

Registration No.:

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Total Number of Pages: 03

Course: B.Tech
Sub_Code: CSPC2007

4th Semester Back Examination: 2025-26

SUBJECT: Computer Networks

BRANCH(S): CSE, CSIT, CST, IT

Time: 3 Hours

Max Marks: 100

Q.Code: V720

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) A digitized voice channel is made by digitizing a 4-kHz bandwidth analog voice signal. We need to sample the signal at twice the highest frequency (two samples per hertz). We assume that each sample requires 8 bits. What is the required bit rate?
- b) What are the propagation time and the transmission time for a 2.5-kbyte message (an e-mail) if the bandwidth of the network is 1 Gbps? Assume that the distance between the sender and the receiver is 12,000 km and that light travels at 2.4×10^8 m/s.
- c) Four channels are multiplexed using TDM. If each channel sends 100 bytes/s and we multiplex 1 byte per channel, compute the size of a frame and the bit rate for the link.
- d) Stations in a slotted ALOHA network send frames of size 1000 bits at the rate of 1 Mbps. What is the vulnerable time for this network?
- e) Define transmission impairment in data communication systems. Name the three major types of transmission impairments.
- f) Briefly mention the count-to-infinity problem in the distance vector routing algorithm.
- g) Write the working principle of the Dynamic Host Configuration Protocol (DHCP).
- h) Compare ARP and RARP protocols.
- i) Find the first and the last address in a block which contains an address 200.107.16.17/18.
- j) What is the purpose of the Domain Name System (DNS)?

Part-II

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

- a) Name various transmission media used for data communication. Write the advantages of optical fiber over twisted-pair and coaxial cable.
- b) Compare and contrast a circuit-switched network and a packet-switched network.
- c) Differentiate between Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM). Four channels, two with a bit rate of 300 kbps and two with a bit rate of 150 kbps, are to be multiplexed using multiple-slot TDM with no synchronization bits. Calculate the size of a frame in bits, frame rate and data rate.
- d) Explain the working of the Go-Back-N ARQ Protocol. Explain how selective repeat improves efficiency compared to Go-Back-N.
- e) Discuss error detection and correction mechanisms in the data link layer. Given the dataword 101001111 and the divisor 10111, show the generation of the CRC codeword at the sender site (using binary division).
- f) Explain the functions of Repeaters, Hubs, Bridges and Switches.
- g) Explain the structure and classes of IPv4 addressing. Discuss subnetting and supernetting.
A company has been assigned the network: 172.16.0.0/20
Calculate the number of subnet bits, the total number of hosts supported and the subnet mask.
- h) Explain the Client-Server Model with neat diagrams. A server handles 200 client requests per second and average request size = 2KB. Calculate the total incoming traffic handled by the server per second and the bandwidth requirement in Mbps. Explain why client-server architecture is widely used in Internet applications.
- i) Explain the concept of Path Vector Routing. Discuss the operation of BGP (Border Gateway Protocol).
- j) List and explain any three error reporting ICMP messages. What is the role of IGMP protocol.
- k) Explain the congestion control mechanism of TCP.
- l) Explain the features of FTP and HTTP protocols.

Part-III

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

Q3 List the layers of the OSI model. How is it different from the TCP/IP model? What are the responsibilities of the datalink layer and network layer? Consider a source computer (S) transmitting a file of size 106 bits to a **(16)**

destination computer (D) over a network of two routers (R1 and R2) and three links (L1, L2, and L3). L1 connects S to R1; L2 connects R1 to R2; and L3 connects R2 to D. Let each link be of length 100km. Assume signals travel over each line at a speed of 108 meters per second. Assume that the bandwidth on each link is 1 Mbps. Let the file be broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D?

- Q4** Explain the working of Carrier Sense Multiple Access (CSMA) protocols. Compare and contrast CSMA/CD and CSMA/CA. Explain why WLANs use CSMA/CA instead of CSMA/CD. (16)
Assume that there are only two stations, A and B, in a bus CSMA/CD network. The distance between the two stations is 2000 m and the propagation speed is 200000 km/s. If station A starts transmitting at time t_1 :
Does the protocol allow station B to start transmitting at time $t_1 + 8$ micro seconds? If the answer is yes, what will happen?
Does the protocol allow station B to start transmitting at time $t_1 + 11$ micro seconds? If the answer is yes, what will happen?
- Q5** Describe the routing process using the Link-State routing protocol. (16)
An ISP is granted the block 80.70.56.0/21. The ISP needs to allocate addresses for two organizations, each with 500 addresses, two organizations, each with 250 addresses and three organizations, each with 50 addresses. Find the number and range of addresses in the ISP block. Find the range of addresses for each organization and the range of unallocated addresses.
- Q6** Explain the working principle of the Transmission Control Protocol (TCP). Discuss Connection establishment, Three-way handshake, Reliable transmission and Flow control mechanism of TCP. (16)

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Total Number of Pages: 02

Course: B.Tech
Sub_Code: RCI4D002

4th Semester Back Examination: 2025-26

SUBJECT: CONCRETE TECHNOLOGY

BRANCH(S): CIVIL

Time: 3 Hours

Max Marks: 100

Q.Code: V428

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)

- Name two mineral admixtures and two chemical admixtures.
- Distinguish between initial setting and final setting of cement.
- What are the various factors which affect the workability of concrete?
- What are the various factors which control the strength of concrete?
- Write the name of two tests which are conducted to measure the workability of concrete.
- Distinguish between fresh concrete and hard concrete.
- State various types of non-destructive testing methods used for concrete.
- State the IS Code used for mix design of concrete.
- What is self compacting concrete?
- What are the constituents of light weight aggregate? What is its application?

Part-II

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

- Explain: soundness of aggregate and gap graded aggregate.
- Explain the chemical composition of cement. Describe the process of hydration of cement.
- Differentiate between segregation and bleeding of concrete. What steps can be taken to avoid this behavior?
- Describe the various steps involved in determining the compressive strength of concrete experimentally.
- Explain the sieve analysis and gradation curve for fine aggregates.
- Explain the purpose of curing of concrete. Also explain the various methods adopted for curing of concrete.
- Describe briefly the experimental procedure to find the flexure strength of concrete.
- What do you mean by creep of concrete? Explain the various factors which influence the creep of concrete.
- What do you mean by nondestructive testing of concrete? Explain any one suitable method of conducting nondestructive testing in a laboratory.

- j) What do you mean by durability of concrete? Explain the various factors which affect the durability of concrete.
- k) Describe the applications of high-performance concrete.
- l) Describe the constituents, advantages, and applications of polymer concrete.

Part-III

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

- Q3** Define admixture. What is the purpose of using admixtures in concrete? Distinguish among accelerating admixtures, retarding admixtures, and air entraining admixtures. **(16)**
- Q4** What do you mean by sieve analysis of aggregates? Explain grading of fine and coarse aggregates. **(16)**
- Q5** Explain the procedure to find the tensile strength of concrete. Find the compressive and tensile strength of M20 and M30 concrete. **(16)**
- Q6** Explain the salient features of polymer impregnated concrete. What do you mean by shrinkage of concrete? Explain the types of shrinkage. **(16)**

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Course: B.Tech

Sub_Code: RAE4G003/RMN4G003/RPL4G003/
RMF4G003/ RMM4G003/REC4G002/RME4G003

4th Semester Back Examination: 2025-26

SUBJECT: Data Structure

BRANCH(S): AERO, MINING, PLASTIC, MANUTECH, METTA, ECE, ETC, MECH

Time: 3 Hours

Max Marks: 100

Q.Code: V723

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)

- Explain the term time-space tradeoff with an example.
- Differentiate between primitive and non-primitive data structures.
- Apply binary search to find 32 in the sorted array and find the number of element comparisons only. 10, 14, 18, 25, 32, 40, 50.
- Explain the advantage of circular queue over simple queue.
- Convert the following infix expression into postfix expression.
 $A + B * C - D$
- Why does linked list require extra memory compared to array?
- Write the function to count the total number of nodes in the following linked list.
 $2 \rightarrow 4 \rightarrow 6 \rightarrow 8 \rightarrow 10 \rightarrow \text{NULL}$
- Differentiate between insertion sort and selection sort.
- Using the hash function $h(x) = x \bmod 10$, find the hash values for 25, 38, 41, 56, 55, 61 and count the number of collisions.
- Differentiate between tree and graph with suitable examples.

Part-II

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

- Define algorithm and explain the characteristics of a good algorithm with suitable examples.
- Write a C program to perform linear search on an array of n elements. Also determine the number of comparisons required for successful and unsuccessful search.
- Describe overflow and underflow conditions in stack and queue operations.
- Explain stack ADT and its operations with suitable examples.
- Develop an algorithm to delete a node containing a specified value from a linked list. Demonstrate using the list:
 $10 \rightarrow 20 \rightarrow 30 \rightarrow 40 \rightarrow 50$

- f) Analyze the time complexity of the following code fragment:
- ```

for(i=1; i<=n; i++)
{
 for(j=1; j<=n; j++)
 printf("***");
}

```
- g) Write an algorithm for searching an element in a singly linked list and analyze its complexity.
- h) Explain how stack can be represented using linked list with suitable diagrams.
- i) Differentiate between bubble sort, selection sort, and insertion sort in terms of worst-case time complexity.
- j) Explain AVL tree rotation with suitable example. Show the imbalance correction for the sequence: 30, 20, 10
- k) Explain graph representation using adjacency matrix and adjacency list.
- l) Write an algorithm for Depth First Search (DFS) traversal and explain its working with suitable example.

### Part-III

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

- Q3** a) Explain asymptotic notations such as Big-O, Big-Ω, and Big-Θ with examples. (8)
- b) Write a C program for binary search. Trace the searching steps for the element 45 in the array. 10, 15, 22, 30, 45, 60, 75, 90 (8)
- Q4** a) Explain different types of queues: linear queue, circular queue, and priority queue. (8)
- b) Write a C program to check whether a given string is palindrome using stack. (8)
- Q5** a) Describe the operations performed on doubly linked list with examples. (8)
- b) Write a C program to create a circular linked list and perform insertion at the beginning and end. (8)
- Q6** a) Write an algorithm for quick sort and explain its partitioning process with suitable example. (8)
- b) Explain the different tree traversal methods with examples. (8)

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Course: B.Tech  
Sub\_Code: RIT4C002/ RCS4C002

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: Design and Analysis of Algorithm

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

Time: 3 Hours

Max Marks: 100

Q.Code: V494

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 algorithm and its characteristics.
- Differentiate between best-case and worst-case complexity.
- What is recursion tree method?
- State Master's theorem with an example.
- Explain brute-force strategy with an example.
- What is Huffman coding?
- Define DFS and BFS.
- What is Cook's theorem?
- Explain randomized quick sort.
- What is an approximation algorithm?

**Part-II**

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

- Solve the recurrence  $T(n) = T(n/2) + n$  using substitution method.
- Write pseudocode for selection sort and analyze its complexity.
- Explain fractional knapsack problem using greedy strategy.
- Solve matrix chain multiplication for matrices (10×20), (20×30), (30×40).
- Demonstrate longest common subsequence (LCS) problem with example strings.
- Explain Travelling Salesman Problem using dynamic programming.
- Apply Kruskal's algorithm to find MST of a given graph.
- Explain topological sorting with an example.
- Discuss NP-complete problems with examples.
- Explain reduction technique in NP-completeness.
- Demonstrate randomized n-Queens problem.
- Explain min-cut problem using randomized algorithm.

### Part-III

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

- Q3** a) Compare substitution, recursion tree, 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) Solve activity selection problem using greedy algorithm. (8)
- Q5** a) Demonstrate Floyd-Warshall algorithm for all-pairs shortest path with a small graph. (8)  
b) Explain network flow algorithm with an example. (8)
- Q6** a) Discuss clique decision and chromatic number decision problems as NP-complete problems. (8)  
b) Explain approximation algorithm for vertex cover problem with example. (8)

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Course: B.Tech  
Sub\_Code: REE4C001/REL4C001

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: Digital Electronics

BRANCH(S): EEE, ELECTRICAL

Time: 3 Hours

Max Marks: 100

Q.Code: V430

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)**

- State De Morgan's theorems.
- Perform the given binary arithmetic: (i)  $100000 + 1011$ , (ii)  $10101 - 1100$
- Convert the decimal number 2679.60 to its binary equivalent.
- What is parity checking?
- What is the purpose of the "don't care" condition in Karnaugh maps?
- Define carry look-ahead adder.
- Define minterm and maxterm.
- Distinguish between synchronous and asynchronous counters.
- What is the principle of R-2R ladder DAC?
- How many flip-flops are required to build a binary counter that counts from 0 to 7777?

**Part-II**

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

- Simplify the Boolean expression:  $(A + B + C')(A' + B)(B' + C)$  using Boolean algebra.
- Describe the working of a Multiplexer and De-Multiplexer.
- Explain the working of a serial adder.
- Explain SR and JK flip-flops with truth tables.
- What is an encoder? Design a 4-to-2-line encoder and explain its operation with truth table and logic diagram.
- Minimize the following Boolean function using K-map:  $F(A, B, C) = \sum m(1, 2, 5, 7)$
- What is a demultiplexer? Design a 1-to-8 demultiplexer and explain its operation.
- Describe serial-in serial-out and serial-in parallel-out shift registers.
- What are error detecting and correcting codes? Provide examples.
- Describe the operation of successive approximation ADC.
- Explain memory organization and memory expansion
- Describe Programmable Logic Array (PLA) and Programmable Array Logic (PAL).

### Part-III

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

- Q3** a) Simplify the following Boolean function using K-map and realize it using NAND gates only: (10 + 6)  
 $F(A, B, C, D) = \sum m(0, 1, 2, 5, 8, 9, 10, 14)$   
b) Explain Quine-McCluskey method of minimization.
- Q4** a) Design a 4-bit synchronous binary counter using JK flip-flops. (8 + 8)  
b) Define sequential circuits. Explain the operation of a clocked SR flip-flop with its truth table and timing diagram.
- Q5** a) What is a shift register? Design a 4-bit serial-in serial-out (SISO) shift register and explain its operation. (8 + 8)  
b) Draw and explain a 4-bit synchronous binary counter with timing diagram.
- Q6** a) Explain R-2R ladder DAC and successive approximation ADC with neat diagrams (8 + 8)  
b) Explain ROM, RAM, CAM and CCD memories with suitable diagrams.

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Total Number of Pages: 02

Course: B.Tech

Sub\_Code: RIT4G002, REE4G001, REL4G001, RCS4G002

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: DIGITAL SIGNAL PROCESSING

BRANCH(S): CSIT, IT, EEE, ELECTRICAL, CSE, CSEAI, CSEAIML, CST

Time: 3 Hours

Max Marks: 100

Q. Code: V752

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 a discrete ramp signal with proper graphical representation and mathematical expression.
- How is the stability of an LTI system determined?
- Establish the relation between Z-transform and DFT.
- What do you mean by correlation of discrete time signal?
- Find Z-transform of a unit step signal.
- Define the frequency shifting property of DFT.
- Compare FIR and IIR Filters in brief.
- Find the correlation of  $x(n) = \{1, -2, 4\}$  and  $h(n) = \{3, 2, 1\}$
- What do you mean by inverse modelling in an adaptive filter?
- Define the Direct-Form-II Structure for IIR systems with neat diagram.

**Part-II**

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

- Determine the Z-transform of  $x(n) = \{-3, 1, 2, 0, 0, 1, 5, 9\}$ .
- Discuss Recursive and Non-recursive discrete time systems.
- Determine the DFT of  $x(n) = 2\delta(n) + 3\delta(n-1) + 3\delta(n-4)$ .
- Find the circular convolution of  $x(n) = \{1, -1, 3\}$  and  $h(n) = \{1, 0, -1\}$
- Discuss the use of DFT in Linear Filtering with an example.
- The impulse response of an LTI system is  $h(n) = \{1, 3, -1, 2\}$  and is excited by an input  $x(n) = \{1, 4, 3, -1\}$ . Determine the output of the system graphically.
- Differentiate between Symmetric and Antisymmetric FIR Filters.
- Explain radix-2 FFT algorithm with suitable example.
- Realize the given system in Direct Form-I
$$y[n] = 0.5y[n-1] - 0.25y[n-2] + x[n] + 0.4x[n-1]$$
- State and explain at least three properties of FFT.
- Explain the design of IIR filters using bilinear transformation. (with suitable example)

- I) Compare the Transposed and Cascade-Form structures for IIR systems. (with suitable example)

**Part-III**

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

- Q3** Compute the DFT of  $x(n) = \cos \frac{n\pi}{4} + \sin \frac{n\pi}{4}$  where  $0 \leq n < 8$ . (16)
- Q4** Explain the methods of designing a Linear-Phase FIR filter using windows with supporting mathematical expressions. What are the characteristic features of FIR filters? (16)
- Q5** Find the inverse Z-Transform of  $H(z) = \frac{z}{3z^2 - 4z + 1}$ . (16)
- Q6** (a) Write short note on Architecture of ADSP series of digital signal processors. (8+8)  
(b) How are IIR filters designed using impulse variance?

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Total Number of Pages: 02

Course: B.Tech  
Sub\_Code: REE4C002/REL4C002

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: Electrical Machines-I

BRANCH(S): EEE, ELECTRICAL

Time: 3 Hours

Max Marks: 100

Q.Code: V498

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)**

- Explain back EMF of the motor.
- What is electromagnetic torque?
- Explain the role of brushes in commutation.
- What is saliency in magnetic systems?
- What are the advantages of an autotransformer?
- Define flux, reluctance, and inductance of the magnetic circuit.
- What is a galvanometer?
- What is eddy current loss?
- What is the function of the commutator?
- What is the function of the stator yoke?

**Part-II**

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

- Explain the OC test briefly of a 1-phase transformer.
- Explain the Biot-Savart Law with diagram.
- Define flux linkage and explain its relationship with current.
- Define the voltage regulation of a transformer.
- State how torque is derived from stored magnetic energy.
- Explain the polarity test and back-to-back (Sumpner's) test of transformers with advantages.
- Compare lap winding and wave winding with advantages and applications.
- Explain the Ampere Law?
- The 2000/200 V, 20 kVA transformer is connected as a step-up auto-transformer. The 200 V winding has enough insulation to withstand 2200 V to ground. Calculate: (i) The LV and HV side voltage ratings of the autotransformer (ii) its kVA rating (iii) kVA transferred inductively and conductively
- Draw the equivalent circuit, approximate equivalent circuit of the transformer.

- k) Explain the Parallel operation of 3-phase transformers.
- l) A separately excited dc motor has an armature resistance of  $0.5 \Omega$ . It runs off a 250 V dc supply drawing an armature current of 20 A at 1500 rpm. The torque developed for an armature current of 10 A for the same field current will be.

### Part-III

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

- Q3** What is the armature reaction of the DC machine? Explain the cross-magnetization and demagnetization effect with the diagram. **(16)**
- Q4** Derive the expression for energy stored in a magnetic circuit. Compare the energy storage in linear and nonlinear magnetic circuits with suitable diagrams. **(16)**
- Q5** Explain neutral floating of 3 phase Y-Y connection? What is the remedy to overcome the problem? **(16)**
- Q6** Explain Scott connection for phase conversion. Describe three-phase to two-phase conversion with phasor diagram. **(16)**

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Total Number of Pages: 02

Course: B.Tech

Sub\_Code: REE4D001/REL4D001/REC4C001

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: Electro Magnetic Theory

BRANCH(S): EEE, ELECTRICAL, ECE, ETC

Time: 3 Hours

Max Marks: 100

Q.Code: V648

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)

- Express the given point P (-2, 6, 3) in Cylindrical and Spherical coordinates.
- State the divergence theorem. Determine the divergence of the vector field  $P = x^2yza_x + xza_z$ .
- State and explain the Coulomb's law of electrostatic fields.
- The electric field E At Point P (0, 0, 5) is (-1.5, -1.5, 11.25) V/m. If a -1 mC charge is located at (0, 0, 5), then what will be the force experienced by the point charge?
- Difference between the magnetic flux and magnetic flux density.
- Write analogy between electric and magnetic fields for field intensity, relationship between field and flux density, and potential.
- Write the Maxwell's equations based on ampere's circuital law for time-varying field showing the conduction and displacement current densities.
- State Poynting's theorem writing the mathematical equation.
- Name, in how many types the waves are classified?
- Draw and show the different elements of a Yagi-Uda antenna.

Part-II

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

- Define the Laplacian of a scalar field. Find the Laplacian of the scalar field  $A = 10r\sin^2\theta \cos\phi$
- A vector field is described by  $F = 500a_x + 750a_y$ . A plane surface S in the region of the field is defined by  $2x + 4y + 6z$ . Find the vector component of F that are normal and tangential to the surface.
- Write the Poisson's and Laplace's equations, and their uses.
- How the electric field intensity E and potential V are related to each other? Find V and D in an electric field  $E = (2a_x + 3a_y + 4a_z)$  N/C, where,  $r_a = (a_x - 2a_y + a_z)$  m and  $r_b = (2a_x + a_y - 2a_z)$  m.
- Explain, how convection current is different from conduction current and displacement current.

- f) Write the Maxwell's equation that depicts the conservative nature of electrostatic field. A charge  $q = 10 \mu\text{C}$  is distributed uniformly over the circumference of a ring of radius 3 m, placed on X-Y plane with its center at the origin. Find the electric potential at the point p (0, 0, 6 m).
- g) Derive the Maxwell's equations for sinusoidal variation of fields with time.
- h) A current element of  $0.05 \text{ a}_x \text{ Am}$  is centered at P' (0, 0, 1 m) in rectangular coordinate. Find the magnetic field intensity at P (2 m, 3 m, -1.2 m)
- i) What is transformer emf? Show that the time varying E field is not conservative.
- j) Explain the reflection of a plane wave at the interface of two dielectric regions.
- k) A two-conductor transmission line has  $R = 0.5 \Omega/\text{m}$ ,  $L = 50 \text{ nH/m}$ , and  $C = 0.02 \text{ nF/m}$ . Calculate the characteristic impedance, propagation constant, attenuation constant, and phase constant at 25 MHz. Neglect the shunt conductance.
- l) A half-wave antenna is located in free space. It is excited by a sinusoidal time varying current at 100 MHz. The antenna wire made of copper has a radius of 2 mm and its conductivity is  $57 \text{ MS/m}$ . Find the radiation efficiency of the antenna.

### Part-III

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

- Q3** a) What is meant by the divergence and curl of a vector? State the divergence and Stoke's theorems. (8 x 2)
- b) Taking a vector field A, show explicitly that the divergence of the curl of any vector field is zero.
- Q4** a) Describe the Faraday's law of electromagnetic induction (8 x 2)
- b) Let the electric field intensity in a lossless dielectric medium is given by  $E(t) = E_{x0} \cos(\omega t - \beta z) \mathbf{u}_x$ , where  $E_{x0} = 150 \text{ V/m}$ ,  $\omega = 2\pi \times 10^8 \text{ rad/s}$ ,  $\beta = 4\pi/3 \text{ rad/m}$ . Find the instantaneous Poynting vector.
- Q5** Describe the impedance matching methods (8 x 2)
- a) By the use of a transformer
- b) By the use of a quarter wave Line
- Q6** With neat sketch, write the working principles of (8 x 2)
- a) Yagi-Uda Antenna and
- b) Parabolic reflector antenna

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Total Number of Pages: 02

Course: B.Tech  
Sub\_Code: RME4C002

4<sup>th</sup> Semester Back Examination: 2025-26  
SUBJECT: ENGINEERING THERMODYNAMICS  
BRANCH(S): MECH, MMEAM  
Time: 3 Hours  
Max Marks: 100  
Q.Code: V431

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.  
Steam tables may be permitted to the candidates during the examination.

**Part-I**

**Q1 Answer the following questions: (2 x 10)**

- Define specific entropy. Mention its physical significance.
- State Kelvin–Planck statement of the Second Law.
- What is meant by quality of energy?
- What is Helmholtz free energy?
- What are the limitations of Carnot vapour cycle?
- Name the components of a Rankine cycle power plant.
- Name the thermodynamic cycles used in petrol and diesel engines.
- What is reversed Carnot cycle?
- Define indicated power.
- Define mean effective pressure.

**Part-II**

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

- Explain the First Law of Thermodynamics for closed and open systems. Discuss the limitations of the First Law of Thermodynamics.
- Derive the steady flow energy equation for a control volume.
- A heat pump is used to heat the house in the winter. A house requires 80 kJ/s heat for heating in winter which is delivered by heat pump from outside air. Work required to operate the heat pump is 10 kW. Calculate COP of heat pump and heat abstracted from the outside.
- Highlight the concept of available and unavailable energy. Explain availability analysis for flow processes.
- Explain TdS relations and their applications in thermodynamics.
- 5 kg of air at 550 K and 4 bar is enclosed in a closed system. (i) Determine the availability of the system if the surrounding pressure and temperature are 1 bar and 290 K respectively. (ii) If the air is cooled at constant pressure to the atmospheric temperature, determine the availability.

- g) Explain the Rankine cycle with schematic diagram and T-s diagram. Derive the thermal efficiency expression for Rankine cycle.
- h) Explain the reheat Rankine cycle with neat diagram. Discuss its advantages and disadvantages in steam power plants.
- i) Explain Brayton cycle with P-V and T-S diagrams.
- j) A Brayton cycle uses reheating between two turbine stages. If turbine work increases from 400 kJ/kg to 520 kJ/kg, determine percentage improvement.
- k) Explain the limitations of single stage compression. Discuss the advantages of multistage compression.
- l) Explain the effect of pressure ratio on compressor work.

### Part-III

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

- Q3** a) In an air compressor air enters at a 5 m/s, 1 bar, 0.5 m<sup>3</sup>/kg. The exit conditions 10 m/s, 6 bar, 0.12 m<sup>3</sup>/kg. The internal energy of air is gained after compression process is 40 kJ/kg. The system losses 4000 kJ/min of heat to surroundings during process. Mass flow rate of air is 30 kg/min. Calculate (i) shaft work input, (ii) ratio of inlet to outlet areas. (8 + 8)
- b) A fluid undergoes a reversible adiabatic compression from pressure 1 MPa and volume 0.3 m<sup>3</sup> to volume 0.05 m<sup>3</sup>, according to the law of  $pV^{1.3} = \text{Constant}$ . Determine (i) Work done, (ii) heat transfer, (iii) change in internal energy, (iv) change of enthalpy, and (v) change of entropy.
- Q4** a) A system at 500 K receives 2200 kJ/s heat from a source at 1200 K. The temperature of heat sink is 300 K. The temperature of both the system and source remain constant during heat transfer. Calculate: (i) Net change of Entropy (ii) Available energy of heat source and system, and (iii) decrease in available energy after heat transfer. (8 + 8)
- b) Air expands in a turbine from 6 bar, 550 °C to 1 bar, 305 °C. In expansion process 12 kJ/kg of heat is rejected to the surroundings at 1 bar, 20 °C. Assume that change of K.E. and P.E. negligible,  $C_p = 1.005 \text{ kJ/kg K}$ . Determine per kg of air (i) decrease in availability, (ii) irreversibility in process, and (iii) effectiveness of process.
- Q5** a) A Rankine cycle operates between boiler pressure of 30 bar and condenser pressure of 0.1 bar. Steam enters turbine at 350 °C. Determine: (i) Turbine work, (ii) Pump work, and (iii) Thermal efficiency. (8 + 8)
- b) Explain the significance of combined cycle power generation in modern energy systems.
- Q6** a) Discuss the effects of subcooling and superheating in VCR systems. (8 + 8)
- b) Explain the reciprocating compressor cycle neglecting clearance volume using P-V diagram. Discuss the effect of clearance volume on compressor performance.

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Total Number of Pages: 02

Course: B.Tech

Sub\_Code: RAU4G001/RCI4G001/RME4C003

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: Introduction to Physical Metallurgy and Engineering Materials

BRANCH(S): AUTO, CIVIL, MECH, MMEAM

Time: 3 Hours

Max Marks: 100

Q.Code: V579

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)**

- Draw [110] direction and (111) plane in a cubic crystal system.
- What is Burger's vector?
- Define Gibbs phase rule.
- What is the difference between annealing and normalizing.
- What do you mean by slip and twin?
- What is a Metal Matrix Composite?
- What is the curie temperature?
- Write two differences between thermosetting and thermoplastics.
- Give two examples of composite materials.
- What is cold working?

**Part-II**

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

- What is a laser? Explain the principle of laser operation and its applications in engineering.
- Explain the eutectic system in phase diagrams. Describe the eutectic reaction and illustrate with an example, mentioning key points such as eutectic composition, eutectic temperature and the phases involved.
- Explain the key phase transformation in the iron-carbon system, including the eutectoid reaction. Describe the formation of phases like ferrite, austenite, and cementite during cooling.
- For a 0.35 wt% C plain carbon steel at a temperature just below the eutectoid temperature determine:
  - Fraction of total ferrite and cementite phase.
  - Fraction of the pro-eutectoid ferrite and pearlite.
  - Fraction of eutectoid ferrite.
- State and explain the Hume-Rothery rules for the formation of substitutional solid solution.

- f) Explain the concept of plastic deformation in metals. Discuss the role of dislocation theory and define Critical Resolved Shear Stress.
- g) What is the yield point phenomenon? Explain upper and lower yield points and Lüders bands formation.
- h) Describe the process of annealing. Explain the stages: recovery, recrystallization, and grain growth with their effects on properties.
- i) Explain the properties of composite materials and discuss the advantages of metal matrix composites (MMC) over conventional materials.
- j) Explain the concept of a binary phase diagram. Describe the significance of the liquidus line, solidus line, and solvus line with the help of a simple binary phase diagram sketch.
- k) Describe different types of bonding in solids with suitable examples.
- l) Calculate the packing density of a face center cubic structure and explain its significance.

### Part-III

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

- |           |                                                                                                                                                                                                      |             |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Q3</b> | Classify different types of cast iron. Explain their microstructures, properties, and typical applications.                                                                                          | <b>(16)</b> |
| <b>Q4</b> | With the help of the iron–cementite phase diagram, explain the formation of different microstructures in steels and cast irons. Relate the microstructure to mechanical properties and applications. | <b>(16)</b> |
| <b>Q5</b> | Explain the Time–Temperature–Transformation (TTT) diagram for steel. Describe the formation of pearlite, bainite, and martensite with the help of the diagram.                                       | <b>(16)</b> |
| <b>Q6</b> | Explain the optical properties of materials. Discuss scattering, refraction, and absorption. Derive the laws governing refraction and explain the atomic theory of optical properties.               | <b>(16)</b> |

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Total Number of Pages: 02

Course: B.Tech

Sub\_Code: RAU4C001 / RME4C001

4<sup>th</sup> Semester Back Examination: 2025-26

**SUBJECT: KINEMATICS & DYNAMICS OF MACHINES**

**BRANCH(S): AUTO, MECH, MMEAM**

**Time: 3 Hours**

**Max Marks: 100**

**Q.Code: V651**

**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)**

- What is the significance of degrees of freedom of a kinematic chain when it functions as a mechanism? Give examples.
- Explain Grubler's criterion for determining degree of freedom for mechanisms.
- Write down the classification of gears according to the position of axes of the shafts.
- What is the purpose of using idle gears.
- Define 'inertia force' and 'inertia torque'.
- Find out the maximum efficiency of a square threaded screw moving in a nut.
- Write down the different types of materials used for belts.
- Write down the expression showing ratio of driving tensions in flat belt drive.
- Distinguish between brakes and dynamometers.
- Define circular pitch and diametral pitch.

**Part-II**

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

**(6 x 8)**

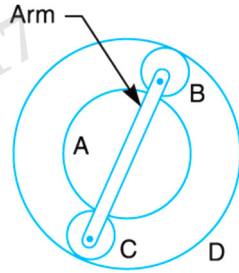
- Derive an expression for the friction moment for a flat collar bearing in terms of the inner radius  $R_1$ , outer radius  $R_2$ , axial thrust  $W$ , and coefficient of friction  $\mu$ . Assume uniform intensity of pressure.
- Sketch and explain any one inversion of a double slider crank chain.
- Explain equivalent dynamic system.
- Derive an expression showing minimum number of teeth required on the pinion to avoid interference.
- With the help of a neat sketch explain the working of an epicyclic gear train and derive velocity ratio by tabular method.
- What is meant by the expression 'friction circle'? Deduce an expression for the radius of friction circle in terms of the radius of the journal and the angle of friction.
- It is stated that the speed at which a belt or rope should be run to transmit maximum power is that at which the maximum allowable tension is three times the centrifugal tension in the belt or rope at that speed. Prove the statement.
- Obtain an expression for the length of a belt in an open belt drive.
- Write down the characteristics of materials used for brake lining.
- With a neat sketch, describe a simple band brake.
- Describe the construction and operation of a prony brake absorption dynamometer.
- Write short notes on Coriolis acceleration component.

### Part-III

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

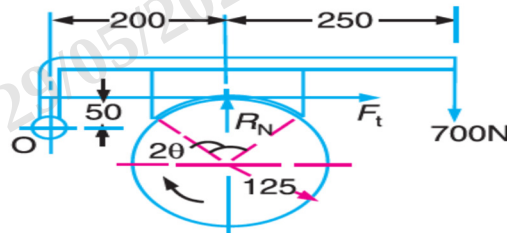
**Q3** Derive velocity and acceleration of the slider or piston of a single slider crank chain analytically. Also derive angular velocity and acceleration of the connecting rod. (16)

**Q4** An epicyclic train of gears is arranged as shown in figure. How many revolutions does the arm, to which the pinions B and C are attached, make:  
a) when A makes one revolution clockwise and D makes half a revolution anticlockwise, and  
b) when A makes one revolution clockwise and D is stationary?  
The number of teeth on the gears A and D are 40 and 90 respectively. (16)



**Q5 a)** Determine the width of a 9.75 mm thick leather belt required to transmit 15 kW from a motor running at 900 r.p.m. The diameter of the driving pulley of the motor is 300 mm. The driven pulley runs at 300 r.p.m. and the distance between the centre of two pulleys is 3 metres. The density of the leather is 1000 kg/m<sup>3</sup>. The maximum allowable stress in the leather is 2.5 MPa. The coefficient of friction between the leather and pulley is 0.3. Assume open belt drive and neglect the sag and slip of the belt. (10)

**b)** A single block brake is shown in below figure. The diameter of the drum is 250 mm and the angle of contact is 90°. If the operating force of 700 N is applied at the end of a lever and the coefficient of friction between the drum and the lining is 0.35, determine the torque that may be transmitted by the block brake. (6)



All dimensions in mm.

**Q6 a)** A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact, and the contact ratio. (8)

**b)** A conical friction clutch is used to transmit 90 kW at 1500 r.p.m. The semicone angle is 20° and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 375 mm and the intensity of normal pressure is not to exceed 0.25 N/mm<sup>2</sup>, find the dimensions of the conical bearing surface and the axial load required. (8)

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Total Number of Pages: 02

Course: B.Tech

Sub\_Code: REI4D002/REC4D002/REE4C003/REL4C003

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: POWER ELECTRONICS

BRANCH(S): AEIE, ECE, ETC, EEE, ELECTRICAL

Time: 3 Hours

Max Marks: 100

Q.Code: V586

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.
- Define Input power factor.
- Define input current harmonic factor.
- 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 thyristor gate characteristics 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 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  $45^\circ$  and  $90^\circ$ , 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.

- g) 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  $E = 120 \text{ V}$ , (b) 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  $0.5 \Omega$ . 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 =  $10 \Omega$ . 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 the principle of operation of three-phase bridge inverter using 180-degree conduction mode and derive all the line to neutral and line to line voltage with neat sketch diagram. **(16)**
- Q5** Explain with neat sketch diagram the operation of dc-dc *buck* converter and analyses its waveform at steady state condition. Derive average voltage, duty ratio control and output voltage. **(16)**
- Q6** Explain with neat sketch diagram the operation of dc-dc *boost* converter and analyses its waveform at steady state condition. Derive average voltage, duty ratio control and output voltage. **(16)**

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Total Number of Pages: 02

Course: B.Tech  
Sub\_Code: RCI4C003

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: Structural analysis - I

BRANCH(S): CIVIL

Time: 3 Hours

Max Marks: 100

Q.Code: V742

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)**

- Draw neat sketch of a two span continuous beam.
- Explain the term "compatibility requirements of structures".
- Draw neat sketch of a propped cantilever beam.
- Name the methods for analysis of pin jointed plane trusses.
- State the uses of influence lines.
- Draw a neat sketch of Suspension cable with three hinged stiffening girders.
- Mention the basic difference between space truss and plane truss.
- State Castigliano's theorem for finding deflection of a structure.
- Write the principle of consistent deformation method.
- State the constraints in application of Strain energy method.

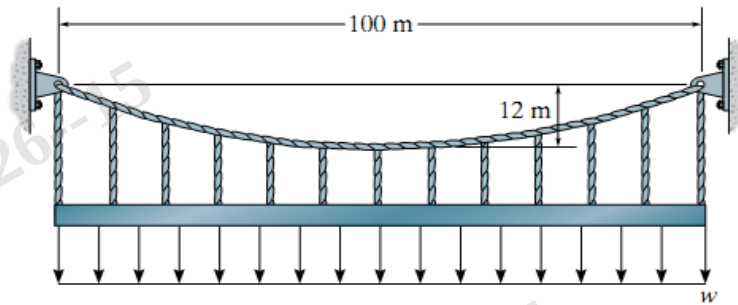
**Part-II**

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

**(6 x 8)**

- A simply supported beam (AB) has a span of 10 m. A uniformly distributed load of intensity 30 kN/m and having length 5 m crosses the beam from left to right. Determine maximum shear force at a section 3 m from left end (A) using influence line diagram.
- Write short note on maximum bending moment envelope.
- A simply supported girder has a span of 12 m. A 100 kN wheel load moves from one end to the other end on the span of girder. Find maximum bending moment which can occur at a section 3 m from the left end
- Derive the expression for maximum deflection of a simply supported beam loaded with uniformly distributed load throughout the span using Virtual work method.
- Derive the expression for maximum deflection of a simply supported beam loaded with a concentrated load at mid span using Castigliano's theorem.
- Derive the expression for maximum deflection of a cantilever beam with a concentrated load at its free end using strain energy method.
- Differentiate between determinate and indeterminate structures with examples.

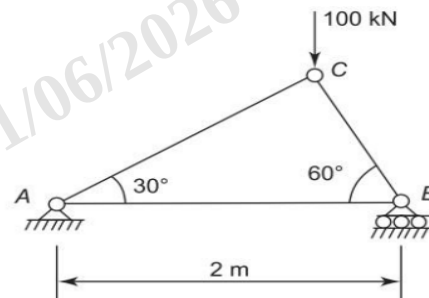
- h) Differentiate between force and displacement methods with examples.
- i) A three hinged parabolic arch of span " $L$ " and rise " $h$ " carries a uniformly distributed load of " $w$ " per unit over the whole span. Show that the arch is not subjected to any bending moment at any section.
- j) Provide short note on degree of static and kinematic indeterminacy in plane frame and continuous structures.
- k) Derive the expression for maximum slope and deflection of a simply supported beam loaded with a concentrated load at mid span using Conjugate beam method.
- l) The cable is subjected to a uniform loading of  $60 \text{ kN/m}$  as shown in figure. Determine the maximum and minimum tension in cable.



### Part-III

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

- Q3** Determine the end moments and draw shear force and bending moment diagram of a simply supported continuous beam ABC having span length lengths  $AB = 4 \text{ m}$  and  $BC = 5 \text{ m}$ . The span BC carries a point load of  $10 \text{ kN}$  at a distance of  $1 \text{ m}$  from support B and span AB carries a uniformly distributed load of intensity  $5 \text{ kN/m}$  throughout the span (AB). Use three moment theorem. All supports are simply supported. (16)
- Q4** A three hinged symmetric parabolic arch (ABC) having span  $40 \text{ m}$  and central rise  $10 \text{ m}$ . It carries a concentrated load of  $50 \text{ kN}$  and  $30 \text{ kN}$  at distance  $10 \text{ m}$  and  $15 \text{ m}$  from left support (A) respectively and a uniformly distributed load of intensity  $10 \text{ kN/m}$  over right half portion of the arch (CB). Determine the normal thrust and radial shear at a section  $10 \text{ m}$  from left end. Draw the bending moment diagram. (16)
- Q5** Determine the vertical and horizontal deflection components of joint C of the truss shown in figure. Given that young's modulus of elasticity of all members is  $200,000 \text{ MPa}$ . sectional area of each bar  $A = 100 \text{ mm}^2$ . (16)



- Q6** Draw the influence line diagram for horizontal thrust, bending moment, normal thrust, and radial shear at a point  $5 \text{ m}$  from left hand support of the arch. Given that the three hinged symmetric parabolic arch having span  $40 \text{ m}$  and central rise  $10 \text{ m}$ . (16)

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Total Number of Pages: 02

Course: B.Tech  
Sub\_Code: RCI4C001

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: Surveying

BRANCH(S): Civil

Time: 3 Hours

Max Marks: 100

Q.Code: V755

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 magnetic declination and its significance in compass surveying.
- Define the sensitivity of a bubble tube.
- What is a benchmark in levelling?
- What is the horizontal equivalent in contouring?
- What is a contour gradient?
- What is the difference between face-left and face-right observation?
- What is reciprocal levelling?
- What is electromagnetic distance measurement?
- Define spatial resolution in remote sensing.
- What is the working principle of a total station?

**Part-II**

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

- Write the procedures to continue a levelling work across a lake, across a high wall, and across a river.
- What is ranging? Explain the indirect ranging procedure with a neat sketch.
- Explain with a sketch the three-foot screw method for the temporary adjustment of a level.
- Compare the Rise and Fall method with the Height of Instrument method.
- Derive the expression for the combined correction for curvature and refraction in levelling.
- Describe the indirect method of locating contour using cross-sections.
- Explain how to measure horizontal angles using the repetition method using theodolite.
- What are the fundamental lines of theodolite? Explain their desired relationships.
- Explain how the nature of the ground and scale of the map affect the choice of contour interval for a map.
- Describe selective and non-selective scattering in remote sensing.

- k) Describe the elements of a remote sensing system with a neat sketch.  
 l) Briefly describe the applications of GIS.

### Part-III

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

**Q3** A 30 m long steel tape was standardized at 20 °C with a pull of 10 kg. A line was measured with this tape under a pull of 15 kg and at a mean field temperature of 38 °C and found to be 28 m long. The cross-sectional area of the tape = 0.03 cm<sup>2</sup>, total weight = 0.693 kg, coefficient of thermal expansion ( $\alpha$ ) = 11 × 10<sup>-6</sup> per °C and Young's modulus ( $E$ ) for steel = 2.1 × 10<sup>6</sup> kg/cm<sup>2</sup>. The tape was supported only at the ends of the measured line during measurement. Calculate the true length of the line after applying corrections for temperature, pull, and sag. **(16)**

**Q4** The following bearings were measured while using a prismatic compass. Determine the corrected bearings. **(16)**

| Line | Fore Bearing (FB) | Back Bearing (BB) |
|------|-------------------|-------------------|
| AB   | 40° 40'           | 221° 5'           |
| BC   | 91° 50'           | 272° 0'           |
| CD   | 24° 40'           | 204° 5'           |
| DE   | 320° 40'          | 140° 40'          |

**Q5** The following consecutive staff readings were taken with a dumpy level: 3.865, 3.345, 2.930, 1.950, 0.855, 3.795, 2.640, 1.540, 1.935, 0.865, 0.665 **(16)**  
 The instrument was shifted after the 5<sup>th</sup> and 8<sup>th</sup> readings. The first reading was taken on a benchmark having a reduced level (RL) of 150 m. Determine the reduced levels of all the points using the Rise and Fall Method.

**Q6** What are the characteristics of contour lines? Describe in detail with sketches. **(16)**

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Total Number of Pages: 02

Course: B.Tech  
Sub\_Code: RCI4C002

4<sup>th</sup> Semester Back Examination: 2025-26

SUBJECT: Transportation Engineering

BRANCH(S): CIVIL

Time: 3 Hours

Max Marks: 100

Q.Code: V663

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 are the advantage and disadvantages of minimum travel road pattern?
- b) Why overtaking zones are provided?
- c) Differentiate between NH and expressway.
- d) How extra widening is provided at horizontal curve with and without transition curve? Show in figure.
- e) What are the different types of Kerb? Mention their dimension.
- f) Define set-back distance.
- g) What is 98<sup>th</sup>, 85<sup>th</sup>, and 15<sup>th</sup> percentile speed?
- h) Define angularity number.
- i) Why tack coat and seal coat are provided?
- j) What are the different grades of modified type bitumen?

**Part-II**

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

- a) How the fund is being distributed for different schemes of roads development activities as per Central Road fund act 2000?
- b) What are the disadvantages of improper highway alignment? Discuss briefly the special care to be taken while aligning hill road.
- c) What are the salient features of second twenty years road plan?
- d) Derive an expression for finding overtaking sight distance.
- e) A valley curve is formed by descending gradient of 1 in 30 which meets an ascending gradient of 1 in 20. Design the total length of valley curve if the design speed is 22 m/sec so as to fulfill both comfort condition and head light sight distance. Allowable rate of change of centrifugal acceleration is  $0.6 \text{ m/sec}^3$ , beam angle is  $1^\circ$  and height of the head light above carriageway is 0.9 m. Assume any other data as per IRC.

- f) Design the length of transition curve for a two-lane two-way NH having design speed 65 Kmph and radius of circular curve is 350 m. Allowable rate of introduction of superelevation is 1 in 150. Pavement rotated about inner edge. Assume any other data as per IRC.
- g) Explain the impact test of aggregate used for road construction.
- h) Explain the relationship between speed, travel time, volume, density, and capacity.
- i) What are the factors affecting highway capacity? Explain different types of highway capacity.
- j) What are the various factors to be considered in pavement design?
- k) Briefly explain ESWL with a neat sketch.
- l) Differentiate between surface and sub surface drainage.

### Part-III

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

- |           |                                                                                                                          |             |
|-----------|--------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>Q3</b> | What are the various uses of speed and delay studies? Explain floating car and riding check method.                      | <b>(16)</b> |
| <b>Q4</b> | Discuss the major changes in design guideline as per IRC:37-2012 as compare to IRC;37-2001.                              | <b>(16)</b> |
| <b>Q5</b> | What are the types of surface course used for bituminous road? Briefly explain construction procedure for premix carpet. | <b>(16)</b> |
| <b>Q6</b> | Explain the various types of failures in flexible pavement. Suggest remedial measure.                                    | <b>(16)</b> |