealing mode and Burst mode of data transfer.
- i) Distinguish and differentiate between Hardwired Control Unit and Micro programmed Control Unit.
- j) What is Pipeline Hazard? Explain Data hazard and Control hazard with example and timing diagram.
- k) What is Array processor? Differentiate between Array processor and Vector processor.
- l) What is Interconnection Network? Distinguish and differentiate between Static network and Dynamic network.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** An instruction is stored at location 300 with address field at location 301. The address field contains 400. A processor register R1 contains 200. Calculate the effective address if the addressing of the instruction is **(16)**
- i) Direct ii) Immediate
 - iii) Relative iv) Indexed with R1 as index register
- Explain with suitable diagram.
- Q4** What is Associative memory? Explain reading and writing mechanism and working principle of Associative memory with proper memory diagram. **(16)**
- Q5** What is an Interrupt? Explain Daisy chaining priority interrupt-based data transfer with diagram. **(16)**
- Q6** Consider a Non-pipeline system takes 50 ns to process a task. The same task can be processed in a Six-segment Pipeline system with a clock cycle of 10 ns. Determine the Speedup, Efficiency and Throughput of the pipeline for 100 tasks. What is the maximum Speedup that can be achieved? **(16)**

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Course: B.Tech/IDD(B.Tech & M.Tech)
Sub_Code: CSPC2004

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Database Engineering

BRANCH(S): CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, ELECTRICAL&C.E.,
ELECTRONICS&C.E., IT

Time: 3 Hours

Max Marks: 100

Q.Code: V645

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Explain the difference between an exclusive lock and a shared lock. Cite an example.
- Define the following terms with an example from each: (a) cardinality (b) arity.
- Explain trivial functional dependency with an example.
- Enlist the DDL commands in SQL along with their syntax and example.
- Differentiate between generalization and specialization with an example.
- Define metadata. What do you mean by system catalog?
- Highlight the necessity of concurrency control.
- Which file organization provides very fast access to any arbitrary record of a file?
- Differentiate between sparse index and dense index with an example from each.
- Specify the rules for converting an E-R model into relational model.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Explain the ACID properties of a transaction.
- What is multi-valued functional dependency? Explain 4NF with an example.
- What is data-independence in DBMS? Explain the two types of data-independence with an example from each. Also explain the three-tier architecture of DBMS.
- What is a schedule? Explain various types of schedules encountered in DBMS.
- Explain the problem of "dirty read" and "lost update" that occurs during the execution of transactions.
- What do you mean by a data model? Explain its various types.
- Explain the relational algebra operations with an example.
- What is a key? Explain different types of keys along-with an example from each.
- What is normalization? Explain the different types of normal forms.
- Explain different states of a transaction with a neat diagram.
- Consider the two sets of FDs: $F1 = \{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$ and $F2 = \{A \rightarrow CD, E \rightarrow AH\}$. Determine whether they are equivalent or not.
- Explain different types of database users.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Consider the relation $R(ABCDEFGH)$ with the following set of functional dependencies: (16)
 $F = \{ A \rightarrow BC, B \rightarrow CD, D \rightarrow EF, BC \rightarrow AG, ABG \rightarrow DF, G \rightarrow H \}$
 (a) Find the closure of each determinant.
 (b) Compute the candidate key.
 (c) Find the canonical cover of the FD.
 (d) Determine the highest normal form the relation is in. If the relation violates any normal form, then decompose accordingly.
- Q4** Consider the following schemas. Formulate the queries using RA, TRC, DRC and SQL: (16)
 Student(Regd no, name, CourseId, emailId, cellno)
 Course(CourseId, course_name, duration)
 i) Add a column city in student table.
 ii) Find out list of students who have enrolled in "computer" course.
 iii) List name of all courses with their duration.
 iv) List name of all students start with „a“.
 v) List email Id and cell no of all computer science and engineering students
- Q5** Construct a E-R diagram for hospital management system. Specify the schemas. Also, use specialization, generalization and aggregation in the diagram. (16)
- Q6** Given the following transactions in a schedule, determine whether they are conflict-serializable or not? If not, then convert the schedule into a conflict-serializable schedule. Also, indicate whether the following schedule is view-serializable or not: (16)

T1	T2	T3
		write(C)
	write(B)	
	read(B)	
		read(C)
write(C)		
	read(C)	

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Course: B.Tech & IDD (B.Tech & M.Tech)

Sub_Code: CSPC2006

4th Semester Regular/ Back Examination: 2025-26

SUBJECT: Design and Analysis of Algorithms

BRANCH(S): AI, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, ELECTRICAL & C.E, ELECTRONICS & C.E, IT

Time: 3 Hours

Max Marks: 100

Q.Code: V493

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- a) Define asymptotic notations with examples.
- b) State the Master Theorem for solving recurrences.
- c) Differentiate between AVL trees and Red-Black trees.
- d) What is the divide and conquer paradigm?
- e) Explain Kruskal's algorithm in brief.
- f) What is dynamic programming?
- g) Define the naive string matching algorithm.
- h) What is the subset-sum problem?
- i) Differentiate between P and NP problems.
- j) What is an approximation algorithm?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- a) Solve the recurrence $T(n) = 2T(n/2) + n$ using the Master method.
- b) Write pseudocode for Quick Sort and analyze its complexity.
- c) Explain binary search with an example.
- d) Discuss heap construction and heap sort.
- e) Apply Prim's algorithm to find MST of a given graph.
- f) Explain Floyd-Warshall algorithm for all-pairs shortest path.
- g) Solve the matrix chain multiplication problem for matrices of dimensions (10×20) , (20×30) , (30×40) .
- h) Explain the Knuth-Morris-Pratt (KMP) string matching algorithm.
- i) Demonstrate the n-Queens problem using backtracking.
- j) Explain branch and bound approach for the Traveling Salesman Problem.
- k) What is polynomial-time verification?
- l) Discuss the vertex cover problem as an approximation algorithm.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** a) Compare substitution, iteration, and master methods for solving recurrences. (8)
b) Analyze Merge Sort and Quick Sort with respect to best, average, and worst case complexities. (8)
- Q4** a) Implement Huffman coding for the following frequency distribution: {A:5, B:9, C:12, D:13, E:16, F:45}. (8)
b) Discuss Dijkstra's and Bellman-Ford algorithms with examples. (8)
- Q5** a) Solve the Longest Common Subsequence (LCS) problem for strings "ABCDGH" and "AEDFHR". (8)
b) Explain optimal binary search tree construction with an example. (8)
- Q6** a) Demonstrate the Hamiltonian circuit problem using backtracking. (8)
b) Explain NP-completeness with examples of NP-complete problems. (8)

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B.Tech/IDD (B.Tech & M.Tech)
MEPC2005

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Design of Machine Elements-I

BRANCH(S): MANUTECH, MECH

Time: 3 Hours

Max Marks: 100

Q.Code: V572

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right hand margin indicate marks.

(Use of relevant data book is permissible)

Part-I

Q1

Answer the following questions:

(2 x 10)

- List the stages in a typical machine design procedure in sequence.
- What is a code in engineering design? Give two examples.
- Define standardization. State its benefits to industry.
- Define tolerance, upper deviation, and lower deviation.
- What are the modes of failure of a riveted joint?
- Classify keys used in machine design.
- Distinguish between rigid and flexible couplings. Give one example of each.
- Define nipping of a leaf spring. What is its purpose?
- Define spring index 'C'. How does it affect the stress in a helical spring?
- What is the difference between a journal bearing and a thrust bearing?

Part-II

Q2

Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

(6 x 8)

- Discuss the criteria for material selection in machine design. How does the use of design data books assist in material and dimension selection?
- A hole has basic size 50 mm, upper deviation +0.025 mm, lower deviation 0.000 mm. A shaft has upper deviation -0.009 mm, lower deviation -0.025 mm. Identify the type of fit and find maximum clearance.
- Design a double-riveted double-cover butt joint for plates 12 mm thick. Steel: $\sigma_t = 90$ MPa, $\tau = 70$ MPa, $\sigma_c = 140$ MPa. Determine: rivet diameter, pitch, and cover plate thickness.
- Discuss the design procedure for Boiler joints.
- A key (length 60 mm, width 12 mm, height 8 mm) connects a shaft of 40 mm diameter. Torque = 400 N·m. Find shear and crushing stresses in the key.
- Design a knuckle joint for an axial load of 120 kN. Safe stresses: tension = 75 MPa, shear = 60 MPa, crushing = 100 MPa.

- g) A solid shaft is transmitting 1 MW at 250 r.p.m. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 25 %. Take the maximum allowable shear stress as 50 MPa.
- h) Design an Oldham coupling (flexible coupling) for a motor shaft of 40 mm transmitting 15 kW at 960 rpm. State the design procedure and find the disc dimensions.
- i) Derive the expression for deflection (axial) of a close-coiled helical spring under load 'W'. Also, obtain the expression for spring stiffness 'k'.
- j) A helical spring has $d = 6$ mm, $D = 60$ mm, $n = 10$ active coils, $G = 80$ GPa. Find the stiffness and deflection under a load of 500 N.
- k) A ball bearing has $C = 40$ kN. It carries a radial load of 8 kN. Find the rated L_{10} life in millions of revolutions.
- l) Design a footstep (pivot) bearing for a vertical shaft carrying an axial load of 20 kN at 600 rpm. $D = 100$ mm. Allowable bearing pressure = 0.6 MPa, $\mu = 0.015$. Find power loss in the bearing using uniform pressure theory.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 60 MPa; shear stress = 30 MPa and crushing stress = 90 MPa. (16)
- Q4** A solid circular shaft is subjected to a bending moment of 4000 N-m and a torque of 20000 N-m. The shaft is made of 45C8 steel having ultimate tensile stress of 800 MPa and an ultimate shear stress of 400 MPa. Assuming a factor of safety as 4, determine the diameter of the shaft. (16)
- Q5** A helical valve spring is to be designed for an operating load range of approximately 105 to 150 N. The deflection of the spring for the load range is 9 mm. Assume a spring index of 10. Permissible shear stress for the material of the spring = 480 MPa and its modulus of rigidity = 80 kN/mm². Design the spring. (16)
- Take Wahl's factor $= \frac{4C-1}{4C-4} + \frac{0.615}{C}$, C being the spring index.
- Q6** Derive the design procedure for a hydrodynamic journal bearing using the Sommerfeld number approach. Obtain expressions for bearing pressure, coefficient of friction, heat generated, and minimum film thickness. (16)

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)
Sub_Code:CSBS2001

4th Semester Regular Examination: 2025-26

SUBJECT: Discrete mathematics

BRANCH(S): AI, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, IT

Time: 3 Hours

Max Marks: 100

Q.Code:V726

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2 x 10)

- Find coefficient of x^3 in expansion of $(1 + x)^5$.
- Check whether $(p \vee q) \wedge \neg p$ is a tautology.
- Let relation R on integers defined by $aRb \Leftrightarrow a - b$ is divisible by 3. Prove that R is an equivalence relation.
- Find all generators of cyclic group Z_8 .
- Let $f: \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = x^3 - x$. Check if injective.
- Show that inverse of an element in a group is unique.
- Determine whether a graph with 5 vertices and 8 edges is planar.
- How many different trees can be formed with 4 labeled vertices?
- If G is a group and $a^2 = e$ for all $a \in G$, prove G is Abelian.
- Show that among 13 people, at least two have birthdays in the same month.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

(6 x 8)

- Negate the statement and simplify $\forall x \in \mathbb{R}, y \in \mathbb{R}$ such that $x + y > 0$.
- Prove that: $A - (B \cup C) = (A - B) \cap (A - C)$.
- Let R on set $\mathbb{Z}$ be defined as: $aRb \Leftrightarrow a \equiv b \pmod{4}$. Prove that R is an equivalence relation and find equivalence classes.
- Show that in any set of 6 integers, there exists two whose difference is divisible by 5.
- Prove that in a group G , $(ab)^{-1} = b^{-1}a^{-1}$.
- State and prove Lagrange's Theorem.
- Determine whether a graph with vertices of degrees 2, 2, 3, 3, 4 has an Euler path or circuit.
- Solve the recurrence relation:
 $a_0 = 3, a_n = 2a_{n-1}, n \geq 1$.
- Check whether mapping $f: \mathbb{Z} \rightarrow \mathbb{Z}, f(x) = x + 1$

is a homomorphism.

- j) Use Euler's formula to test whether a graph with $V = 6, E = 12$ is planar.
- k) Explain why Dijkstra's algorithm fails for graphs with negative edge weights, with example.
- l) Let $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = x^3 + 1$.
- Prove that f is bijective
 - Find $f^{-1}(x)$.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Let $f: \mathbb{R} \rightarrow \mathbb{R}$, $f(x) = x^3 - 3x$ (16)
- Check whether f is one-one
 - Find intervals where it is increasing/decreasing
 - Determine if inverse exists
 - Sketch behavior of function
- Q4** Prove that: (16)
- $$\sum_{k=0}^n k \binom{n}{k} = n \cdot 2^{n-1}$$
- Then use it to find:
 $\sum_{k=0}^5 k \binom{5}{k}$.
- Q5** Let $f: \mathbb{Z} \rightarrow \mathbb{Z}_6, f(x) = x \bmod 6$ (16)
- Prove that f is a homomorphism
 - Find kernel and image
 - Check whether it is isomorphism
 - Justify your answer .
- Q6** Prove that: (16)
- A tree with n vertices has $n - 1$ edges
 - Adding one edge creates exactly one cycle
 - Removing one edge disconnects the tree.

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Course: B.Tech/IDD (B.Tech & M.Tech)

Sub_Code: EEPC2003

4th Semester Regular/Back Examination: 2025-26

SUBJECT: ELECTRICAL MACHINES-II

BRANCH(S): EE, EEE, ELECTRICAL

Time: 3 Hours

Max Marks: 100

Q.Code: V497

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Why is a synchronous generator called a constant-speed machine? What are the types of rotors used in three-phase synchronous generators?
- Which type of synchronous generators are used in Hydroelectric plants and why?
- What is Blondel's two reaction theory? Why X_d is greater than X_q ?
- What are the applications of synchronous condenser?
- Why is it possible to design alternators to generate much higher voltages than DC generators?
- Why rotor core losses of induction motor are negligible when compared stator core losses under running condition?
- What is meant by hunting of synchronous motor? How will you minimize it?
- Define crawling and cogging of three phase induction motor.
- What is the function of capacitor in single phase induction motor?
- Write four applications of single-phase induction motor.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- A three phase 16-pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed and the speed is 375 rpm. Find the frequency and the phase and line EMF. Assume full-pitched coil.
- What is meant by "armature reaction" of a synchronous machine? Explain with relevant diagram the relations of armature reaction and power factor of a synchronous machine considering different cases.
- Describe the slip test method-for the measurement of X_d and X_q of synchronous machines.
- A three phase, 10 kVA, 400 V, 50 Hz, star connected alternator supplies the rated load at 0.8 power factor lagging. If resistance/phase and reactance/phase are 0.5Ω and 10Ω respectively, find the voltage regulation and power angle.

- e) Define synchronizing power. What is synchronizing power and synchronizing Torque Coefficient?
- f) Explain the constructional features and principle of operation of synchronous motor.
- g) A 3 phase, 2.3 kV, star connected synchronous motor draws a current of 200 A from the supply while driving a certain load. The stator has armature resistance of 0.2Ω per phase and a synchronous reactance of 2.2Ω per phase. The motor is operating at 0.5 power factor leading. Determine the generated EMF per phase.
- h) Explain how a rotating magnetic field is produced in a three-phase induction motor.
- i) Draw the torque-slip characteristics of a 3-phase induction motor. Explain them briefly.
- j) In the case of an 8-pole induction motor, the supply frequency was 50 Hz and the shaft speed was 735 rpm. What were the magnitude of the following:
 - (i) Synchronous speed
 - (ii) Speed of slip
 - (iii) Percentage slip
 - (iv) The frequency of induced current in the rotor.
- k) Why are the single-phase induction motor not self-starting? What are different types of starting methods for single phase induction motor? Explain.
- l) The power input to a 3-phase induction motor is 60 kW. The stator losses total 1 kW. Find the mechanical power developed and the rotor copper loss per phase if the motor is running with a slip of 3 %.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Derive the equation for power developed in a salient pole alternator. A salient-pole synchronous generator delivers rated kVA at 0.8 p.f. lagging at rated terminal voltage. It has $X_d = 1.0$ p.u. and $X_q = 0.6$ p.u. If its armature resistance is negligible, compute the excitation voltage under these conditions. (16)
- Q4**
 - a) What are the conditions required for the parallel operation of alternator? What are the advantages of parallel operation of two alternators? (8 x 2)
 - b) Explain "Two bright and One dark lamp" method of synchronization of three phase alternator with infinite bus-bar.
- Q5** What are the differences between synchronous motor and three phase induction motor? Explain the operation of synchronous motor with variable excitation at constant load. Draw the V-curve and inverted V-curve at different loading conditions. (16)
- Q6** Mention the need of starters in 3-phase induction motors. List the various starters used in 3-phase induction motor and explain with circuit diagram. (16)

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)

Sub_Code: EEPC2004

4th Semester Regular/Back Examination: 2025-26
SUBJECT: Electrical Measurement & Instrumentation

BRANCH(S): EEE, ELECTRICAL

Time: 3 Hours

Max Marks: 100

Q.Code: V646

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- The current flowing in a circuit consists of a DC of 3A and an AC of peak value 2A. What will be the readings of a moving coil ammeter moving iron ammeter?
- A 0 to 200V voltmeter has a guaranteed accuracy of 1 % of full-scale reading. The voltage measured by this instrument is 50 V. What is the limiting error?
- Give the different stages inside the CRT tube.
- What methods are used to measure High Resistance?
- An energy meter having a meter constant of 1200 rev per KWH is found to make 5 revolutions in 75 s. What is the load power?
- What is piezoresistive effect?
- Explain the characteristics of Current Transformer.
- Explain different types of standards in measuring instruments.
- Explain the difference between spring control and gravity control.
- Discuss the merits and demerits of potentiometers used in transducers.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- A sheet of bakelite 4.5 mm thick is tested at 50 Hz between electrodes 0.12 m in diameter. The Schering bridge employs a standard air capacitor C2 of 106 pF capacitance, a non-reactive resistance R4 of $1000/\pi$ ohm in parallel with a variable capacitor C4 of 0.5 μ F and variable resistance of 260 ohm. Calculate the capacitance, power factor, and relative permittivity of sheet.
- Describe the various methods for measurement errors.
- The inductive reactance of the pressure coil circuit of a dynamometer wattmeter is 0.4 % of its resistance at normal frequency 50 Hz and the capacitance is negligible. What is the percentage error and correction factor due to the reactance for load at 0.707 p.f lagging?

- d) Derived the general equation for a moving iron instrument.
- e) Discuss the sources of error in a dynamometer instrument.
- f) Draw the circuit diagram of Maxwell-inductance Bridge. Draw the phase diagram of Maxwell-inductance Bridge.
- g) In a Hay' bridge, the four arms are R_1-L_1 , R_2 , R_3-C_3 , R_4 connected in clockwise order, show that under the phase null condition Q of the coil is given by $Q = \text{Voltage across } C_3 / \text{Voltage across } R_3$.
- h) Derive the expression for gauge factor of the strain gauges.
- i) Describe the construction and working principle of a D'Arsonval galvanometer.
- j) Describe the construction and working principle of Power Factor Meters.
- k) In an indicating PMMC type ammeter the current through the coil for full scale deflection is 5 mA. Coil resistance is 5 ohm and swamping resistance is 4 ohms. The meter is to be used for measuring current up to 1 ampere. Calculate the value of shunt resistance required. What arrangement is required to be made to compensate to temp change. Which may occur. Derive necessary expression
- l) Explain the phenomena of Creeping. If an energy meter disc makes 10 revolutions in 100 seconds when a load of 360w is connected to it, determine the meter constant revolution/Kwh.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- | | | |
|-----------|---|-------------|
| Q3 | Derive the expression for transformer ratio and phase angle of CT with phasor diagram. | (16) |
| Q4 | Explain with diagram of the Linear Variable Differential Transformer (LVDT). | (16) |
| Q5 | Describe the construction details of an electrodynamicometer type wattmeter. Derive the expression for torque when the instrument is used on a.c. | (16) |
| Q6 | Draw an electrodynamic type frequency meter circuit and explain its working. | (16) |

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech &M.Tech)

Sub Code: HSHS2001/REN4E001

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Engineering Economics

BRANCH(S): AEIE, AI, AUTO, BIOMED, BIOTECH, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSIT, CST, ECE, EEE, EEVDT, ELECTRICAL, ELECTRONICS & C.E, ENV, ETC, MECH, METTA, MINERAL, MINING, MME, CSE, EE, AG, CIVIL, CSE, CSEAIML, CST, ECE, EEE, ELECTRICAL, ENV, ETC, IT, MECH, METTA, MME

Time: 3 Hours

Max Marks: 100

Q. Code: V368

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- If the price rises by 3 %, the quantity demanded falls by 1.5 %. Calculate the price elasticity of demand.
- Distinguish between a change in demand and change in quantity demanded.
- Distinguish between 'short-run' and 'long run' in the context of production.
- What is the relationship between average cost and marginal cost?
- What is the relationship between AR and MR under perfect competition.
- Distinguish between perfect competition and monopoly.
- What is a cash flow diagram, and how does it represent the inflows and outflows of cash over time?
- Define Depreciation.
- What does "too many dollars chasing too few goods" mean?
- What are the two essential functions of a bank?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Distinguish between a movement along a supply curve and shift in the supply curve. What are the factors which cause in the shift in the supply curve?
- Demand for a firm product has been estimated to be
 $Q_d = 1000 - 200P$
If Price of the product is ₹ 3, find out Price elasticity of Demand.
- How do total product, average product and marginal product change due to a change in the use of one input, keeping other inputs constant?

- d) Why the AC curve is U-shaped?
- e) If the demand and supply curve for the mobile phones are $Q_d = 100 - 6P$, $Q_s = 28 + 3P$, what is the quantity of mobile phones bought and sold at equilibrium?
- f) What is the P/ V ratio? What are the various applications of P/V ratio?
- g) An investor holds a time payment purchase contract on some machine tools. The investor will receive ₹ 140 at the end of each month for a 5-year period. The first payment is due in one month. He offers to sell you the contract for ₹ 6800 cash today. If you otherwise can make 1% per month on your money, would you accept or reject the investor's offer?
- h) A person is just 30 years old. He plans to invest an equal sum of ₹ 20,000 every year for the next 30 years from the end of next year. The bank gives 10 % interest compounded annually. Find the maturity value of his account when he is 60 years old.
- i) The Acme Chemical Company paid ₹45,000 for research equipment, which it believes will have zero salvage value at the end of its 5-year service life. Compute the depreciation schedule for the equipment by using the straight-line depreciation method.
- j) Distinguish between national product at factor cost and national product at market price.
- k) Define central banking and distinguish this concept from that of commercial banking.
- l) Discuss the various measures to control Inflation.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** What are the determinants of demand? What happens to the demand curve when any of these determinants change? Distinguish between a change in demand and a change in the quantity demanded, noting the causes(s) of each. **(16)**
- Q4** The following data are obtained from ABC Co. Ltd. **(16)**
 Sales = ₹ 1,00,000
 Variable Cost= ₹ 60,000
 Fixed Cost = ₹ 30,000
 You are required to calculate:
 (i) P/V ratio
 (ii) Break-even point
 (iii) Margin of Safety
 (iv) Break-even point when there is 20 per cent increase in selling price.
 (v) Break-even point when there is 10% decrease in Fixed Costs.
- Q5** Machine A has a first cost of ₹ 9,000, no salvage value at the end of its 6-year useful life, and annual operating costs of ₹5,000. Machine B costs ₹16,000 new and has an expected resale value of ₹ 4,000 at the end of its 9-year economic life. Operating costs for machine B are ₹ 4,000 per year. Compare the two alternatives on the basis of their present worth, using the repeated-projects assumptions at 10 percent annual interest. **(16)**
- Q6** Discuss and analyze the factors causing inflation. **(16)**

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)
Sub_Code: CIPC2005

4th Semester Regular/Back Examination: 2025-26

SUBJECT: FLUID DYNAMICS

BRANCH(S): CIVIL

Time: 3 Hours

Max Marks: 100

Q.Code: V734

Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Define displacement thickness. Mention its physical significance.
- What is laminar sub-layer?
- Define induced drag.
- What is angle of attack?
- Velocity distribution near a wall is given by: $u = 2y - y^2$. Determine wall shear stress condition and identify whether separation occurs.
- What is angular momentum principle?
- Define stagnation pressure.
- What is air vessel?
- What is NPSH?
- What is wetted perimeter?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Explain the concept of boundary layer formation over a flat plate.
- The velocity profile in a laminar boundary layer is given by

$$\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

Determine (i) Displacement thickness, and (ii) Momentum thickness.

- Air flows over a flat plate at velocity 8 m/s. Distance from leading edge is 1.5 m. Kinematic viscosity of air is $1.5 \times 10^{-5} \text{ m}^2/\text{s}$. Determine (i) Reynolds number at the section, and (ii) Laminar boundary layer thickness.
- Discuss circulation theory of lift generation.
- Derive the expression for force exerted by a jet on a stationary curved vane.

- f) A jet of water moving at 24 m/s strikes a flat plate moving in the same direction at 8 m/s. Jet diameter is 60 mm. Determine (i) Force exerted on the plate, (ii) Work done per second, and (iii) Efficiency of the system.
- g) Discuss the conditions for maximum efficiency of moving vanes.
- h) Derive expressions for work done and efficiency of Pelton wheel turbine.
- i) Differentiate between impulse and reaction turbines.
- j) A centrifugal pump delivers: Discharge = $0.18 \text{ m}^3/\text{s}$, Head = 28 m, and Speed = 960 rpm. If speed increases to 1320 rpm, determine (i) New discharge, (ii) New head, and (iii) Ratio of power required.
- k) Derive Chezy's equation for uniform flow.
- l) Differentiate between notches and weirs.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** a) Explain wake formation and vortex shedding behind cylinders. (8 + 8)
 b) An airfoil of plan area 16 m^2 moves through air at 75 m/s. The coefficient of lift is 0.95 and coefficient of drag is 0.06. Density of air is 1.225 kg/m^3 . Determine (i) Lift force, (ii) Drag force, (iii) Lift-to-drag ratio, and (iv) Power required to overcome drag.
- Q4** a) Derive the impulse momentum equation for steady flow. (8 + 8)
 b) A ship propulsion system ejects water backward at 45 m/s with mass flow rate of 320 kg/s. Ship velocity is 16 m/s. Determine (i) Propulsive thrust, (ii) Propulsive power, and (iii) Kinetic energy imparted to water per second.
- Q5** a) Discuss effects of acceleration of piston on pressure in suction and delivery pipes. (8 + 8)
 b) A three-stage centrifugal pump delivers water at rate of $0.12 \text{ m}^3/\text{s}$ against a total head of 90 m. Overall efficiency is 78 %. Determine (i) Head developed per stage, (ii) Water power developed, (iii) Shaft power required, and (iv) Specific speed of the pump if speed is 1450 rpm.
- Q6** a) Discuss hydraulic jump and its characteristics. (8 + 8)
 b) A rectangular channel 4 m wide carries water at discharge of $20 \text{ m}^3/\text{s}$ with flow depth 1.8 m. Determine (i) Specific energy of flow, (ii) Critical depth, (iii) Minimum specific energy, and (iv) State whether flow is subcritical or supercritical.

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)
Sub_Code: MEPC2003

4th Semester Regular/Back Examination: 2025-26
SUBJECT: Fluid Mechanics and Hydraulic Machines
BRANCH(S): ME, MANUTECH, MECH, MMEAM
Time: 3 Hours
Max Marks: 100
Q.Code: V499

Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

- Q1 Answer the following questions: (2 x 10)**
- a) A U-tube manometer contains water and mercury. If the mercury level difference is 9 cm, determine the pressure difference between the two points connected to the manometer.
 - b) Differentiate between steady flow and unsteady flow.
 - c) What are key features in series and parallel pipes with respect to head loss and discharge?
 - d) Define coefficient of discharge of a reciprocating pump.
 - e) What is overall efficiency and volumetric efficiency of a centrifugal pump?
 - f) What is draft tube and where is it used?
 - g) Differentiate between laminar flow and turbulent flow.
 - h) A 9.52 cm diameter sphere with a mass of 158.3 g is neutrally buoyant in a liquid. What is the density of the liquid?
 - i) Explain the difference between compressible flow and incompressible flow.
 - j) At room temperature, the density of liquid water is 0.9976 g/cm^3 . If the pressure produced by a column of mercury with a height of 760 mm is to be replicated by a column of water, will the height of the water column be greater than, less than, or equal to 760 mm?

Part-II

- Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)**
- a) Derive the expression for hydraulic efficiency of a Pelton turbine.
 - b) Derive the differential form of the continuity equation in Cartesian coordinates.
 - c) Two velocity components are given in the following equations, find the third component such that it satisfies the continuity equation: $u = x^3 + y^2 + 2z^2$, $v = -x^2y - yz - xy$
 - d) A centrifugal pump delivers 25 L/s of water through a pipe 80 m long and 120 mm diameter to a height of 15 m. Determine the power required to drive the pump if the efficiency is 70 % and friction factor $f = 0.01$
 - e) A shaft of 120 mm diameter rotates inside a concentric sleeve of 125 mm diameter and 250 mm long. If the space between them is filled with oil and the torque required is 1.2 N-m at 80 rpm, determine the viscosity of oil.

- f) Write a short note on cavitation in centrifugal pumps and explain its effects and remedies.
- g) Write a short notes on Stability of immersed and floating bodies
- h) Derive the expression of metacentric height for a floating body.
- i) A jet of water of diameter 60 mm strikes a stationary flat plate normally with velocity 25 m/s. Determine the force exerted on the plate.
- j) A horizontal venturimeter with a discharge coefficient of 0.98 is being used to measure the flow rate of a liquid of density 1030 kg/m³. The pipe diameter at entry to the venturi is 75 mm and The venturi throat has an area of 1000 mm². If the flow rate is 0.011 m³/s. Determine the height difference recorded on a U-tube manometer connecting the throat to the upstream pipe. Take the relative density of mercury to be 13.6.
- k) State Newton's law of viscosity and explain the difference between ideal fluid and real fluid with examples.
- l) Define specific speed of a turbine and derive its expression.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** What is a stream line? Define stream function. (16)
 For the velocity potential: $\Phi = x^3 - 3xy^2$
 Determine the corresponding stream function and evaluate velocity at point (1, 2).
- Q4** a) Derive the expression for power developed by a reaction turbine. (8 x 2)
 b) Explain the governing of hydraulic turbines with neat sketches.
- Q5** A centrifugal pump has an impeller with outer diameter 500 mm and inner diameter 250 mm. (16)
 The width at outlet is 25 mm and width at inlet is 60 mm. The vane angles at inlet and outlet are 18° and 12° respectively. The pump runs at 1500 rpm. Assuming shockless entry and neglecting losses, determine:
 a) Discharge through the pump
 b) Theoretical head developed
 c) Power required to drive the pump
 d) Pressure rise across the impeller.
- Q6** Derive the Bernoulli's equation and state its assumptions. Water flows through a horizontal (16)
 pipe which enlarges suddenly from 150 mm to 300 mm diameter. The discharge through the pipe is 0.25 m³/s and the pressure in the smaller pipe is 12 N/cm². Find:
 a) Head loss due to sudden enlargement
 b) Pressure in the enlarged section
 c) Energy loss per second.

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)

Sub_Code: CIPC2006

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Geotechnical Engineering

BRANCH(S): CIVIL

Time: 3 Hours

Max Marks: 100

Q.Code: V577

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.

The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2 x 10)

- a) Define soil mechanics and geotechnical engineering.
- b) What are residual soils and transported soils?
- c) Define clay mineralogy.
- d) What is soil structure?
- e) Define void ratio and porosity.
- f) State the relationship between water content and degree of saturation.
- g) What are index properties of soil?
- h) Define liquid limit and plastic limit.
- i) What is particle size distribution curve?
- j) What is capillary rise in soils?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

(6 x 8)

- a) Explain the origin and formation of soils.
- b) Discuss construction and properties of flow net.
- c) Explain the concept and applications of inverted filters.
- d) Describe factors affecting compaction of soil.
- e) Describe field methods for determination of permeability.
- f) Discuss total stress, pore water pressure, and effective stress in soils.
- g) Describe Indian Standard Soil Classification System.
- h) Explain seepage through earth dams with neat sketch.
- i) Explain direct shear test with advantages and limitations.
- j) Discuss triaxial compression test and its applications.
- k) Discuss different types of clay minerals and their engineering significance.
- l) Discuss modern methods of soil stabilization used in geotechnical engineering.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Derive Terzaghi's one-dimensional consolidation equation and explain assumptions involved. (16)
- Q4** Explain various methods of soil stabilization and discuss their advantages, limitations, and applications. (16)
- Q5** A soil sample has a bulk unit weight of 18 kN/m^3 and water content of 12 %. If specific gravity is 2.68, determine: (16)
(a) Dry unit weight
(b) Void ratio
(c) Degree of saturation
- Q6** Water flows through a soil sample of length 20 cm and cross-sectional area 150 cm^2 under a constant head of 40 cm. If 600 cm^3 water is collected in 5 minutes, determine coefficient of permeability using Darcy's law. (16)

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)
Sub_Code: MEPC2004

4th Semester Regular/Back Examination: 2025-26
SUBJECT: KINEMATICS & DYNAMICS OF MACHINES
BRANCH(S): AUTO, MANUTECH, MECH, MMEAM
Time: 3 Hours
Max Marks: 100
Q.Code: V650

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- a) Define kinematic chain. What are the different types of kinematic chain?
- b) Explain the terms: i. Lower pair, ii. Higher pair.
- c) Write down the advantages and disadvantages of gear drive.
- d) Define diametral pitch.
- e) Define gear train and write down the different types of gear train.
- f) Define coefficient of fluctuation of speed.
- g) Write down the function of a governor.
- h) Discuss the various types of the brakes.
- i) Write down the important factors for the selection of belt drive.
- j) Why is balancing of rotating parts necessary for high-speed engines?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

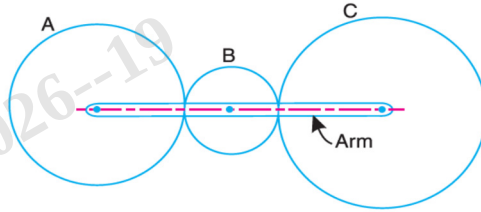
- a) Derive an expression for the effort required to raise a load with a screw jack taking friction into consideration.
- b) Derive an expression for energy stored in a flywheel.
- c) Derive an expression for the length of the path of contact in a pair of meshed spur gears.
- d) How the velocity ratio of epicyclic gear train is obtained by tabular method?
- e) Explain the term height of the governor. Derive an expression for the height in the case of a Watt governor.
- f) Write down the difference between self-energizing and self-locking Brake with proper diagram and mathematical expression.
- g) Explain clearly the terms 'static balancing' and 'dynamic balancing'. State the necessary conditions to achieve them.
- h) Derive an expression for the length of open belt drive.
- i) Explain fluctuation of energy.
- j) Show that slider crank mechanism is a modification of the basic four bar mechanism.

- k) Write down the properties of instantaneous Centre and types of instantaneous centers.
 l) Explain the phenomena of 'slip' and 'creep' in a belt drive.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

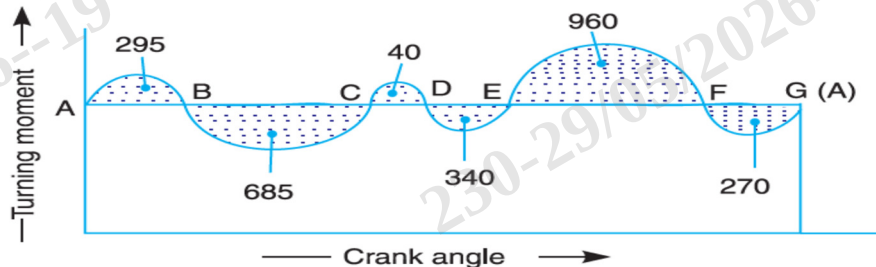
- Q3** In an epicyclic gear train, as shown in Figure the number of teeth on wheels *A*, *B*, and *C* are 48, 24 and 50 respectively. If the arm rotates at 400 r.p.m., clockwise, find: i. Speed of wheel *C* when *A* is fixed, and ii. Speed of wheel *A* when *C* is fixed. (16)



- Q4** Derive the retardation of the vehicle when brakes applied i) rear wheels only, ii) front wheels only, and iii) all the four wheels (16)

- Q5 a)** Determine the minimum number of teeth required on a pinion, in order to avoid interference which is to gear with,
 i. a wheel to give a gear ratio of 3 to 1; and ii. an equal wheel.
 The pressure angle is 20° and a standard addendum of 1 module for the wheel may be assumed. (8)
- b)** Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 r.p.m. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160° and maximum tension in the belt is 2500 N. (8)

- Q6 a)** The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 N-m; crank angle, 1 mm = 1° . The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm². The rotating parts are equivalent to a mass of 36 kg at a radius of gyration of 150 mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m. (10)



- b)** A Hartnell governor having a central sleeve spring and two right-angled bell crank levers moves between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15 mm. The sleeve arms and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine: i. loads on the spring at the lowest and the highest equilibrium speeds, and ii. stiffness of the spring. (6)

Registration No.:

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Total Number of Pages: 03

B.Tech & IDD (B.Tech & M.Tech)
PCAC2008

4th Semester Regular/Back Examination: 2025-26

Machine Learning Techniques and Applications

AUTO, CHEM, CIVIL, CSE, ECE, EEE, EEVDT, ELECTRICAL, ETC, MANUTECH, MECH,
METTA, MINERAL, MINING, MME, PLASTIC

Time: 3 Hours

Max Marks: 100

Q.Code: V436

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Define perceptron and mention one limitation of single-layer perceptrons.
- Define cost function in deep learning. Mention one commonly used loss function.
- What is the role of pooling layers in CNN. A 4X4 feature map is processed using 2X2 max pooling with a stride of 2. Calculate the output feature map size.
- Define cosine similarity in word embeddings and mention its significance.
- Differentiate between encoder and decoder in Transformer Networks.
- Define cross-validation in ML projects. A 4-fold cross-validation experiment produced accuracies: [85%, 88%, 90%, 87%]. Calculate the average accuracy.
- What is the role of preprocessing in Machine Learning? Mention any two preprocessing steps.
- What is feature selection in Machine Learning? State one advantage of feature selection.
- Differentiate between cloud-based and edge-based ML systems.
- Define rollback mechanisms in ML version control systems.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Explain the architecture and working principle of Logistic Regression for binary classification. Derive the sigmoid function and discuss the role of the cost function in model training. Illustrate the gradient descent algorithm used for parameter optimization.
- Write the concept of Deep Learning and explain how deep neural networks differ from traditional machine learning models. Explain the advantages, limitations, and applications of deep learning.

- c) Discuss how CNNs automatically learn spatial hierarchies of features from images. Consider a 5X5 input matrix:

$$\begin{bmatrix} 1 & 2 & 0 & 3 & 1 \\ 4 & 1 & 2 & 1 & 0 \\ 0 & 1 & 3 & 2 & 1 \\ 1 & 2 & 1 & 0 & 2 \\ 2 & 0 & 1 & 3 & 1 \end{bmatrix}$$

Apply the following 3X3 filter with stride=1 and no padding.

$$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

Compute the resulting feature map.

- d) Explain the concepts of overfitting and underfitting in CNNs. Discuss techniques such as dropout, data augmentation, regularization, and early stopping used to improve model generalization.
- e) Write the vanishing gradient problem in the Recurrent Neural Network (RNN). How do Long Short-Term Memory (LSTM) networks overcome this limitation?
- f) Write the concept of Reinforcement Learning (RL). Discuss the elements of RL, including agent, environment, state, action, reward, and policy, with suitable examples.
- g) Write down the concept of Q-Learning in Reinforcement Learning. Discuss Q-table and Bellman Equation. Explain how Q-Learning helps an agent learn optimal policies without requiring a model of the environment.
- h) Compare the Recurrent Neural Network (RNN) and the Transformer Network in terms of architecture, computation, and performance.
- i) Explain how to determine whether Machine Learning is a good fit for solving a problem. Discuss factors such as data availability, scalability, complexity, and interpretability. A prediction system produced the following outcomes: Correct predictions = 860 and Incorrect predictions = 140. Calculate the accuracy and error rate of the ML model.
- j) Discuss the Attention Mechanism used in Transformer Networks. How does self-attention capture contextual relationships between words in a sentence? Consider the attention score matrix:

$$\begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$$

Apply softmax row-wise and compute the normalized attention weights.

- k) Discuss project organization and workflow management in Machine Learning projects. Write the responsibilities of data scientists, ML engineers, domain experts, project managers, and data engineers.
- l) Discuss the challenges faced by Machine Learning models after deployment in production environments. Explain issues such as data drift, concept drift, model degradation, and system failures with suitable examples. Explain methods used to detect and mitigate drift in production models.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** What do you mean by Machine Learning? Write the difference between supervised, unsupervised, and reinforcement learning with suitable examples. Explain the structure and working of a Multilayer Perceptron (MLP). Discuss feedforward propagation, activation functions, and backpropagation learning algorithm in detail. Compare MLP with a single-layer perceptron. **(16)**
- Q4** Explain the architecture and working principle of Convolutional Neural Network (CNN). Discuss the roles of convolution layer, pooling layer, activation function, and fully connected layer with suitable diagram. **(16)**
An input image of size 32 X 32 is processed using a Convolution filter size = 5X5, Stride = 1, Padding = 0 and Number of filters = 6.
i. Calculate the output feature map size after convolution
ii. Total number of trainable parameters in the convolution layer
iii. Output size after applying 2X2 max pooling with a stride 2
- Q5** Discuss the concept of sequence modeling in Natural Language Processing (NLP). Explain how Recurrent Neural Network (RNN) and Long Short-Term Memory (LSTM) models are used in sequence prediction and language generation tasks. **(16)**
- Q6** What is CRISP-DM (Cross Industry Standard Process for Data Mining) framework? Discuss all phases of CRISP-DM and explain how it helps in organizing Machine Learning projects systematically. A classifier produced the following confusion matrix values: TP = 90, TN = 80, FP = 15 and FN = 15. Calculate Accuracy, Precision, Recall and F1-score. **(16)**

Registration No.:

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Total Number of Pages: 02

B.Tech/IDD(B.Tech & M.Tech)

HSHS2002/ROB3E002/ ROB4E002

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Organizational Behaviour

AE, AEIE, AERO, AUTO, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CSEIOT, CSIT, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, IT, MANUTECH, MECH, METTA, MINING, MME, MMEAM, PLASTIC, PT

Time: 3 Hours

Max Marks: 100

Q. Code: V370

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Define organisational behavior.
- What are the three components of attitude?
- What do you mean by selective perception?
- Differentiate between group and team.
- List the five personality traits in the big five model.
- How do you define cognitive framework?
- Outline the possible benefits of workplace spirituality.
- Name the two factors in Herzberg's motivation theory.
- What are the primary differences between strong and weak organizational cultures?
- State the three steps in Kurt Lewin's model of change.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Explain the scope and importance of OB in modern management.
- Discuss the barriers to changing attitudes in a workplace environment.
- Describe the Myers-Briggs type indicator (MBTI) and its application in performance.
- Explain the attribution theory of perception with suitable examples.

- e) Compare and contrast Maslow's need hierarchy with Herzberg's Two-Factor Theory.
- f) Explain the five-stage model of group development (Tuckman's Model).
- g) What are the characteristics of an effective work team?
- h) Differentiate between transactional and transformational leadership styles.
- i) Discuss the methods used to sustain organizational culture over time.
- j) Identify the internal and external forces that act as stimulants to change.
- k) Explain Vroom's expectancy theory of motivation.
- l) What are the common intervention strategies for facilitating organizational change?

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- | | | |
|----|---|------|
| Q3 | Critically analyze the relationship between personality and job-fit theory. How can managers use personality tests to improve organizational effectiveness? | (16) |
| Q4 | Compare the process theories with contemporary theories. Which, in your opinion, is most relevant for a global workforce today? | (16) |
| Q5 | Discuss Kotter's eight-step plan for implementing change. Why do employees typically resist change, and what strategies can leaders use to overcome this resistance? | (16) |
| Q6 | Define organizational culture. Elaborate on the various types of cultures (Soft vs. Hard, Formal vs. Informal) and explain how a leader can create a positive organizational culture? | (16) |

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)
Sub_Code: EEPC2005

4th Semester Regular/Back Examination: 2025-26
SUBJECT: POWER ELECTRONICS
BRANCH(S): EEE, ELECTRICAL, ELECTRICAL & C.E.
Time: 3 Hours
Max Marks: 100
Q.Code: V585

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Compare power MOSFET with IGBT.
- What is the effect of source inductance on the performance of converters?
- What do you mean by hard firing of a thyristor?
- Define latching and holding current of SCR.
- Define load commutation of thyristor.
- What are the advantages of using freewheeling diode in rectifier?
- When full wave converter can be used as line-commutated inverter?
- Explain constant frequency system of control of chopper.
- What are the major drawbacks of 1-phase half-bridge inverter?
- What are the advantages of 120-degree mode of inverter over 180-degree mode?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Draw and explain the static I-V characteristics of a Thyristor.
- Explain the operation of snubber circuit with suitable diagram.
- For an SCR, the gate – cathode characteristics has a straight-line slope of 130. For trigger source voltage of 15 V and allowable gate power dissipation of 0.5 Watts. Compute the gate source resistance.
- Explain the principle of operation of single-phase half-wave thyristor having R-L load and freewheeling diode with suitable diagram and mathematical expressions.
- A single-phase 230 V, 1 kW heater is connected across 1-phase, 230 V, 50 Hz supply through an SCR. For firing angle delays of 45° and 90° , calculate the power absorbed in the heater element.
- Explain the operation of single-phase full-wave mid-point thyristor converter having R-L load with suitable diagram and mathematical expressions.
- Explain the operation of single-phase full-wave bridge type thyristor converter having R-L-E load with suitable diagram and mathematical expressions for the firing angle more than 90° degree.

- h) A single-phase full converter bridge is connected to R-L-E load. The source voltage is 230 V, 50 Hz. The average load current of 10 A is constant over the working range. For $R = 0.4 \Omega$ and $L = 2 \text{ mH}$, compute: (i) firing angle delay for $E = 120 \text{ V}$, (ii) firing angle delay for $E = -120 \text{ V}$. Indicate which source is delivering power to load in part (i) and (ii).
- i) A 3-phase full-converter charges a battery from a three-phase supply of 230 V, 50 Hz. The battery emf is 200 V and its internal resistance is 0.5Ω . On account of inductance connected in series with the battery, charging current is constant at 20 A. Compute the firing angle delay and the supply power factor.
- j) Draw and explain the operation of single-phase half bridge and full bridge voltage source inverter along with its steady state analysis.
- k) Explain and derive the output voltage waveform of PWM inverter with sinusoidal pulse width modulation.
- l) For a dc-dc buck converter, dc source voltage = 230 V, load resistance = 10Ω . Take a voltage drop of 2 V across chopper when it is on. For a duty cycle of 0.4, calculate: (i) average and rms values of output voltage and (ii) converter efficiency.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Explain the principle of operation of three-phase bridge inverter using 120-degree conduction mode and derive all the line to neutral and line to line voltage with neat sketch diagram. **(16)**
- Q4** Explain in detail the operation of switching characteristics of thyristor during turn-on and turn-off with suitable voltage and current waveforms. **(16)**
- Q5** Explain the operation of dual converter with and without circulating current with neat sketch diagram and suitable voltage and current waveforms. **(16)**
- Q6** Explain the operation of single-phase-to-single-phase circuit for step-up mid-point cycloconverter with neat sketch diagram and waveforms. A single-phase full wave ac voltage controller feeds a load of $R = 20 \Omega$ with an input voltage of 230 V, 50 Hz. Firing angle for both the thyristor is 45° . Calculate (a) rms value of output voltage (b) load power and input pf. **(16)**

Registration No.:

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Total Number of Pages: 02

Course: B.Tech
Sub Code: PCAC2013

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Robotics: Mobility & Design

BRANCH(S): CIVIL, CSE, ECE, EEE, ELECTRICAL, ETC, MECH, METTA

Time: 3 Hours

Max Marks: 100

Q.Code: V439

Answer Question No.1 (Part I), which is compulsory, any eight from Part II, and any two from Part III.

The figures in the right-hand margin indicate marks.

Part I

Q1 Answer the following questions: (2 x 10)

- a) Define embodied behaviors in robotics.
- b) How are the kinematics of a robot designed?
- c) Define degrees of freedom (DOF).
- d) A wheeled robot moves at 2 m/s for 15 seconds. Calculate the distance travelled.
- e) Briefly describe optical flow.
- f) Define pose estimation and its importance in robots.
- g) Briefly explain projective transformation.
- h) Assume a robot camera captures an image with dimensions 1920×1080 pixels; calculate the total number of pixels in the image.
- i) What is RANSAC used for in robotics perception?
- j) Define landmark-based localization.

Part II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- a) Explain mobility in animals and robots, and correlate with suitable examples.
- b) To achieve stable mobility, the importance of robot body design is emphasized, why?
- c) Explain the concepts of kinematics and dynamics in legged robots.
- d) Explain designing dynamical behaviors through the manipulation of energy landscapes.
- e) A robotic arm takes 4 seconds to rotate 120° . Determine its angular velocity in both degrees and radians per second.
- f) Detail the geometric models used to form images in robotic vision.
- g) How does optical flow contribute to robotic navigation and mapping?
- h) What is the net displacement of a mobile robot that travels from position A(2,3) to position B(8,11)?
- i) Explain the pose estimation techniques used in robotics.
- j) Discuss the working principle and applications of the RANSAC algorithm.
- k) A robot captures two images from different viewpoints separated by 5 m. Explain how multi-view geometry helps estimate 3D structure from these images?

- I) How are projective transformations applied in robotic perception systems?

Part III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** How do physical body design, templates, embodied behaviors, and composition programming collectively enable robots to navigate unstructured environments? **(16)**
- Q4** Provide a detailed analysis of the kinematics and dynamics of legged robots. Using a four-legged robot that takes 0.6 m steps at 2 Hz as a reference, calculate its forward speed and evaluate the overall significance of gait analysis. **(16)**
- Q5** Explain robotic perception systems in detail. Discuss the geometry of **(16)**
- Image Formation,
 - Optical Flow,
 - Rotations,
 - Translations and
 - Pose Estimation techniques with suitable diagrams.
- Q6** Explain multi-view geometry and landmark-based localization in robotics. A robot estimates the position of an object at coordinates (4, 5, 6) m relative to its camera. After translation of (2,1,3) m, determine the new coordinates of the object with respect to the robot frame and explain the importance of coordinate transformations in robotic navigation. **(16)**

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)
Sub_Code: EOPC2003

4th Semester Regular/Back Examination: 2025-26

SUBJECT: SIGNALS AND SYSTEMS

BRANCH(S): EEE, ELECTRICAL

Time: 3 Hours

Max Marks: 100

Q.Code: V740

Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

- Write the condition for stability of a DT-LTI system with respect to the position of poles.
- What do you mean by a discrete time system?
- Define an impulse signal with proper mathematical expression and graphical representation.
- Define amplitude scaling of a discrete-time signal.
- What is meant by the response of an LTI system?
- What is the associative property of convolution?
- Define Continuous-Time Fourier Series (CTFS).
- Explain the circular time-shift property in DTFS.
- What is aliasing? How can it be avoided?
- Define CTFT with proper mathematical expression.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- Describe the elementary signals such as unit impulse, unit step, ramp, and exponential signals with their mathematical representations and sketches.
- Explain cascade interconnection of discrete-time systems using block diagrams.
- Explain causal and non-causal discrete-time systems with practical examples.
- Find the cross correlation of the sequences $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{2, 4, 6\}$.
- State and explain any three properties of auto correlation.
- How are Discrete-Time Systems described by Difference Equations?
- Derive the Fourier series representation of a square wave signal.
- Determine the Fourier series coefficients for $x(n) = \sin[\pi(n-1)/4]$.
- Explain the reconstruction of a signal from its samples using interpolation with neat diagram.
- Find the DTFT of the sequence $x(n) = u(n - k)$.

- k) Explain the necessity of discrete time processing of continuous-time signals.
l) State six properties of CTFT.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Explain the various operations performed on discrete-time signals such as time shifting, scaling, folding, and amplitude scaling with examples. (16)
- Q4** A random process $\{X(t)\}$ is applied to a network with response $h(t) = te^{-bt}u(t)$, where $b > 0$ is a constant. The cross function of $X(t)$ with the output $Y(t)$ is known to have the same i. e Auto Correlation Function (ACF). $R_{XY}(\tau) = \tau e^{-b\tau}u(\tau)$. Find the ACF of the output $\{Y(t)\}$ (16)
- Q5** a) State and explain the properties of CTFS in details. (8 x 2)
b) Find the Fourier series of $f(x) = |\sin(x)|$ on the interval $[-\pi, \pi]$
- Q6** a) Find the Fourier transform of the function $f(t) = \cos w_c t$ (8 x 2)
b) State and explain the properties of DTFT in details.

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)

Sub_Code: CIPC2004

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Structural Analysis

BRANCH(S): Civil

Time: 3 Hours

Max Marks: 100

Q.Code: V509

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

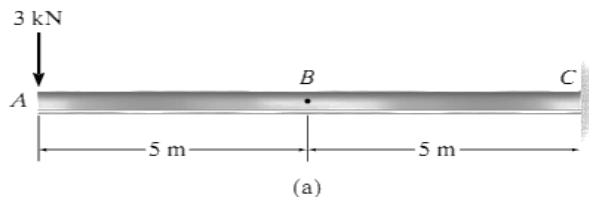
Part-I

- Q1 Answer the following questions:** (2 x 10)
- a) State maximum strain theory of failure.
 - b) State Betti's law.
 - c) Mention the limitations of strain energy method.
 - d) Define space truss.
 - e) Draw the influence line diagram for vertical reaction at A of a simply supported beam (AB) of length 'L'.
 - f) Give two examples of displacement method.
 - g) Show graphically difference between strain energy and complementary energy.
 - h) State Clapeyron's theorem of three moments.
 - i) Draw neat sketch of a three hinged arch.
 - j) Define degree of static indeterminacy.

Part-II

- Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 x 8)
- a) A three hinged parabolic arch of span 20 m and rise 5 m is loaded with a uniformly distributed load of 5 kN/m over the left half of the span. Calculate the bending moment at a section from 4 m from left end.
 - b) A cantilever beam AB of span 5 m is fixed at A and propped at B. The beam carries a uniformly distributed load of intensity 10 kN/m over its whole span. Determine the reaction at propped end using consistent deformation method.
 - c) A cable carries a uniformly distributed load of 12 kN/m on its horizontal span of 60 m. Determine the maximum sag (dip) may be allowed at mid span if the maximum tension in the cable is 900 kN.
 - d) A simply supported girder has a span of 5 m. A wheel load of 80 kN moves from one end to the other end on the span of the girder. Determine the maximum bending moment which can occur at 2 m from left end support.
 - e) Derive the expression for deflection at the free end of a cantilever beam carrying a concentrated load at free end using Castigliano's theorem.
 - f) A fixed beam AB of length 5 m is carrying a point load of 20 kN at C. Find the fixed end moments if AC = 2 m and CB = 3 m. Draw the bending moment diagram of AB.

- g) Four-point loads 8 kN, 15 kN, 15 kN, and 10 kN have center to center spacing of 2 m between consecutive loads and they traverse a simply supported girder of 30 m span from left to right with 10 kN load leading. Calculate the maximum bending moment at 8 m from the left support.
- h) A simply supported beam of span carries a concentrated load at mid-span. Derive expression for maximum deflection using strain energy method.
- i) Determine the slope at point B of the steel beam shown in Fig.(a). Take young's modulus of elasticity (E) = 200 GPa, moment of inertia (I) = $60 \times 10^6 \text{ mm}^4$. Use virtual work method.



- j) State Maximum normal stress theory & maximum normal strain theory of failure.
- k) Write short note on Equilibrium equations and compatibility requirements.
- l) Provide a detailed classification of arches with neat sketches according to geometry and support conditions.

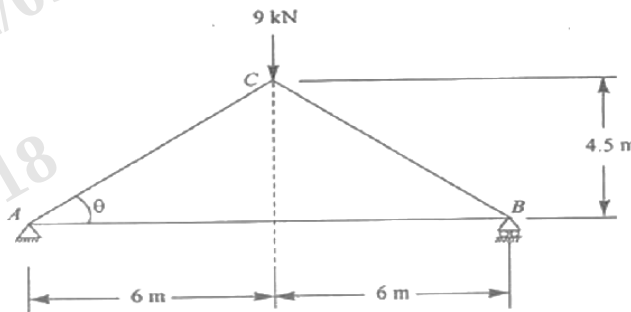
Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3

Find the vertical deflection of joint C of the pin-jointed truss shown in figure. the area of the horizontal member (AB) is 150 mm^2 . The areas of AC and BC are 150 mm^2 each. Take young's modulus of elasticity is 200 kN/mm^2 . Use unit load method.

(16)



Q4

Determine the maximum shear force and bending moment at quarter span from left end of a simply supported beam when a uniformly distributed load longer than the span of intensity 20 kN/m , accompanied by a concentrated load of 100 kN crosses the span of 12 m . Use influence lines for calculation. The concentrated load can occupy any position.

(16)

Q5

A three-hinged parabolic arch has span 16 m and central rise 4 m . It carries a concentrated load of 100 kN at 4 m from left support. Evaluate reaction components, bending moment, normal thrust and radial shear at a section 6 m from left support.

(16)

Q6

Draw the bending moment diagram of a simply supported continuous beam ABC having span length $AB = 5 \text{ m}$ and $BC = 4 \text{ m}$. The span AB carries a point load of 10 kN at a distance of 2 m from support A and span BC carries a uniformly distributed load of intensity 15 kN/m throughout the span (BC). Use three moment theorems. All supports are simply supported.

(16)

Registration No.:

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Total Number of Pages: 02

Course: B.Tech/IDD (B.Tech & M.Tech)
Sub_Code: CIPC2007

4th Semester Regular/Back Examination: 2025-26

SUBJECT: Water Supply & Sanitary Engineering

BRANCH(S): CIVIL

Time: 3 Hours

Max Marks: 100

Q.Code: V664

Answer Q1 (Part-I) which is compulsory, any eight from Part-II, and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

- Q1** Answer the following questions: (2 x 10)
- a) What is domestic water demand?
 - b) What are the desirable limits of turbidity, pH, iron and color (as per IS 10500)?
 - c) Discuss the factors governing location of Intake.
 - d) Describe methods for removal of iron and manganese from water.
 - e) What is reverse osmosis (RO)? How does it work?
 - f) What is the difference between coagulation and flocculation?
 - g) Discuss the growth of microorganisms in batch process with suitable sketch.
 - h) What are the functions of screening and grit chamber in waste water treatment plant?
 - i) Discuss the factors influencing solid waste generation rates.
 - j) Classify solid waste based on type and source.

Part-II

- Q2** Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)
- a) Discuss the factors, which affect the per capita demand of water in a community.
 - b) A pump is to deliver water from an underground tank against a static head of 62 m. The suction pipe is 85 m long and is of 40 cm diameter with Darcy-Weisbach friction factor $f = 0.02$. The delivery pipe is of 40 cm diameter, 2100 m long and $f = 0.022$. The pump characteristics may be expressed as $H_p = 100 - 6000 Q^2$. Where H_p = pump head in meters and Q = discharge in m^3/sec . Calculate the head and discharge of the pump.
 - c) Discuss sources, effects, and measurement procedure for any four water quality parameters: Turbidity, Chloride, Organics, Colour, Heavy metals & Hardness.
 - d) What are the different methods of water softening? Describe Lime soda process of water softening in detail.
 - e) A trickling filter has a diameter of 30 m and depth 3 m. It is operated with a direct circulation ratio of 1.5 and influent sewage rate of 2 million liters per day. Influent BOD into the filter is 200 mg/L and effluent BOD is 30 mg/L. Calculate the hydraulic loading rate and organic loading rate. What is the efficiency of the filter?

- f) The population of a town is 20,000 and the average per capita demand is 100 L/p/d. Water is passing through a sedimentation tank which is 6 m wide, 15 m length and having a water depth of 3 m:
- Find the detention time for tank.
 - What is average flow velocity through tank?
 - Compute the overflow rate.
- g) Design six slow sand filter beds from the following data:
- Population to be served = 50000 persons
 - Quantity of water to be supplied = 200 liters per head per day
 - Length of each bed is twice the breadth
 - Rate of filtration: 150 liters/hr/m²
- Assume whatever data are necessary and not given.
- h) Discuss the different stages in sludge digestion process and factors affecting the process.
- i) Distinguish between primary treatment and secondary treatment. Draw the flow diagram for treatment of sewage using activated sludge process.
- j) What is the principle of composting? Describe the difference between aerobic and anaerobic composting.
- k) What is a sanitary landfill? Explain the essential components and site selection criteria for a landfill.
- l) Explain briefly the working principle, advantages, and disadvantages of incineration.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3** Define design period. What are the factors affecting the design period? A town has a population detail as given under. Estimate the future population in the year 2050 using Arithmetic Increase, Incremental Increase Method, Geometric Increase and decreasing rate of growth method. **(16)**
- | | | | | | | | |
|--------------------------------|------|------|------|------|------|------|------|
| Year | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2010 |
| Population (x10 ³) | 400 | 540 | 995 | 1550 | 1713 | 1893 | 2100 |
- Q4** Discuss the working of any FOUR water treatment processes: (i) Sedimentation (ii) Ion exchange (iii) Fluoridation and defluoridation (iv) Electro-dialysis (v) Disinfection **(16)**
- Q5** What is meant by activated sludge process and trickling filter? Describe with neat sketch. Mention the advantage and disadvantage of these systems. **(16)**
- Q6** Discuss the integrated framework of Municipal Solid Waste Management (MSWM). Explain all functional elements from the source of generation to final disposal. **(16)**