

R23

II B.TECH I SEM

SUPPLEMENTARY

END EXAMINATION QUESTION PAPERS

MAY/JUNE 2025

**II B.Tech I Semester Supple. Examinations, May-2025**

**Sub Code: R23CC2101 DISCRETE MATHEMATICS & GRAPH THEORY**

Time: 3 hours

(CSE, IT, CSE(AIML), AI, AIML, DS, CYS)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

**PART-A: Answering all the questions from Part-A is compulsory (10 x 2M = 20M)**

Q.No	Questions	KL	CO	M
1	a Construct truth table for $P \wedge (P \leftrightarrow Q)$ ?	L3	1	2M
	b Define Tautology and give an example.	L1	1	2M
	c What is the principle of inclusion and exclusion?	L1	2	2M
	d What is Poset? And write the Properties of Poset.	L1	2	2M
	e What is Recurrence Relation? Give an example.	L1, L2	3	2M
	f What is the difference between Circular and Restricted Permutations?	L4	3	2M
	g What is Hamiltonian circuit? Give an example.	L1	4	2M
	h Define bipartite graph with an example.	L1	4	2M
	i Define Minimum Cost Spanning Tree(MST).	L1	5	2M
	j Find the number of edges in a plane graph (G) containing 4 regions.	L2, L3	5	2M

**PART-B: Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)**

Q.No	Questions	KL	CO	M	
2	<b>Unit-I</b>				
	a	i) Define PCNF? Obtain PCNF for the following $(\sim P \rightarrow R) \wedge (Q \leftrightarrow p)$ ?	L1, L3	1	5M
		ii) What is Conjunctive Normal Form ? Obtain a Conjunctive Normal Form of $P \wedge (P \rightarrow Q)$	L1, L3	1	5M
	OR				
	b	i) Write short note on the applicability of Inference Theory for Predicate Calculus.	L2	1	5M
		ii) Show that the following premises are inconsistent: $E \rightarrow S, S \rightarrow H, A \rightarrow H, \text{AND } E \wedge A$	L3	1	5M
3	<b>Unit-II</b>				
	a	i) What are the properties of an Equivalence Relation? Illustrate with a suitable example.	L2	2	5M
		ii) Draw a Hasse diagram representing the Partial order "a divides b" ( $a b$ ) on $S = \{2, 3, 4, 6, 8, 9, 12, 16\}$ .	L3	2	5M
	OR				
	b	i) Define transitive closure of relation R? What is the transitive closure in the relation $R = \{(a, b), (b, c), (c, a)\}$ ?	L1, L3	2	5M
ii) What are recursive functions? Write Short note on the essential characteristics of any recursive functions.		L1, L2	2	5M	

Unit-III					
4	a	i) Solve the recurrence relation of Fibonacci sequence of numbers $f_n = f_{n-1} + f_{n-2}$ for all $n \geq 2$ where initial conditions $f_0 = 0, f_1 = 1$	L3	3	5M
		ii) What do you understand by 'restricted permutation' and 'restricted combination'? Give an example to each.	L2	3	5M
	OR				
	b	i) State whether the following statement is TRUE or FALSE and also justify your answer: "Binomial Coefficient count combinations where as the Multinomial Coefficient count permutations"	L5	3	5M
	ii) Solve the recurrence relation $T(n) = T(n/2) + 1, T(1) = 1$	L3	3	5M	
Unit-IV					
5	a	i) Define Isomorphism? Write any four properties of Isomorphism.	L1	4	5M
		ii) Define Hamiltonian cycle? Identify any FOUR Hamiltonian cycles of Following undirected graph:	L1, L3	4	5M
	OR				
	b	i) What is Euler's Circuit? Write the rules of constructing Euler's circuit	L1	4	5M
	ii) Verify whether the following graph is isomorphic or not. And, Justify your answer.	L5	4	5M	
Unit-V					
6	a	i) Illustrate the procedure of Prime's algorithm to find the Minimum Cost Spanning Tree of a graph with an example.	L2	5	5M
		ii) Define Chromatic number of a graph and illustrate the process of finding the chromatic number of a graph by taking any example connected graph of 4 vertices.	L1, L3	5	5M
	OR				
	b	i) State and Explain Euler's theorem.	L2	5	5M
	ii) Write and explain Kruskal's algorithm.	L2	5	5M	

**II B.Tech I Semester Supple. Examinations, May-2025**

**R23**

Sub Code: R23CC2102

**UNIVERSAL HUMAN VALUES**

Time: 3 hours

(COMMON TO ALL BRANCHES)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

**PART-A**

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Human being as the Co-existence of the self and the body. Explain	K1	1	2M
	b	Explain the meaning of value education.	K2	1	2M
	c	Outline the Body as instrument.	K2	2	2M
	d	Explain the importance of Human values.	K1	2	2M
	e	Explain the term Harmony in family	K2	3	2M
	f	Present the individual responsibility to Society.	K1	3	2M
	g	Explain about value based life.	K2	4	2M
	h	Explain the needs of body	K1	4	2M
	i	Define Natural Acceptance	K1	5	2M
	j	Explain the concept of Humanistic Constitution.	K2	5	2M

**PART-B**

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M	
2	<b>Unit-I</b>					
	a	i) Examine the role of Education in Holistic Development.	K3	1	5M	
		ii) Write about the objectives of Value Education	K3	1	5M	
	<b>OR</b>					
	b	i) Classify the various methods used in Value Education	K3	1	5M	
		ii) Debate the contemporary issues in basic human aspirations.	K2	1	5M	
3	<b>Unit-II</b>					
	a	i) Illustrate the relationship between Self and Body.	K4	2	5M	
		ii) Differentiate between Self and Body	K3	2	5M	
	<b>OR</b>					
	b	i) Debate the right utilization of Body.	K2	2	5M	
		ii) Explain the relationship between Self and Body.	K4	2	5M	

Unit-III					
4	a	i) Discuss the importance of Trust in Relationship.	K2	3	5M
		ii) Outline the concept of Respect. Illustrate the respect as right evaluation.	K4	3	5M
	<b>OR</b>				
	b	i) Write a short note on Harmony in the Society.	K3	3	5M
ii) Examine the system to exploring Human Goal.		K3	3	5M	
Unit-IV					
5	a	i) Outline the nature and order (animal, bio & human).	K4	4	5M
		ii) Illustrate the four orders of nature.	K4	4	5M
	<b>OR</b>				
	b	i) Debate the holistic perception of harmony in existence.	K2	4	5M
ii) Outline the nature and existence.		K4	4	5M	
Unit-V					
6	a	i) Briefly outline the natural acceptance of Human Values.	K2	5	5M
		ii) Critically examine the holistic technologies.	K3	5	5M
	<b>OR</b>				
	b	i) Illustrate the Value based life and profession.	K4	5	5M
ii) Outline the contemporary issues in Professional Ethics.		K4	5	5M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Supple. Examinations, May-2025

Sub Code: R23CC2103

**DIGITAL LOGIC & COMPUTER ORGANIZATION**

Time: 3 hours

(CSE, IT,CS)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Perform the base conversion to the following decimal numbers: i) 15 → Binary Number ii) 78 → Octal Number	L3	1	2M
	b	Illustrate the difference between fixed point and floating point representation with an example?	L2	1	2M
	c	Define flip-flop and what is the storage capacity of one flip-flop?	L1	2	2M
	d	List the functional units of a digital computer.	L1	2	2M
	e	What is the use of Program Control?	L1	3	2M
	f	What is address sequencing and where it will be useful?	L1	3	2M
	g	What do you mean by memory mapped I/O ?	L1	4	2M
	h	What is the difference between Address space and Memory space?	L4	4	2M
	i	Define DMA and what is the state of CPU when bus grant is activated ?	L2	5	2M
	j	Define Interrupt and Mention any two types of Interrupts.	L1	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) What is K-map ? Illustrate the simplification procedure of 3-variable K-map with the help of an example.	L2	1	5M
		ii) Write the difference between signed binary number and unsigned binary number. Explain the process of binary number to decimal number conversion with an example.	L1, L3	1	5M
	OR				
	b	i) What are universal gates? Explain how basic gates can be realized using NAND and NOR gates?	L1, L2	1	5M
		ii) What is Multiplexer? Design 4 X 1 Multiplexer and briefly explain its functionality.	L1, L6	1	5M
3	Unit-II				
	a	i) What is the use of Binary Counter? Illustrate the application of Binary Counter with an example.	L2	2	5M
		ii) Draw the circuit diagram of an SR flip-flop and explain its operation with the help of a truth table.	L2	2	5M
	OR				
b	i) What are the characteristics of multiprocessor systems? Mention the factors that influences the performance of a multiprocessor system.	L2	2	5M	

		ii) What are the functions of Shift Register? Briefly explain the usage of Serial in- Serial out(SISO) Shift Register.	L2	2	5M
4	Unit-III				
	a	i) Write in detail about <i>micro programmed control</i> and the role of <i>control memory</i> in the execution of micro instruction	L2	3	5M
		ii) Illustrate the sequence of steps to be followed to multiply 15 and 9 using Booth's multiplication algorithm.	L2, L3	3	5M
	OR				
	b	i) Write a short note on the basic organization of micro-programmed control with neat diagram.	L1	3	5M
ii) Briefly explain various steps involved in the execution of a Complete Instruction by the processor.		L2	3	5M	
5	Unit-IV				
	a	i) What is ROM? How PROM , EPROM and EEPROM differ from each other?	L1, L4	4	10M
		OR			
	b	i) Distinguish between Associative mapping and Set- Associative mapping.	L4	4	5M
ii) What is Cache memory and why it is called as high speed memory? Briefly explain.		L1, L2	4	5M	
6	Unit-V				
	a	Explain how DMA enables direct transfer from I/O to memory using a block diagram	L2	5	5M
		ii) What is Bus? Explain the types of buses with neat diagram.	L2	5	5M
	OR				
	b	i) What is DMA? Write the advantages of DMA as compared to Interrupt driven I/O.	L2, L4	5	5M
ii) What is an Interrupt? Explain Interrupt Cycle in brief.		L2	5	5M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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Sub Code: R23CC2104

**R23**

## II B.Tech I Semester Supple. Examinations, May-2025

### Advanced Data Structures & Algorithm Analysis

Time: 3 hours

(Branch: Common to all Branches)

Max. Marks: 70

Note: Question paper consists of Two parts (Part-A and Part-B)

#### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M=20M)

Q.No	Questions	KL	CO	Marks
1	a) Describe & Define any three Asymptotic Notations.	K2	1	2M
	b) Define Time and Space complexity of Algorithm?	K2	1	2M
	c) Write advantages and disadvantages of Divide and Conquer approach.	K1	2	2M
	d) Define Graph. Mention various representations of a graph.	K3	2	2M
	e) Compare Greedy method Vs Dynamic Programming.	K3	3	2M
	f) State the Job Sequencing with Deadline Problem.	K1	3	2M
	g) What is the time complexity for Travelling Salesperson Problem?	K1	4	2M
	h) Define Chromatic number & Give the state space tree for 4 – coloring problem.	K1	4	2M
	i) Compare NP Hard and NP Complete Problems.	K1	5	2M
	j) State Clique Decision Problem.	K1	5	2M

Answer either 'a' or 'b' from each question of **PART-B** (5x10M=50M)

Q. No	Question	KL	CO	Marks
2	<b>a</b> Define Algorithm. Explain characteristics of an efficient Algorithm.	K2	1	5
	Explain various Asymptotic Notations with an example each.	K3	1	5
	(Or)			
	<b>b</b> What do you mean by height of an AVL tree and explain about double rotations with an example.	K3	1	5
	Define Max Heap? Construct a Max Heap on the sequence 10,20,30,40,50,60,70,80. Perform 2 deletion operations on it.	K4	1	5
3	<b>a</b> Define Graph. Explain different Graph traversal techniques with an example.	K2	2	10
	(Or)			
	<b>b</b> Show the result of running Quick Sort technique on the sequence 38,27,43,3,9,82,10	K3	2	5

		Derive the Best, Worst and Average time complexities of Merge sorting technique.	K3	2	5
4	a	Write an Algorithm for All-Pair shortest path Algorithm. Mention worst case time complexity of it.	K3	3	5
		Solve the following instance of 0/1 Knapsack problem using Dynamic programming. $n = 3$ ; $(W_1, W_2, W_3) = (3, 5, 7)$ ; $(P_1, P_2, P_3) = (3, 7, 12)$ ; $M = 4$ .	K3	3	5
	(Or)				
	b	What is the solution generated by function Job sequencing algorithm when $n=6$ $(p_1, p_2 \dots p_6) = (3, 5, 20, 18, 1, 6)$ and $(d_1, d_2 \dots d_6) = (1, 3, 4, 3, 2, 1)$ .	K3	3	5
What is Minimal Spanning tree? Explain Prim's algorithm to find Minimal Spanning Tree with an Example.		K3	3	5	
5	a	Explain the general method of backtracking. Mention few applications of Backtracking,	K2	4	5
		Given an array $arr[]$ consisting of $N$ integers and an integer $K$ , Write an algorithm find the length of the longest sub-set with a sum equal to $K$ .	K3	4	5
(Or)					
	b	You are given a set of $N$ items, each with a weight and a profit. You are also given a knapsack with a capacity $W$ . Write a function to determine the maximum value you can achieve by including some of the items without exceeding the capacity using Dynamic programming approach Input: $N=3$ , weights = $[1, 2, 3]$ , Profits = $[60, 100, 120]$ , $W = 5$ .	K3	4	7
		Compare Backtracking approach Vs Branch and Bound approach,	K3	4	3
6	a	Compare P Vs NP problems.	K3	5	5
		State and Explain the Traveling Salesperson Decision Problem. Mention its time complexity.	K3	5	5
	(Or)				
	b	Write few difference between NP Hard and NP Complete Problems. Mention few classic examples of NP-Complete problems.	K3	5	5
Can a problem be NP-Hard but not NP-Complete? Explain with an example.		K3	5	5	



# NARA SARA OPETA ENGINEERING COLLEGE

(AUTONOMOUS)

## II B.Tech I Semester Supple. Examinations, May-2025

Sub Code: R23CC2105

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Time: 3 hours

(CSE, IT, CSE(AIML), AI, AIML, DS, CYS)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Tabulate the difference between C++ and Java.	2	1	2M
	b	Give one example program to show the purpose of Ternary Operator.	1	1	2M
	c	Differentiate Constructor and method.	1	2	2M
	d	What is a local variable and scope of a variable?	1	2	2M
	e	Initialize 2-d array with random values between 0 and 99.	2	3	2M
	f	Write the use of super keyword.	1	3	2M
	g	Differentiate between protected and default access specifiers.	1	4	2M
	h	Differentiate checked exceptions with unchecked exceptions	1	4	2M
	i	How to create a file in java with example.	1	5	2M
	j	What are Daemon Threads?	1	5	2M

### PART-B.

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
1	Unit-I				
	a	i) Define Data Type? Give the declaration of variable in Java.	1	1	5M
		ii) Create a java program to print the biggest of 3 numbers.	2	1	5M
	OR				
	b	i) List out the looping statements available in Java. Explain with example.	2	1	5M
ii) What is y after the following switch statement is executed? Rewrite the code using an if-else statement. <code>x = 3; y = 3;</code> <code>switch (x + 3) {</code> <code>case 6: y = 1;</code> <code>default: y += 1; }</code>		3	1	5M	
2	Unit-II				
	a	i) What is a constructor in JAVA? How many types of constructors are there in JAVA? Explain with examples.	2	2	5M
		ii) Explain constructor overloading with suitable example.	2	2	5M
	OR				
	b	i) Explain Method overloading and Method overriding.	2	2	5M
ii) Write a method for computing first n terms of Fibonacci sequence.		3	2	5M	

		Unit-III			
4	a	Explain different types of inheritance with example .	2	3	10M
	OR				
	b	i) What is an Interface in JAVA? Explain how do interfaces support polymorphism?	2	3	5M
		ii) Write a JAVA program to create a super class called figure that stores the dimensions of a two- dimensional object. It also defines a method called area () that computes the area of an object. The program derives two sub classes from figure. The first is rectangle and the second is Triangle. Each of these subclasses overrides area (), so that it returns the area of a rectangle and a triangle respectively.	3	3	5M
		Unit-IV			
5	a	i) What is package? What are the requirements of it? What we can achieve using package?	2	4	5M
		ii) What are the wrapper classes? Explain the use of any one wrapper class.	2	4	5M
	OR				
	b	i) Explain about Nested try statements with an example.	2	4	5M
ii) Write a java program to create own exception for Negative Value Exception if the user enter negative value.		3	4	5M	
		Unit-V			
6	a	i) Explain the Reader and Writer classes along with some of its methods.	2	5	10M
	OR				
	b	i) What is runnable interface? How can you use this interface in creating thread?	2	5	5M
ii) What is Multithreading? Illustrate the ways to create multiple threads in java.		2	5	5M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

## II B.Tech I Semester Supple. Examinations, May-2025

**R23**

Sub Code: R23CC2106

**ARTIFICIAL INTELLIGENCE**

Time: 3 hours

(CSE(AIML), AI, AIML)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No	Questions	KL	CO	M
1	a) What is the role of rationality in AI?	K2	1	2M
	b) What is a problem-solving agent in AI?	K4	1	2M
	c) What is the difference between informed and uninformed search strategies?	K2	2	2M
	d) Define A* algorithm	K2	2	2M
	e) What is logic programming in AI?	K2	3	2M
	f) What is the difference between propositional and predicate logic?	K2	3	2M
	g) Explain the concept of decision trees in learning from observations.	K2	4	2M
	h) What is Explanation-Based Learning (EBL) in AI?	K2	4	2M
	i) Define DART in the context of expert systems.	K3	5	2M
	j) What is an expert system shell?	K4	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No	Questions	KL	CO	M	
2	Unit-I				
	a	i) Apply the concept of rationality to a real-world AI application, such as an AI-based trading system.	K4	1	5M
		ii) Compare goal-based agents with utility-based agents in terms of decision-making and performance.	K3	1	5M
	OR				
	b	i) Design an intelligent agent for an automated customer service application, detailing its structure, environment, and problem-solving approach.	K2	1	5M
		ii) Define the history of AI intelligent agents	K2	1	5M
3	Unit-II				
	a	i) How can the AO algorithm be applied to decision-making in a task scheduling system? Provide a simple example.	K2	2	5M
		ii) Explain the concept of Breadth-First Search (BFS) and how it enhances search efficiency in tree traversal.	K4	2	5M
	OR				
	b	i) Design an evaluation function for a basic board game like Connect Four, and explain how it guides the game's decision-making process.	K2	2	5M
		ii) Discuss the advantages and limitations of alpha-beta pruning in adversarial search. How does it optimize the minimax algorithm's performance in turn-based strategy games?	K2	2	5M

4	Unit-III				
	a	i) Discuss the role of rule-based systems in knowledge representation and how rule-based deduction supports reasoning in AI.	K2	3	5M
		ii) Evaluate the advantages and limitations of using semantic nets, frames, and inheritance for representing knowledge in AI systems.	K2	3	5M
	OR				
	b	i) Explain how predicate logic and logic programming contribute to formal reasoning and problem-solving in AI applications.	K2	3	5M
		ii) Evaluate the effectiveness of semantic networks and frames in representing hierarchical and relational structures in AI systems.	K2	3	5M
5	Unit-IV				
	a	i) Compare the representation power of First-Order Logic and Propositional Logic with examples.	K2	4	5M
		ii) Explain the construction and working of decision trees in machine learning.	K4	4	5M
	OR				
	b	i) Define the key components of Reinforcement Learning and explain their roles.	K2	4	5M
		ii) How does unification support inference in First-Order Logic?	K2	4	5M
6	Unit-V				
	a	i) Discuss the key components of the architecture of expert systems and how they support decision-making.	K2	5	5M
		ii) Analyze how MYCIN, DART, and XCON have influenced the development of expert systems and real-world applications.	K2	5	5M
	OR				
	b	i) Compare expert system shells with fully developed expert systems, highlighting their features and applications.	K2	5	5M
		ii) Explain the process of knowledge acquisition and the role of meta-knowledge in building expert systems.	K2	5	5M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Supple. Examinations, May-2025

R23

Sub Code: R23CE2101 NUMERICAL TECHNIQUES & STATISTICAL METHODS

Time: 3 hours

(CE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No	Questions	KL	CO	M
1	a Formulate the Newton Raphson iterative formula to find the root of an equation.	K3	1	2M
	b Explain the concept of Interpolation?	K3	1	2M
	c Write the Taylors series formula the term containing the fourth derivative.	K3	2	2M
	d Demonstrate the Runge-Kutta 2 <sup>nd</sup> order.	K3	2	2M
	e If $P(A) = \frac{3}{8}, P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{4}$ then compute $P(A^c \cap B^c)$ .	K3	3	2M
	f Solve variance of the distribution, if X has Binomial distribution with mean 25 and probability of success is 0.2	K3	3	2M
	g Compare the difference between Population Mean and Sample Mean?	K4	4	2M
	h Demonstrate central limit theorem.	K3	4	2M
	i Examine the concept of Level of Significance in hypothesis testing.	K4	5	2M
	j Analyze when to use a Chi-Square Test for Goodness of Fit versus a Chi-Square Test for Independence.	K4	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No	Questions	K L	CO	M								
2	Unit-I											
	a	i) Compute an approximate root of the equation $x \log_{10} x = 1.2$ by using Regula Falsi method.	K3	1	5M							
	a	ii) The function $y = \sin x$ is tabulated below <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">x</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;"><math>\frac{\pi}{4}</math></td> <td style="padding: 5px;"><math>\frac{\pi}{2}</math></td> </tr> <tr> <td style="padding: 5px;"><math>y = \sin x</math></td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">0.70711</td> <td style="padding: 5px;">1.0</td> </tr> </table> <p>Using Lagrange's interpolation formula, compute the value of <math>\sin\left(\frac{\pi}{6}\right)</math>.</p>	x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$y = \sin x$	0	0.70711	1.0	K3	1
x	0	$\frac{\pi}{4}$	$\frac{\pi}{2}$									
$y = \sin x$	0	0.70711	1.0									
OR												
b	i) Using Newton-Raphson method, compute a real root of $xe^x - \cos x = 0$	K3	1	5M								

	<p>ii) Using Newton's Forward Interpolation formula, compute the polynomial <math>y = \tan x</math> satisfying the following data. Hence evaluate <math>\tan(0.12)</math> and <math>\tan(0.28)</math></p> <table border="1"> <tr> <td>x</td> <td>0</td> <td>0.15</td> <td>0.20</td> <td>0.25</td> <td>0.30</td> </tr> <tr> <td>y</td> <td>0</td> <td>0.1511</td> <td>0.2027</td> <td>0.2533</td> <td>0.3093</td> </tr> </table>	x	0	0.15	0.20	0.25	0.30	y	0	0.1511	0.2027	0.2533	0.3093	K3	1	5M							
x	0	0.15	0.20	0.25	0.30																		
y	0	0.1511	0.2027	0.2533	0.3093																		
Unit-II																							
3	a	<p>i) Compute <math>\int_0^6 \frac{1}{1+x} dx</math>, by using (i) Trapezoidal rule (ii) Simpson's <math>\frac{1}{3}</math> rule (iii) Simpson's <math>\frac{3}{8}</math> rule.</p>	K3	2	5M																		
		<p>ii) Using Picard's method, Compute <math>y(0.1)</math> for the equation <math>\frac{dy}{dx} = \frac{y-x}{y+x}</math>, <math>y(0) = 1</math></p>	K3	2	5M																		
	OR																						
	b	<p>i) Use Runge-Kutta method of order four to compute <math>y</math> when <math>x = 0.6</math> in steps of 0.2 given that <math>y' = 1 + y^2</math>, <math>y(0)</math></p>	K3	2	10 M																		
Unit-III																							
4	a	<p>i) For the discrete probability distribution</p> <table border="1"> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> </tr> <tr> <td>f</td> <td>0</td> <td>k</td> <td>2k</td> <td>2k</td> <td>3k</td> <td>k<sup>2</sup></td> <td>2k<sup>2</sup></td> <td>7k<sup>2</sup>+k</td> </tr> </table> <p>Compute (i) k (ii) mean (iii) variance</p>	x	0	1	2	3	4	5	6	7	f	0	k	2k	2k	3k	k <sup>2</sup>	2k <sup>2</sup>	7k <sup>2</sup> +k	K3	3	5M
	x	0	1	2	3	4	5	6	7														
	f	0	k	2k	2k	3k	k <sup>2</sup>	2k <sup>2</sup>	7k <sup>2</sup> +k														
		<p>ii) In a bolt factory machines, A, B, C manufacture 20%, 30% and 50% of the total of their output and 6%, 3% and 2% are defective. A bolt is drawn at random and found to defective. Compute the probabilities that it is manufactured from (i) Machine A, (ii) Machine B, (iii) Machine C.</p>	K3	3	5M																		
OR																							
	b	<p>i) Ten coins are thrown simultaneously. Compute the probability of getting atleast (i) seven heads (ii) six heads</p>	K3	3	5M																		
		<p>ii) In a Normal distribution 7% of the items are under 35 and 89% are under 63. Determine the mean and variance of the distribution.</p>	K4	3	5M																		
Unit-IV																							
5	a	<p>i) Assuming that <math>\sigma = 20</math>, explain how large a random sample be taken to assert with probability 0.95 that the sample mean will not differ from the true mean by more than 3.0 points.</p>	K4	4	5M																		
		<p>ii) The mean and standard deviation of population are 11795 and 14054 respectively. If <math>n = 50</math>, find 95% confidence interval for the mean.</p>	K4	4	5M																		

	OR																																		
a	i) A random sample of 400 items is found to have mean 82 and S.D. of 18. Write the maximum error of estimation 95% confidence interval. Find the confidence limits for the mean if $\bar{x} = 82$ .										K6	4	5M																						
b	ii) Given random sample of 500 points on a heated plate with an average temperature of 73.54 degrees Fahrenheit with a standard deviation of 2.79 degree Fahrenheit, analyze how the sample size and standard deviation influence the width of the 99% confidence interval for the average temperature. Then calculate the confidence interval.										K4	4	5M																						
	Unit-V																																		
a	i) A sample of 900 members has a mean of 3.4 cms and S.D 2.61 cms. Is sample has been taken from a large population of mean 3.25 cm and S.D 2.61 cms. If the population is normal and its mean is unknown find the 95% fiducial limits of true mean.										K3	5	5M																						
a	ii) Experience had shown that 20% of a manufactured product is of the top quality. In one day's, production of 400 articles only 50 are of top quality. Using this data, test the hypothesis at 0.05 level.										K6	5	5M																						
	OR																																		
6	i) To examine the hypothesis that the husbands are more intelligent than the wives, an investigator took a sample of 10 couples and administered them a test which measures the I.Q. The results are as follows:										K3	5	5M																						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Husbands</td> <td>117</td> <td>105</td> <td>97</td> <td>105</td> <td>123</td> <td>109</td> <td>86</td> <td>78</td> <td>103</td> <td>107</td> </tr> <tr> <td>Wives</td> <td>105</td> <td>98</td> <td>87</td> <td>104</td> <td>116</td> <td>95</td> <td>90</td> <td>69</td> <td>108</td> <td>85</td> </tr> </table>										Husbands	117	105	97	105	123	109	86	78	103	107	Wives	105	98	87	104	116	95	90	69	108	85			
Husbands	117	105	97	105	123	109	86	78	103	107																									
Wives	105	98	87	104	116	95	90	69	108	85																									
b	Test the hypothesis with a reasonable test at the level of significance of 0.05																																		
	ii) A random sample of six steel beams has a mean compressive strength of 58,392 p.s.i (pounds per square inch) with a standard deviation of 648 p.s.i. Use this information and the level of significance $\alpha = 0.05$ to test whether the true average compressive strength of the steel from which this sample came is 58,000 p.s.i. Assume normality.										K3	5	5M																						

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

## II B.Tech I Semester Supple. Examinations, May-2025

Sub Code: R23CE2103

Time: 3 hours

**SURVEYING**

(CE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	What are the objectives of surveying?	K1	1	2M
	b	Define Dip and declination	K3	1	2M
	c	What is the definition of contour?	K1	2	2M
	d	Differentiate between backsight and foresight.	K2	2	2M
	e	Write the principles of Theodolite.	K3	3	2M
	f	Distinguish between line of collimation and line of sight	K3	3	2M
	g	Write the uses of curves	K2	4	2M
	h	Differentiate between simple curve and compound curve.	K2	4	2M
	i	Define Wave length	K1	5	2M
	j	Define vertical aerial photograph.	K1	5	2M

### PART-B: Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) Briefly explain the various accessories (any three) in chain surveying.	K1	1	5M
		ii) A 20 m chain and was found to be 10 cm to long after chaining a distance of 1500 m. It was founded to be 18 cm too long at the end of the day's work after chaining a total distance of 2900 m. Find the true distance if the chain was correct before the commencement of the work.	K3	1	5M
	OR				
	b	i) Tabulate the differences between surveyor compass and prismatic compass with appropriate sketches.	K2	1	5M
		ii) Calculate the sag correction for a 30 m steel under a pull of 100 N in three equal spans of 10 m each. Weight of one cubic meter of steel = 0.078N. Area of cross section of tape = 0.08sq.cm	K3	1	5M
3	Unit-II				
	a	i) Write the temporary adjustments of a leveling instrument.	K1	2	5M
		ii) In levelling between two points A and B on opposite sides of a river, the level was set up near A and the staff readings on A and B were 2.642 and 3.228m respectively. The level was then moved and set up near B, the respective staff readings on A and B were 1.086 and 1.664. Find the true difference level of A and B.	K2	2	5M

	OR																							
	b	i) Describe various methods of contouring with sketches. Discuss the merits and demerits of each.	K1	2	5M																			
	b	ii) The following perpendicular offsets were taken at 10 m intervals from a survey line to an irregular boundary line: 3.25, 5.60, 4.20, 6.65, 8.75, 6.20, 3.25, 4.20, 5.65. Calculate the area enclosed between the survey line, the irregular boundary line and the first and last offsets by Simpsons method.	K3	2	5M																			
	Unit-III																							
		i) What are the types of theodolites? Explain any one type in detail.	K2	3	5M																			
	a	ii) The following observations were made for a closed traverse round an obstacle. Due to obstructions length of lines DE and EA could not be measured. Find out the missing lengths.		3																				
4		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Line</th> <th style="width: 15%;">length</th> <th style="width: 15%;">Bearing</th> </tr> </thead> <tbody> <tr> <td>AB</td> <td>500</td> <td>98°30'</td> </tr> <tr> <td>BC</td> <td>620</td> <td>30° 20'</td> </tr> <tr> <td>CD</td> <td>468</td> <td>298° 30'</td> </tr> <tr> <td>DE</td> <td>?</td> <td>238° 00'</td> </tr> <tr> <td>EA</td> <td>?</td> <td>150° 10'</td> </tr> </tbody> </table>	Line	length	Bearing	AB	500	98°30'	BC	620	30° 20'	CD	468	298° 30'	DE	?	238° 00'	EA	?	150° 10'	K3		5M	
Line	length	Bearing																						
AB	500	98°30'																						
BC	620	30° 20'																						
CD	468	298° 30'																						
DE	?	238° 00'																						
EA	?	150° 10'																						
	OR																							
		i) How measurement of vertical angle is carried out in theodolite surveying?	K1	3	5M																			
	b	ii) A staff was held vertically at a distance of 90m from an external focusing theodolite and stadia reading taken with the line of sight horizontal are 1.158, 2.055m. If the focal length of objective glass was 20cm and distance from vertical axis was 10cm. calculate i) Stadia interval, ii) Multiplying constant.	K3	3	5M																			
	Unit-IV																							
	a	i) Compute the various elements of a simple curve if the intersection angle of a two-degree curve is 120°.	K2	4	5M																			
5		ii) What are the different types of horizontal curves? Explain how would you select the most suitable type for a particular site.	K2	4	5M																			
	OR																							
	b	i) What is Global positioning system (GPS)? Explain the role of GPS in modern surveying methods.	K2	4	5M																			
		ii) List out the modern surveying methods. Discuss the need for a total station and its advantages over other methods.	K1	4	5M																			
	Unit-V																							
	a	i) Explain the process of mapping by stereo plotting instruments.	K2	5	5M																			
		ii) Write a note on flight planning and stereoscopy	K1	5	5M																			
	OR																							
6	b	i) Explain the following: a) Terrestrial photogrammetry b) Aerial triangulation c) Mapping using stereo plotting instruments and d) Radial triangulation	K2	5	5M																			
		ii) Write about relief and tilt displacements.	K1	5	5M																			

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

## II B.Tech I Semester Supple. Examinations, May-2025

Sub Code: R23CE2104

STRENGTH OF MATERIALS

Time: 3 hours

(CE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Define modulus of rigidity	K1	1	2M
	b	What is meant by Poisson's ratio?	K1	1	2M
	c	Explain about point of contraflexure?	K2	2	2M
	d	Explain about types of loads?	K1	2	2M
	e	State the assumptions of simple bending	K1	3	2M
	f	What is bending stress?	K1	3	2M
	g	Write about shear stresses?	K3	4	2M
	h	Write section modulus formula for rectangular section.	K2	4	2M
	i	Explain about wire wound cylinders	K2	5	2M
	j	What are the stresses induced in thin cylinder?	K2	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
Unit-I					
2	a	i) Define the following : a) Bending Moment. b) Shear force.	K1	1	5M
		ii) A metal rod 20 mm diameter and 2 m long is subjected to a tensile force of 75 kN, it showed an elongation of 3 mm and reduction of diameter by 0.008 mm. Calculate the Poisson's ratio and three modules of elasticity	K2	1	5M
	OR				
	b	i) Derive the relationship between elastic constant Young's Modulus(E), Shear Modulus( G) and Poisson's ratio( $\mu$ ).	K2	1	5M
ii) Determine the change in length, breadth and thickness of steel bar 4m long, 30mm wide and 20mm thick, when subjected to an axial pull of 120 KN in the direction of its length. Take E=200Gpa and Poisson's ratio = 0.3.		K3	1	5M	
Unit-II					
3	a	i) Derive the relationship between Shear force and Bending moment.	K1	2	5M
		ii) A simply supported beam 6 m long is carrying a uniformly distributed load of 5 kN/m over a length of 3 m from the right end. Draw shear force and bending moment diagrams for the beam and also calculate the maximum bending moment on the beam.	K3	2	5M

		OR			
		i) Draw the SFD for a cantilever carrying Uniformly Varying Load on the whole span.	K2	2	5M
	b	ii) A cantilever beam of length 2m carries an uniformly distributed load of 3kN/m over a length of 1.5m from its fixed end and a point load 5 kN at its free end. Draw the shear force and bending moment diagrams.	K1	2	5M
		Unit-III			
		i) Write the assumptions of simple theory of bending.	K1	3	5M
	a	ii) A 280mmx 120mm I section beam is to be used as a cantilever of 3.6m length. Find the UDL which can be carried by the beam if the permissible stress is 125MPa, and $I = 75 \times 10^4 \text{ mm}^4$ .	K3	3	5M
		OR			
		i) Derive the simple bending equation?	K2	3	5M
	b	ii) A timber cantilever 200 mm wide and 300 mm deep is 3 m long. It is loaded with a U.D.L of 3kN/m over the entire length. A point load of 2.7 kN is placed at the free end of the cantilever. Find the maximum bending stress produced.	K3	3	5M
		Unit-IV			
		i) What are the limitations of the moment area method?	K1	4	5M
	a	ii) A beam 6m long, simply supported at its end, is carrying of 50 kN a point load at its centre. The moment of inertia of the beam (I) is given as $78 \times 10^6 \text{ mm}^4$ . If E for the material of the beam $2.1 \times 10^5 \text{ N/mm}^2$ . Calculate the deflection at the centre of the beam.	K2	4	5M
		OR			
		i) Write the steps involved in Macaulay's method?	K2	4	5M
	b	ii) A cantilever of uniform cross –section of length l carries two point loads W at the free end and 2W at a distance a from the free end. Find the maximum deflection due to this loading.	K3	4	5M
		Unit-V			
		i) State the assumptions involved in the analysis of thick cylinders.	K1	5	5M
	a	ii) A thin cylindrical vessel 2 m long and 400 mm in diameter with 10 mm thick plates is subjected to an internal pressure of 3 MPa. Calculate the maximum shear stress and the changes in dimensions of the vessel, if Young's modulus is 200 GPa and Poisson's ratio is 0.3 for the vessel material.	K3	5	5M
		OR			
		i) Write the assumptions made in Euler's theory.	K2	5	5M
	b	ii) A thick cylindrical pipe of internal radius 140-mm and external radius 180-mm is subjected to an internal pressure of 15MPa. Determine the hoop stress in the cross section. What is the percentage error if the maximum hoop stress is found from the equation for thin pipes?	K3	5	5M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

**II B.Tech I Semester Supple. Examinations, May-2025**

**R23**

**Sub Code: R23EE2101 NUMERICAL METHODS AND COMPLEX VARIABLES**

Time: 3 hours

(EEE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

**PART-A**

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Give the geometrical interpretation of the iterative process of the Newton-Raphson method for finding a real root of the equation.	1	1	2M
	b	Define the term interpolation.	1	1	2M
	c	Use trapezoidal rule to evaluate $\int_4^8 \frac{dx}{x}$ , using four equal sub intervals.	3	2	2M
	d	Given differential equation $\frac{dy}{dx} = x + 2y$ with $y(1) = 1$ , compute $y(1.1)$ correct to four decimal places using Euler's method by taking $h = 0.05$ .	3	2	2M
	e	Prove that $f(z) =  z ^2$ is differentiable only at origin and hence find the value of $f'(0)$ .	3	3	2M
	f	Evaluate $\oint_C \frac{\tan(z/2)}{(z-x_0)^2} dz$ , ( $-2 < x_0 < 2$ ), where $C$ denotes the positively oriented boundary of the square whose sides lie along the lines $x = \pm 2$ and $y = \pm 2$ .	3	3	2M
	g	Evaluate $\oint_C z e^{\frac{1}{z}} dz$ , where $C$ is the unit circle $ z  = 1$ .	3	4	2M
	h	Find the residue of $z^2 \sin\left(\frac{1}{z}\right)$ at $z = 0$ .	3	4	2M
	i	Find the fixed points of the mapping $w = \frac{5z+4}{z+5}$ .	3	5	2M
	j	When you say that a mapping $w = f(z)$ is conformal in a domain $D$ .	3	5	2M

**PART-B**

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) State the condition of convergence of the sequence of approximations of the iterative method. Find a real root of the equation $x - \sin x = \frac{1}{2}$ correct to four decimal places using iteration method.	3	1	5M
		ii) Using Lagrange's interpolation formula to find a cubic polynomial that fits the data $(-2, -12)$ , $(-1, -8)$ , $(2, 3)$ , and $(3, 5)$ .	3	1	5M
	OR				
b	i) Find a real root of the equation $x + \cot x = 0$ correct to four decimal places using Newton-Raphson method.	3	1	5M	
	ii) Find $f(0.23)$ and $f(0.29)$ from the following table by using appropriate interpolation formulae.	3	1	5M	

		x	0.20	0.22	0.24	0.26	0.28	0.30					
		f(x)	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139					
Unit-II													
3	a	i) Given differential equation $\frac{dy}{dx} = x^2 + y$ with $y(0) = 1$ , compute $y(0.02)$ correct to four decimal places using Taylor's method. Compare the computed value with exact solution									3	2	5M
		ii) Evaluate $\int_0^1 e^{-x^2} \sin x \, dx$ using Simpson's $\frac{1}{3}rd$ rule with $h = 0.1$ .									3	2	5M
	OR												
	b	Write an algorithm to implement the Runge-Kutta fourth-order formula to solve an initial problem. Using the algorithm find $y(0.1)$ , $y(0.2)$ , and $y(0.3)$ , given that $\frac{dy}{dx} = 1 + \frac{2xy}{1+x^2}$ , $y(0) = 0$ .									3	2	10M
Unit-III													
4	a	i) Consider the function $f: C \rightarrow C$ defined by $f(z) = \begin{cases} \frac{z^5}{z^4+5}, & \text{if } z \neq 0 \\ 0, & \text{if } z = 0 \end{cases}$ . Then prove that $f(z)$ satisfies Cauchy-Riemann equations at origin, but not differentiable at origin.									3	3	6M
		ii) Determine constant $a$ such that the function $u = e^{3x} \cos(ay)$ is harmonic and hence find its harmonic conjugate.									3	3	4M
	OR												
	b	i) Prove that $f(z) = z^{1/3}$ is analytic everywhere except at origin and hence find $f'(z)$ .									3	3	5M
ii) Evaluate $\oint_C (z - z_0)^n \, dz$ , where $n$ is the integer, $z_0$ is the constant, and $C$ is the circle of radius $r$ with center $z_0$ .									3	3	5M		
Unit-IV													
5	a	i) Determine the Laurent's series of the function $f(z) = \frac{z^2 - 4}{(z+1)(z+4)}$ , in the regions (1) $0 <  z  < 1$ (2) $1 <  z  < 4$ (3) $ z  > 4$ .									3	4	5M
		ii) Using residue theorem, Evaluate $\int_{-\infty}^{\infty} \frac{\cos x}{x^4 + 1} \, dx$ .									3	4	5M
	OR												
	b	i) Evaluate $\oint_C \frac{\cosh(\pi z)}{z(z^2+1)} \, dz$ , where $C$ is the circle $ z  = 2$ described in positive sense.									3	4	5M
ii) Evaluate $\int_0^{2\pi} \frac{d\theta}{5+4 \sin \theta}$ , using residue theorem.									3	4	5M		
Unit-V													
6	a	i) Under the transformation $w = \frac{1}{z}$ , find the image of $ z - 2i  = 2$ .									3	5	5M

	Show that the transformation $w = z + \frac{1}{z}$ converts the straight line $\arg z = \alpha \left( \alpha < \frac{\pi}{2} \right)$ into a branch of hyperbola of eccentricity $\sec \alpha$ .	3	5	5M
OR				
b	i) Find the bilinear transformation which maps the points $z = 0, -i, -1$ into the points $w = i, 1, 0$ . Find the image of the line $y = mx$ under this transformation, where $m$ is a constant.	3	5	5M
	ii) Show that the transformation $w = \frac{2z+3}{z-4}$ maps the circle $x^2 + y^2 - 4x = 0$ into the straight line $4u + 3 = 0$ .	3	5	5M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Supple. Examinations, May-2025

**R23**

Sub Code: R23EE2103

**ELECTROMAGNETIC FIELD THEORY**

Time: 3 hours

(EEE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	What is the concept of potential gradient.	K1	1	2M
	b	What are the properties of electric flux density?	K1	1	2M
	c	Define dielectric polarization.	K1	2	2M
	d	What is meant by relaxation time in dielectrics?	K1	2	2M
	e	Give the significance of Ampere's Circuital Law.	K1	3	2M
	f	Differentiate between scalar and vector potentials.	K1	3	2M
	g	What is the significance of Lorentz force equation?	K1	4	2M
	h	State the boundary conditions for magnetic fields.	K1	4	2M
	i	What is statically induced EMF?	K1	5	2M
	j	Define Poynting vector.	K1	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	<b>Unit-I</b>				
	a	i) Derive the expression for the electric field intensity due to a uniform surface charge distribution.	K3	1	5M
		ii) Explain the concept of work done in moving a point charge in an electrostatic field.	K2	1	5M
	<b>OR</b>				
	b	i) Discuss the applications of Gauss's law with examples.	K2	1	5M
		ii) Derive the expression for electric flux density for a line charge.	K3	1	5M
3	<b>Unit-II</b>				
	a	i) Explain the behaviour of conductors in an electric field.	K2	2	5M
		ii) Derive the expression for energy stored in a dielectric medium.	K3	2	5M
	<b>OR</b>				
	b	i) Derive the expression for capacitance of a parallel plate capacitor with multiple dielectrics.	K3	2	5M
		ii) Explain boundary conditions for dielectric-to-dielectric interfaces.	K2	2	5M

<b>Unit-III</b>					
4	a	i) Derive the expression for magnetic field intensity due to a rectangular current loop.	K3	3	5M
		ii) Explain the concept of magnetic torque on a current-carrying loop.	K2	3	5M
	<b>OR</b>				
	b	i) Discuss the force between two parallel current-carrying conductors.	K2	3	5M
ii) Derive the expression for the magnetic field due to a toroidal coil.		K3	3	5M	
<b>Unit-IV</b>					
5	a	i) Derive the expression for mutual inductance between two coaxial solenoids.	K3	4	5M
		ii) Explain the energy stored in a magnetic field using self-inductance.	K3	4	5M
	<b>OR</b>				
	b	i) Derive the expression for the inductance of a toroidal core.	K3	4	5M
ii) Explain the determination of mutual inductance between two circuits.		K3	4	5M	
<b>Unit-V</b>					
6	a	i) Discuss the modification of Maxwell's equations for time-varying fields.	K2	5	5M
		ii) Explain the physical significance of displacement current.	K3	5	5M
	<b>OR</b>				
	b	i) Derive the expression for the energy flow in an electromagnetic field using the Poynting theorem.	K3	5	5M
ii) Explain the concept of statically induced EMF with examples.		K3	5	5M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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**II B.Tech I Semester Supple. Examinations, May-2025**

**R23**

Sub Code: R23EE2104

**ELECTRICAL CIRCUIT ANALYSIS-II**

Time: 3 hours

(EEE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

**PART-A**

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No	Questions	KL	CO	M
1	a) What is the importance of phase sequence in three phase systems?	2	1	2M
	b) Write the current and voltage relations of three phase delta circuit?	2	1	2M
	c) What is the importance of complex S-plane in Laplace transforms?	1	2	2M
	d) Write the objectives of transient analysis?	2	2	2M
	e) Write the basic equations and conditions to derive impedance parameters?	2	3	2M
	f) Write the basic equations and conditions to derive transmission parameters?	1	3	2M
	g) Write short notes on the Fourier coefficients?	1	4	2M
	h) Write the basic features of periodic excitation?	2	4	2M
	i) Write the properties of band elimination filter?	1	5	2M
	j) Brief the characteristic features of high pass filters?	2	5	2M

**PART-B**

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No	Questions	KL	CO	M	
2	Unit-I				
	a	i) Draw the circuit diagram and explain the two watt meter method for three phase power measurement?	2	1	5M
		ii) Each phase of a balanced three phase delta connected load has a 0.3 henry inductor in series with a parallel combination of a 7.7 micro farad capacitor and 97.2 ohms resistance. If a 3 phase voltage of 212 volts at a frequency of 348 rad/sec is applied to this load, determine the phase current, line current and the total power absorbed by the load?	3	1	5M
	OR				
	b	i) A balanced three phase inductive load is connected to a balanced three phase power system. The line voltage is 418V and the line current is 11.7A. The angle of the phase impedance of the load is 65°. Calculate the complex power and the real power absorbed by the load?	3	1	5M
ii) A balanced delta connected three phase load absorbs a complex power of 112 kVA with a lagging power factor of 0.7 when the r.m.s line to line voltage is 212.5V. Find the impedance of each arm of the delta connected load?		3	1	5M	

		Unit-II			
3	a	i) Explain in detail about the Laplace transforms of standard functions?	2	2	5M
		ii) Draw the circuit diagram and analyze the transient response of R-C parallel circuit with D.C excitation?	3	2	5M
	OR				
	b	i) State and prove shifting theorem with relevant to Laplace transforms?	4	2	5M
ii) Draw the circuit diagram and analyze the transient response of R-L series circuit with D.C excitation?		3	2	5M	
		Unit-III			
4	a	i) Analyze the conditions for reciprocity and symmetry of parameters of two port network?	3	3	5M
		ii) Derive the hybrid parameters of two port network with necessary equations?	3	3	5M
	OR				
b	i) A two port network has the following open circuit impedance parameters: $Z_{11}=-j114.8$ , $Z_{12}=-j158.2$ , $Z_{21}=-j158.2$ , $Z_{22}=-j78$ . Determine the short circuit admittance parameters?	3	3	10 M	
		Unit-IV			
5	a	i) Describe the basic properties of trigonometric Fourier series with periodic waveforms?	2	4	5M
		ii) Determine the Fourier transform of a unit step function $u_1(t)$ ?	3	4	5M
	OR				
	b	i) Describe the basic properties of complex Fourier series with periodic waveforms?	2	4	5M
ii) Determine the Fourier transform of $f(t)=\cos\omega_0 t$ ?		3	4	5M	
		Unit-V			
6	a	i) Explain about the basic tie set schedule with an example?	2	5	5M
		ii) A T section low pass filter has an inductance of 32.5mH in each of the series arms and a shunt arm capacitance of 0.32 micro farads. Determine the cut off frequency, characteristic impedance, ratio of input and output voltages and the phase shift at 1.2 KHz and 5.6 KHz?	3	5	5M
	OR				
	b	i) Explain about the basic cut set schedule with an example?	2	5	5M
ii) A proto type high pass filter has a cut off frequency of 8.6 KHz and nominal impedance of 616 ohms. Find the values of inductance and capacitance used in the filter?		3	5	5M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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**PART-A**

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Explain the principle of operation of DC Machine	1	1	2M
	b	What is the significance of back-emf?	1	1	2M
	c	Compare 3-point and 4-point starter	1	2	2M
	d	Draw the performance characteristics of DC Shunt and Series motor.	1	2	2M
	e	Define voltage regulation of transformer	1	3	2M
	f	What is all-day efficiency of a transformer?	1	3	2M
	g	Why short circuit test is usually carried out on the high-voltage side of the transformer?	1	4	2M
	h	Compare auto-transformer with two-winding transformer	1	4	2M
	i	What are the advantages and disadvantages of Y – Y connection of 3-phase transformer?	1	5	2M
	j	What are the points which favour the use of open-delta connections?	1	5	2M

**PART-B**

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) Explain the effect of armature field produced by the armature current carrying conductors on the main magnetic field	2	1	5M
		ii) A 4-pole, DC machine is having 500 wave wound conductors and running at 1000 rpm. The flux per pole is 30 mWb. What will be the voltage induced in the armature winding?	3	1	5M
	OR				
	b	i) Classify the methods of excitation of DC Generator and explain each.	2	1	5M
		ii) A 50 HP, 400 V, 4 pole, 1000 rpm, DC motor has flux per pole equal to 0.027 Wb. The armature having 1600 conductors is wave connected. Calculate the gross torque when the motor takes 70 ampere.	3	1	5M
3	Unit-II				
	a	i) Explain the speed-current, torque-current and speed-torque characteristics of a DC shunt motor.	2	2	5M
		ii) A 240 V DC shunt motor has a field resistance of 400 ohm and an armature resistance of 0.1 ohm. The armature current is 50 A and the speed is 1000 rpm. Calculate the additional resistance in the field to increase the speed to 1200 rpm. Assume that armature current remains the same and the magnetisation curve to be a straight line.	3	2	5M

	OR			
	i) Explain the working principle of a 3-point starter of a DC shunt motor.	2	2	5M
b	ii) In a brake test on a DC shunt motor, the load on tight side of the brake band was 32 kg and the other side 2 kg. The motor was running at 1200 rpm; its input being 65 A at 400 V DC. The pulley diameter is 1m. Determine the torque, output of the motor and efficiency of the motor.	3	2	5M
	Unit-III			
	i) Determine the number of primary and secondary turns of a single-phase 2310/220V, 50 Hz transformer which has in emf of 13V per turn approximately.	3	3	5M
a	ii) Explain the operation of loaded transformer with phasor diagram for different power factor.	2	3	5M
	OR			
	i) Explain the losses which occur in an actual transformer	2	3	5M
4	ii) A 5 kVA single phase transformer has full-load copper loss of 100 watt and 60 watt as iron loss. The daily variation of load on the transformer is as follows: b 7 AM to 1 PM                      3 kW at power factor 0.6 lagging. 1 PM to 6 PM                      2 kW at power factor 0.8 lagging. 6 PM to 1 AM                      5 kW at power factor 0.9 lagging. 1 AM to 7 AM                      No-load Determine the all-day efficiency.	3	3	5M
	Unit-IV			
	i) Explain the separation of Hysteresis and Eddy Current Losses with graph.	2	4	5M
5	ii) Open-circuit, and short-circuit tests were conducted on a 50 kVA, 6360/240 V, 50 Hz, single-phase transformer in order to find its efficiency. The observations during these tests are: <b>O.C. test:</b> Voltage across primary winding = 6360 V; Primary current = 1.0 A, and Power input = 2 kW. <b>S.C. test:</b> Voltage across primary = 180 V; Current in secondary winding = 175 A, and Power input = 2 kW. Calculate the efficiency of the transformer, when supplying full-load at p.f. of 0.8 lagging.	3	4	5M
	OR			
	i) What are the reasons for which transformers are put in parallel? and explain the conditions for parallel operation.	2	4	5M
b	ii) Explain the working principle of Auto-Transformer	2	4	5M
	Unit-V			
	i) Draw the diagram of polyphase transformer and explain.	2	5	5M
6	ii) Explain method of transformation of three-phase power from one circuit to another by using two transformers	2	5	5M
	OR			
	i) Explain the necessity and conditions for parallel operation of transformer.	2	5	5M
b	ii) Draw the schematic diagram of a no-load tap-changer and explain the percentage of winding in the circuit at different studs	2	5	5M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

## II B.Tech I Semester Supple. Examinations, May-2025

R23

Sub Code: R23ME2101

### NUMERICAL METHODS & TRANSFORM TECHNIQUES

Time: 3 hours

(ME)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

**PART-A: Answering all the questions from Part-A is compulsory (10 x 2M = 20M)**

Q.No		Questions	KL	CO	M
1	a	Write the geometrical interpretation of an approximating real root of the equation $f(x)=0$ by the method of false position.	3	1	2M
	b	Prove that $(1+\Delta)(1-\nabla)=1$ .	3	1	2M
	c	Write Simpson's 1/3 rule to find the value of the definite integral.	3	2	2M
	d	State the convergence condition for Picard's method to solve $\frac{dy}{dx}=f(x,y), y(x_0)=y_0$	3	2	2M
	e	Find the Laplace transform of $\frac{\sin t}{t}$ .	3	3	2M
	f	Find the inverse Laplace transform of $\tan^{-1}(2/s)$ .	3	3	2M
	g	Find the half-range sine series for $f(x)=1$ in $(0, \pi)$ .	3	4	2M
	h	Find the Fourier series of $f(x)=x$ in $(-\pi, \pi)$ .	3	4	2M
	i	State the Fourier integral theorem.	1	5	2M
	j	State convolution theorem for Fourier transformation.	1	5	2M

**PART-B: Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)**

Q.No		Questions	KL	CO	M												
2	Unit-I																
	a	i) Find the real root of the equation $2x - \log_{10} x = 7$ correct to four decimal places, using the fixed point iteration method with initial guess $x_0=3.8$ .	3	1	5M												
		ii) Apply Lagrange's formula to find $f(x)$ from the following data:	3	1	5M												
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;"><math>x</math></td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">4</td> <td style="padding: 2px;">5</td> </tr> <tr> <td style="padding: 2px;"><math>f(x)</math></td> <td style="padding: 2px;">4</td> <td style="padding: 2px;">3</td> <td style="padding: 2px;">24</td> <td style="padding: 2px;">39</td> </tr> </table>	$x$	0	1	4	5	$f(x)$	4	3	24	39					
	$x$	0	1	4	5												
	$f(x)$	4	3	24	39												
OR																	
b	i) Use the Newton-Raphson method to obtain a real root of $x \sin x = 4$ correct to four decimal places.	3	1	5M													
	ii) The following are the data from the steam table:	3	1	5M													
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 2px;">Temperature °C</td> <td style="padding: 2px;">140</td> <td style="padding: 2px;">150</td> <td style="padding: 2px;">160</td> <td style="padding: 2px;">170</td> <td style="padding: 2px;">180</td> </tr> <tr> <td style="padding: 2px;">Pressure <math>kgf/cm^2</math></td> <td style="padding: 2px;">3.585</td> <td style="padding: 2px;">4.854</td> <td style="padding: 2px;">6.302</td> <td style="padding: 2px;">8.076</td> <td style="padding: 2px;">10.225</td> </tr> </table>	Temperature °C	140	150	160	170	180	Pressure $kgf/cm^2$	3.585	4.854	6.302	8.076	10.225			
Temperature °C	140	150	160	170	180												
Pressure $kgf/cm^2$	3.585	4.854	6.302	8.076	10.225												
Using Newton's formula, find the pressure of steam for a temperature of 142°C																	
3	Unit-II																
	a	i) Using the Runge-Kutta method of order four, compute $y(0.2)$ correct to four decimal places, given that $\frac{dy}{dx} = x + y^2, y(0) = 1$ .	3	2	5M												

		ii) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Simpson's 3/8 rule with $h=1/6$ .	3	2	5M
		OR			
	b	i) Given $\frac{dy}{dx}=1+xy, y(0)=1$ , obtain Taylor's series for $y(x)$ . Compute $y(0.1)$ correctly to five decimal places.	3	2	5M
		ii) Evaluate $\int_0^2 \frac{dx}{x^3+x+1}$ by Simpson's 1/3 rule with $h=1/4$ .	3	2	5M
		Unit-III			
	a	i) Using Laplace transforms, prove that $\int_0^\infty \frac{e^{-t} \sin^2 t}{t} dt = \frac{1}{4} \log 5$ .	3	3	5M
		ii) Find the Laplace transform of $\left(\sqrt{t} - \frac{1}{\sqrt{t}}\right)^3$ .	3	3	5M
		OR			
	b	i) Using convolution theorem, Find inverse Laplace transform of $\frac{1}{(s^2+1)(s^2+4)(s^2+9)}$ .	3	3	5M
		ii) Solve $y''+2y'+5y=e^{-t} \sin t, y(0)=0, y'(0)=1$ , using Laplace transforms.	3	3	5M
		Unit-IV			
	a	i) Find the Fourier series of the function $f(x)= \cos x $ in the interval $(-\pi, \pi)$ .	3	4	5M
		ii) Find the half-range Fourier sine series for the function $f(x)=\begin{cases} \frac{1}{4}-x, & 0 < x < \frac{1}{2} \\ x-\frac{3}{4}, & \frac{1}{2} < x < 1. \end{cases}$	3	4	5M
		OR			
	b	i) Find the Fourier series of the function $f(x)= x , -2 < x < 2$ and hence deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$ .	3	4	5M
		ii) Find the half-range Fourier cosine series of the function $f(x)=\begin{cases} x, & 0 < x < \frac{\pi}{2} \\ \pi-x, & \frac{\pi}{2} < x < \pi. \end{cases}$	3	4	5M
		Unit-V			
	a	i) Find Fourier cosine transform of $\frac{1}{x^2+1}$ .	3	5	5M
		ii) Solve the integral equation $\int_0^\infty f(x) \cos px dx = \begin{cases} 1-p, & 0 \leq p \leq 1 \\ 0, & p > 1 \end{cases}$ and hence deduce that $\int_0^\infty \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}$ .	3	5	5M
		OR			
	b	i) Find the Fourier sine transform of $\frac{e^{-ax}}{x}, (a > 0)$ .	3	5	5M
		ii) Find the Fourier transform of $\frac{1}{\sqrt{x}}$ .	3	5	5M

## II B.Tech I Semester Supple. Examinations, May-2025

R23

Sub Code: R23ME2103

THERMODYNAMICS

Time: 3 hours

(ME)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Define thermodynamic system, state, and property.	K1	1	2M
	b	What are the causes of irreversibility?	K3	1	2M
	c	Based on which law of thermodynamics temperature measurement is based. State that law.	K5	2	2M
	d	What are the corollaries of First law of thermodynamics?	K2	2	2M
	e	State Kelvin Planck's law of thermodynamics.	K1	3	2M
	f	Define entropy. What is the entropy of an isolated system?	K1	3	2M
	g	Define dryness fraction.	K1	4	2M
	h	What do you mean by saturation state?	K3	4	2M
	i	Define ton of refrigeration.	K1	5	2M
	j	Explain DBT, WBT.	K2	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M	
2	Unit-I					
	a	i) What are the different types of thermodynamic systems? Explain with suitable examples.	K2	1	5M	
		ii) Explain the concept of continuum.	K3	1	5M	
	OR					
	b	i) Explain quasistatic process with the help of p-v diagram and justify the process is reversible.	K4	1	7M	
ii) Differentiate extensive and intensive properties.		K2	1	3M		
3	Unit-II					
	a	i) Derive steady flow energy equation.	K3	2	5M	
		ii) Write short notes on: Thermal energy reservoir, Heat engine and Heat pump.	K1	2	5M	
	OR					
	b	i) A mass of 1.5 kg of air is compressed in a quasi-static process from 0.1 MPa to 0.7 MPa for which $p v = \text{constant}$ . The initial density of air is $1.16 \text{ kg/m}^3$ . Find the work done by the piston to compress the air	K3	2	5M	
ii) State First law of thermodynamics. What are its applications?		K2	2	5M		
4	Unit-III					
	a	i) Show that Kelvin-Planck and Clausius' statements are equivalent.	K5	3	10M	

	OR				
	b	i) Write short notes on: PMM-II, Availability, Irreversibility.	K1	3	5M
		ii) Calculate the decrease in available energy when 25 kg of water at 95°C mix with 35 kg of water at 35°C, the pressure of water being 1 atm and temperature being 15°C.	K4	3	5M
	Unit-IV				
5	a	i) Draw phase equilibrium on T-s coordinates and show different phases, critical state and triple point of a pure substance.	K4	4	5M
		ii) Show the 25%, 50%, 75%, 100% quality lines and saturated liquid and saturated vapor line in Mollier chart.	K2	4	5M
	OR				
	b	i) Derive Clausius-Clapeyron equation.	K3	4	10M
	Unit-V				
		i) Explain the working principle of vapor compression refrigeration system with the help of flow and p-h diagrams.	K4	5	8M
		ii) What are the desirable properties of refrigerants?	K1	5	2M
	OR				
6	b	The atmospheric air at 40°C dry bulb temperature and 75 % relative humidity enters a cooling coil at rate of 200 m <sup>3</sup> /min. The coil dew-point temperature is 15°C and the by-pass factor of the coil is 0.1. Determine: (i) the temperature of air leaving the cooling coil (ii) the capacity of the cooling coil in tons of refrigeration (iii) the sensible heat factor for the process	K5	5	10M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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**II B.Tech I Semester Supple. Examinations, May-2025**

Sub Code: R23ME2104

Time: 3 hours

**MECHANICS OF SOLIDS**

(ME)

Max. Marks: 70

**R23**

Note: Question Paper consists of Two parts (Part-A and Part-B)

**PART-A**

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No	Questions	KL	CO	M
a	Define the terms 'Factor of Safety' and 'Bulk Modulus'.	L1	1	2M
b	What do you mean by 'Temperature stresses'?	L2	1	2M
c	Classify different types of supports for beams.	L2	2	2M
d	Give the relation between shear force and loading function of a beam.	L2	2	2M
e	State any two assumptions made in the theory of simple bending.	L2	3	2M
f	Define the term 'Section modulus' used in simple bending of beam.	L1	3	2M
g	Give the relation between deflection and radius of curvature of a beam.	L2	4	2M
h	Define the term 'Torsional rigidity' used in torsion of circular shafts.	L1	4	2M
i	What type of stresses will induce in a thin cylinder due to internal pressure?	L2	5	2M
j	Define 'slenderness ratio' of a column.	L1	5	2M

**PART-B: Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)**

Q.No	Questions	KL	CO	M																				
<b>Unit-I</b>																								
a	<p>A bar shown in figure – 1 consists of three portions. Each portion is made of different material and subjected to different loads. Find the minimum value of load 'P' so that overall deformation is not to exceed 3 mm.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr> <th></th> <th>Portion-1</th> <th>Portion-2</th> <th>Portion-3</th> </tr> </thead> <tbody> <tr> <td>Material</td> <td>Steel</td> <td>Bronze</td> <td>Aluminium</td> </tr> <tr> <td>Cross-section Area, mm<sup>2</sup></td> <td>480</td> <td>650</td> <td>320</td> </tr> <tr> <td>Allowable stress, MPa</td> <td>140</td> <td>120</td> <td>80</td> </tr> <tr> <td>Modulus of Elasticity (E), GPa</td> <td>200</td> <td>83</td> <td>70</td> </tr> </tbody> </table> <div style="text-align: center; margin: 10px 0;"> <p style="text-align: center;">Figure – 1: A Bar</p> </div>		Portion-1	Portion-2	Portion-3	Material	Steel	Bronze	Aluminium	Cross-section Area, mm <sup>2</sup>	480	650	320	Allowable stress, MPa	140	120	80	Modulus of Elasticity (E), GPa	200	83	70	L3	1	10M
		Portion-1	Portion-2	Portion-3																				
Material	Steel	Bronze	Aluminium																					
Cross-section Area, mm <sup>2</sup>	480	650	320																					
Allowable stress, MPa	140	120	80																					
Modulus of Elasticity (E), GPa	200	83	70																					
OR																								
b	Derive an expression or relation between three elastic constants of a material.	L3	1	10M																				

Unit-II

Determine the values and draw the shear force and bending moment diagrams for a simply supported beam as shown in Figure-2 below.

L5 2

10M

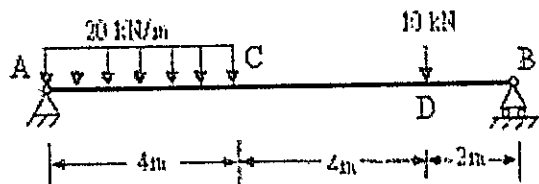


Figure – 2: Simply Supported Beam

OR

A simply supported beam of length 12 meters, is subjected to linearly varying load with zero at each end to 3 kN/m at the mid-span. Draw the shear force and bending moment diagrams.

L4 2

10M

Unit-III

Derive the relation  $\frac{\sigma}{y} = \frac{M}{I} = \frac{E}{R}$  for simple bending, with usual notations.

L3 3

10M

OR

A 300 mm x 150 mm I-girder having 12 mm thick flanges and 8 mm thick web is subjected to a shear force of 150 kN at a particular section. Determine the value of the maximum shear stress in the flange. Also find the ratio of the maximum shear stress to minimum shear stress in the web.

L3 3

10M

Unit-IV

A simply supported beam of 8 meters length carries two concentrated loads of 64 kN and 48 kN at a distance of 1.5 m and 4 m respectively from the left-hand end. Find the deflection under each load and maximum deflection by using Macaulay's method. Take  $E = 210 \text{ GPa}$  and  $I = 180 \times 10^6 \text{ mm}^4$ .

L3 4

10M

OR

The compound shaft shown in figure-3 is attached to rigid supports. For the bronze portion AB, the diameter is 75 mm, the allowable shear stress is 60 MPa and  $G_b = 35 \text{ GPa}$ . For the steel portion BC, the diameter is 50 mm, the allowable shear stress is 80 MPa and  $G_s = 83 \text{ GPa}$ . Calculate the maximum torque T that can be applied.

L4 4

10M

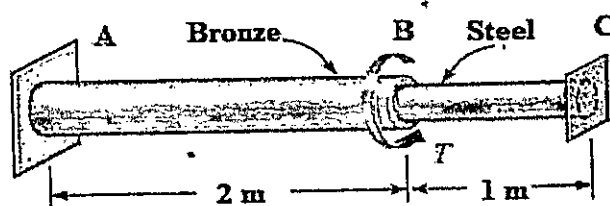


Figure – 3: Compound shaft

Unit-V

Derive an expression for volumetric strain of a thin cylindrical pressure vessel (with flat ends) of internal diameter 'D' and thickness 't', subjected to an internal pressure 'P'. Take Modulus of elasticity is 'E' and Poisson's ratio is 'v'.

L3 5

10M

OR

i) What is meant by equivalent length of columns? What are its values for different end conditions of columns?

L3 5

5M

ii) What is Euler's curve and explain its importance.

L3 5

5M

## II B.Tech I Semester Supple. Examinations, May-2025

R23

Sub Code: R23ME2105

MATERIAL SCIENCE & METALLURGY

Time: 3 hours

(ME)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Expand the following i) BCC ii) HCP	K2	1	2M
	b	Define Grain and grain boundaries,	K2	1	2M
	c	Lists the properties of Alloy cast-iron.	K2	2	2M
	d	What are the application of Super alloys.	K2	2	2M
	e	Differentiate between Normalizing and Annealing.	K4	3	2M
	f	What is meant by tempering?	K2	3	2M
	g	Explain powder extrusion process.	K2	4	2M
	h	State the applications of powder metallurgical products.	K4	4	2M
	i	What are nano material and list few applications.	K2	5	2M
	j	Expand the followings i) MMC ii) CMC.	K3	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q. No		Questions	KL	CO	M	
2	Unit-I					
	a	i) What is Solid solutions and Explain Substitutional & Interstitial solid solutions	K3	1	5M	
		ii) Difference between Ionic, Covalent, Metallic Bonds.	K3	1	5M	
	OR					
	b	i) Draw Iron carbon equilibrium Diagram and mark on it all salient temperatures, composition and phases involved	K3	1	5M	
		ii) Explain Lever rule and Gibbs Phase rule.	K2	1	5M	
3	Unit-II					
	a	i) Write the classification of steel? and Explain	K2	2	5M	
		ii) Explain the production of gray cast iron? Give their applications.	K3	2	5M	
	OR					
	b	i) Explain the structure and properties of Aluminum and its alloy.	K3	2	5M	
		ii) Explain the types of cast iron and their applications.	K3	2	5M	

Unit-III					
4	a	Draw TTT diagram for a eutectoid steel and indicate transformation products.	K4	3	10M
	OR				
	b	i) How do you find the hardenability? Explain.	K3	3	5M
ii) Discuss different types of annealing processes.		K3	3	5M	
Unit-IV					
5	a	Explain the different mechanical methods of metal powder production.	K5	4	10M
	OR				
	b	Explain the different pressure less powder shaping methods and also state their advantages and disadvantages.	K5	4	10M
Unit-V					
6	a	i) What are cermets? Explain with examples.	K3	5	5M
		ii) Write the classification of composites? Also indicate their typical applications.	K3	5	5M
	OR				
	b	i) Explain the manufacture of fiber reinforced composites.	K3	5	5M
		ii) Explain the properties and applications of PMC.	K3	5	5M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Supple. Examinations, May-2025

**R23**

Sub Code: R23EC2101

**PROBABILITY THEORY & STOCHASTIC PROCESS**

Time: 3 hours

(ECE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	A box contains three white balls and two red balls. We remove at random two balls in succession. What is the probability that the first removed ball is white and the second is red?	K1	1	2M
	b	Define uniform and exponential random variables.	K1	1	2M
	c	What is a continuous random variable? State the properties of probability density function $f_X(x)$ of a continuous random variable X.	K1	2	2M
	d	Find the mean value of a Poisson random variable.	K1	2	2M
	e	If X and Y are independent, find variance of (X + Y)	K2	3	2M
	f	Explain circular symmetry of two random variables.	K1	3	2M
	g	Define a random process. What are the different types of random processes?	K1	4	2M
	h	Define wide sense stationary random process.	K1	4	2M
	i	List the properties of cross-power spectral density functions	K1	5	2M
	j	Define Autocorrelation function of a random process.	K1	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) Two players A and B draw balls one at a time alternately from box containing m white balls and n black balls. Suppose the player who picks the first white ball wins the game. What is the probability that the player who starts the game will win?	K3	1	5M
		ii) If the probability density function of a random variable X is given by $f(x) = \begin{cases} \frac{x^2}{6}; & 0 \leq x \leq 3 \\ 0; & \text{otherwise} \end{cases}$ Find $P(0 < X < 2)$ and $F_X(x)$ ?	K3	1	5M
	OR				
b		i) A box contains m white balls and n black balls. Balls are drawn at random one at a time without replacement. Find the probability of encountering a white ball by the kth draw.	K3	1	5M

		ii) Define and write properties of condition density and its properties.	K2	1	5M
		Unit-II			
3	a	i) Define Moment Generating Function for a random variable. Let X be a binomial random variable with parameters n (number of trials) and p (probability of success). Determine its MGF and obtain the mean and variance.	K2	2	5M
		ii) The density function of a random variable is given as $f_X(x) = ae^{-bx^2/2}$ . Determine the characteristic function and the first two moments.	K3	2	5M
		OR			
	b	i) Explain monotonic and non-monotonic transformation of continuous random variables. ii) Prove Chebyshev's inequality by stating it.	K2	2	5M
		Unit-III			
4	a	i) Let x and y be independent exponential random variables with common parameter $\lambda$ and $u = x + y$ , $v = x - y$ . Find the joint and marginal p.d.f. of u and v.	K3	3	5M
		ii) Assuming x and y to be independent uniform random variables i.e. $X \sim U(0,1)$ and $Y \sim U(0,1)$ , prove that u and v are not independent, but uncorrelated.	K4	3	5M
		OR			
	b	i) Prove Central Limit Theorem by stating it. ii) Suppose x and y are independent uniformly distributed random variables in the interval $(0, \pi)$ and $z = \min(x, y)$ , $w = \max(x, y)$ . Determine $f_{zw}(z, w)$ .	K3	3	5M
		Unit-IV			
5	a	i) Explain ensemble average and time average for a random process. What is the relation between those averages in case of ergodic (wide sense) stationary processes?	K3	4	5M
		ii) Determine the autocorrelation function $R_{xx}(\tau)$ and the power $P_x$ of a low-pass random process with a white noise PSD $S_x(\omega) = N/2$ .	K3	4	5M
		OR			
	b	i) For a given random process X(t), the mean value is $\bar{x}=6$ and autocorrelation are $R_{xx}(\tau) = 36 + 25e^{-\tau}$ . Find a) the average power of the process X(t), b) Variance of X(t) ii) Explain cross-correlation function and its properties.	K4	4	5M
		Unit-V			
6	a	i) Determine the relation between autocorrelation function and power spectral density of an ergodic random process.	K3	5	5M
		ii) Explain power spectrum and its properties.	K3	5	5M
		OR			
	b	i) Explain relation between cross power spectrum and cross correlation function. ii) Determine the autocorrelation function and the Power spectral density of the DSB-SC-modulated process $X(t) = m(t) \cos(\omega t + \theta)$ , where m(t) is a wide-sense stationary random process, and $\theta$ is an RV uniformly distributed over $(0, 2\pi)$ and independent of m(t).	K3	5	5M
		K4	5	5M	
		KL: Blooms Taxonomy Knowledge Level      CO: Course Outcome      M: Marks			

## II B.Tech I Semester Supple. Examinations, May-2025

R23

Sub Code: R23EC2103

SIGNALS & SYSTEMS

Time: 3 hours

(ECE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Define complex exponential signal.	2	1	2M
	b	Why the sampling theorem is called uniform sampling theorem and low pass sampling theorem?	2	1	2M
	c	Write the Dirichlet conditions for Fourier series.	1	2	2M
	d	Identify whether the system $y(t) = t \cdot x(t)$ is time-invariant.	2	2	2M
	e	List four properties of Hilbert transform.	1	3	2M
	f	State the shift property of convolution.	1	3	2M
	g	State the time-shifting property of Z-Transform.	1	4	2M
	h	Define Region of Convergence (ROC) in Laplace transforms.	1	4	2M
	i	Differentiate between causal and non-causal systems.	2	5	2M
	j	What is signal bandwidth and system bandwidth?	2	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) Find whether the following signal is even or odd $x(t) = u(t+4) - u(t-2)$	2	1	5M
		ii) Prove that the following systems is stable or not. $h(t) = w_0  \sin w_0 t u(t) $	3	1	5M
	OR				
	b	i) Find whether the following discrete time signal is periodic or not? IF periodic, determine the fundamental period. $\sin(2\pi n/5) + \cos(2\pi n/3)$	2	1	5M
		ii) Derive the conditions for avoiding aliasing in sampling.	4	1	5M
3	Unit-II				
	a	i) Convert the exponential Fourier series representation of a signal to its trigonometric Fourier series representation.	3	2	5M
		ii) With a suitable example, Derive the conditions for orthogonality between two functions over a given interval.	2	2	5M
	OR				
	b	i) Obtain Cosine Fourier series from trigonometric Fourier series.	2	2	5M
		ii) Write a brief note on the concept of mean square error in signal approximation and its significance.	1, 2	2	5M

Unit-III					
4	a	i) Derive the Fourier Transform of a rectangular pulse signal $x(t)=1$ for $ t  \leq T/2$	3	3	5M
		ii) Solve for the Fourier Transform of a periodic signal $x(t)=\cos(2\pi f_0 t)$ .	2	3	5M
	OR				
	b	i) State and prove the time shifting and frequency shifting properties of Fourier transform.	2	3	5M
ii) Find the inverse Fourier transform of $X(w) = e^{-4w} U(w)$ .		2	3	5M	
Unit-IV					
5	a	i) Determine the Z-transform of the following signal and sketch the ROC: $x_1(n) = \begin{cases} (1/2)^n, & n \geq 0 \\ (1/4)^{-n}, & n < 0 \end{cases}$	2,3	4	5M
		ii) Determine the initial value $x(0^+)$ for the following Laplace transforms: $X(s) = \frac{4}{s^2 + 3s - 5}$	3	4	5M
	OR				
	b	i) Determine the Z-transform of the following signal: $x(n) = \frac{1}{3}(n^2 + n) \left(\frac{1}{2}\right)^{n-1} u(n-1)$		4	5M
ii) Find the Laplace transform of the signal $x(t) = e^{-4t}u(-t) + e^{-7t}u(t)$ , identify its ROC and draw the ROC diagram.			4	5M	
Unit-V					
6	a	i) Prove whether the system $y(t) = x(t) + \int_{-\infty}^t x(\tau) d\tau$ is static or dynamic.		5	7M
		ii) Describe the relationship between signal bandwidth and system bandwidth for effective transmission.		5	3M
	OR				
	b	i) Consider a stable LTI system characterised by the differential equation $\frac{d^2 y(t)}{dt^2} + \frac{2dy(t)}{dt} + y(t) = x(t)$ . Find its impulse response.		5	7M
ii) Explain the characteristics of an ideal low-pass filter with a neat diagram			5	3M	

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Supple Examinations, May-2025

Sub Code: R23EC2104

ELECTRONIC DEVICES & CIRCUITS

Time: 3 hours

(ECE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Explain the difference between transition and diffusion capacitances of P-N diode	2	1	2M
	b	Define Depletion region and explain how the p-n junction formed?	1	1	2M
	c	Explain the working of Schottky barrier diode with necessary sketches	2	2	2M
	d	Define peak inverse voltage	3	2	2M
	e	What are the differences between BJT and JFET?	4	3	2M
	f	If the transistor has an $\alpha$ of 0.98, find the value of $\beta$ and if $\beta$ is 200 find $\alpha$	2	3	2M
	g	What are the advantages of self-biasing circuit?	1	4	2M
	h	List the advantage and disadvantages of fixed bias method	2	4	2M
	i	Write the applications of JFET	3	5	2M
	j	Why are n-channel MOSFETs preferred over P-channel MOSFET?	2	5	2M

### PART-B: Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) Explain the semiconductors, insulators and metals classification using energy band	2	1	10M
	OR				
	b	i) Explain the VI characteristics and energy band diagram of PN junction diode	3	1	10M
3	Unit-II				
	a	i) With circuit and necessary waveforms explain the operation of bridge rectifier	2	2	5M
		ii) An ac supply of 220V is applied to a half wave rectifier circuit through a transformer with a turns ratio of 10:1. Find (i) DC output voltage (ii) PIV. Assume the diode to an ideal one.	1	2	5M
	OR				
	b	i) Explain the operation of varactor diode with neat diagram	2	2	5M
ii) With a neat sketch explain the working of Half-wave rectifier.		3	2	5M	
4	Unit-III				
	a	i) Explain the operation, input and output characteristics of a transistor in CB configuration with the help of neat diagram	4	3	10M
OR					

	b	i) Explain input and output characteristics of a transistor in CE configuration	5	3	5M	
		ii) From the transistor current components, deduce the current equation of transistor	5	3	5M	
Unit-IV						
5	a	i) Explain any two bias compensation techniques		4	5M	
		ii) An npn transistor if $\beta=50$ is used in CE circuit with $V_{cc} = 10V, R_c = 2K\Omega$ . The bias is obtained by connecting $100k\Omega$ resistor from collector to base. Find the quiescent point and stability factor.		4	5M	
	OR					
	b	i) What is thermal runaway? Explain how it can be avoided.	1	4	5M	
ii) Differentiate bias stabilization and compensation techniques		2	4	5M		
Unit-V						
6	a	i) Draw the construction diagram, operation characteristics and parameters of JFET	2	5	5M	
		ii) A certain JFET operates in the linear region with a constant drain voltage of 1V. When the gate voltage is 2V, a drain current of 10mA flows, but when gate voltage is changed to 1V, the drain current becomes 22.8mA. Find (a) the pinch-off voltage (b) the channel resistance for zero gate voltage	2	5	5M	
	OR					
	b	i) Draw and explain the drain characteristics of n-channel enhancement type	3	5	5M	
ii) Explain the four distinct regions of the output characteristics of JFET		3	5	5M		

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Supple. Examinations, May-2025

**R23**

Sub Code: R23EC2105

**SWITCHING THEORY & LOGIC DESIGN**

Time: 3 hours

(ECE)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	State and prove De Morgan's theorem.	2	1	2M
	b	Convert the following into Gray code i) 11011001.11	3	1	2M
	c	Construct the Minimum number of two input NOR gates required to implement $Y = A + B C$	3	2	2M
	d	List the maxterms corresponding to the logical expression $Y = (A + B + C') (A + B' + C') (A' + B' + C)$	4	2	2M
	e	Construct the half adder using NAND gates.	3	3	2M
	f	Build the 4-bit parallel adder using full adders.	3	3	2M
	g	Compare synchronous & Asynchronous counters.	4	4	2M
	h	Make use of combinational circuit and memory unit design a sequential circuit	3	4	2M
	i	Build the structure of PAL.	3	5	2M
	j	List out the types of PLDs	2	5	2M

### PART-B

Answer either 'a' or 'b' from each question of PART-B (5 x 10M = 50M)

Q.No		Questions	KL	CO	M
2	Unit-I				
	a	i) Perform the dual and complement of the following function: $A'BD'+B'(C'+D')+A'C'$	3	1	5M
		ii) Make use of Number System Conversion technique to convert the given (202) <sub>10</sub> to ( ? ) <sub>2</sub> , ( ? ) <sub>8</sub> , ( ? ) <sub>16</sub> .	3	1	5M
	OR				
	b	i) Examine the given 8 bit data word 01011011, generate the 12 bit word for the hamming code that corrects and detects single bit error.	3	1	5M
ii) Explain the logic gates with it symbol and truth table.		4	1	5M	

Unit-II					
3	a	<b>Simplify</b> the following function using k-map a) $F(A, B, C, D) = \sum m(0, 5, 7, 10, 11, 13, 14, 15)$ b) $F(A, B, C, D) = \sum d(2, 3, 9, 12)$ .	3	2	10M
	OR				
	b	<b>Make use of</b> given function $T(w, x, y, z) = \sum (0, 1, 5, 7, 8, 10, 14, 15)$ i) <b>Show</b> on the map ii) <b>Find</b> all prime implicants and indicate which are essential. iii) <b>Find</b> a minimal expression	3	2	10M
Unit-III					
4	a	<b>Make use of</b> a Boolean function $F = (1, 2, 5, 7)$ to Construct (a) 8x1 multiplexer (b) 4x1 multiplexer.	3	3	10M
	OR				
	b	<b>Convert</b> Excess-3 code to BCD using Full adder circuits.	3	3	10M
Unit-IV					
5	a	i) <b>What</b> is flip-flop? How can be used in sequential circuit and explain in detail.	2	4	5M
		ii) <b>What</b> is an excitation table? Write the excitation tables for JK and T flip-flops.	2	4	5M
	OR				
	b	i) <b>Draw</b> the logic diagram of a JK flip-flop and using excitation table explain its operation.	3	4	5M
		ii) <b>Draw</b> the logic diagram of a SR flip-flop and using excitation table explain its operation.	3	4	5M
Unit-V					
6	a	i) <b>List</b> the merits and demerits of PROM	3	5	5M
		ii) <b>Develop</b> the following four Boolean functions using PAL. $F1(w, x, y, z) = \sum m(1, 2, 3, 7, 9, 11)$ $F2(w, x, y, z) = \sum m(0, 1, 2, 3, 10, 12, 14)$ $F3(w, x, y, z) = \sum m(4, 5, 6, 7, 9, 15)$ $F4(w, x, y, z) = \sum m(1, 2, 3, 10, 13, 15)$	3	5	5M
	OR				
	b	i) <b>Build</b> a BCD to Excess-3 code converter and implement using suitable PLA.	3	5	5M
		ii) <b>Classify</b> the different types of PLDs and Compare the three combinational PLDs.	2	5	5M

KL: Blooms Taxonomy Knowledge Level

CO: Course Outcome

M: Marks

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## II B.Tech I Semester Supple. Examinations, May-2025

Sub Code: R23DS2107

**Introduction to Data Science**

**R23**

Time: 3 hours

(Data Science)

Max. Marks: 70

Note: Question Paper consists of Two parts (Part-A and Part-B)

### PART-A

Answering all the questions from Part-A is compulsory (10 x 2M=20M)

Q.No		Questions	KL	CO	Marks
1	a	What is the role of data science in business, medical research, healthcare, education, social media, technology and financial institutions?	K2	1	2M
	b	Define data exploration process.	K2	1	2M
	c	What is semi-supervised learning.	K1	2	2M
	d	Write a short note on the role of Machine learning in Data Science.	K3	2	2M
	e	Mention various types of NoSQL databases.	K3	3	2M
	f	What are key Concepts in Distributed Data Storage?	K1	3	2M
	g	Write the basic structure of a Cypher query.	K1	4	2M
	h	Explain about any two core functionalities of NLTK.	K1	4	2M
	i	Name two commonly used tools for data visualization.	K1	5	2M
	j	What is a prototype in software development?	K1	5	2M

PART-B: Answer either A OR B c,d from each question of PART-B (5 x 10M=50M)

Q. No		Question	KL	CO	Marks
2	A	Write a Brief note on the following i. Retrieving data ii. Cleansing the data iii. Integrating and transforming data iv. Importance of project charter	K2	1	10
	OR				
	B	Briefly explain the steps in data science process with diagram	K2	1	10
3	A	Explain various Programming tips for dealing with large data sets.	K3	2	10
	OR				
	B	Explain the differences between supervised, unsupervised, and semi-supervised learning, providing examples of real-world applications for each.	K2	2	10
	A	Explain the CAP theorem and its significance in NoSQL databases. How do NoSQL databases manage the trade-offs between consistency, availability, and partition tolerance?	K3	3	10

4	OR				
	B	What is a database transaction. Explain how do the ACID properties influence the behavior of transactions? Illustrate with an example how each of the ACID properties ensures that a database remains consistent even in the event of a system failure or crash.	K3	3	10
5	A	How does Neo4j handle relationships in data, and why is this important for solving problems related to connected data in real-world applications?	K2	4	10
	OR				
	B	How can SQLite be used to perform basic text analytics tasks, such as word frequency analysis, n-gram extraction, and text summarization?	K3	4	10
6	A	Describe the process of setting up an interactive dashboard with dc.js, starting from data preparation to visualization.	K3	5	10
	OR				
	B	What are dashboard development tools, and why are they essential in modern data-driven organizations?	K3	5	10

