NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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

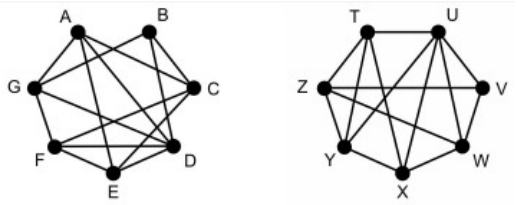
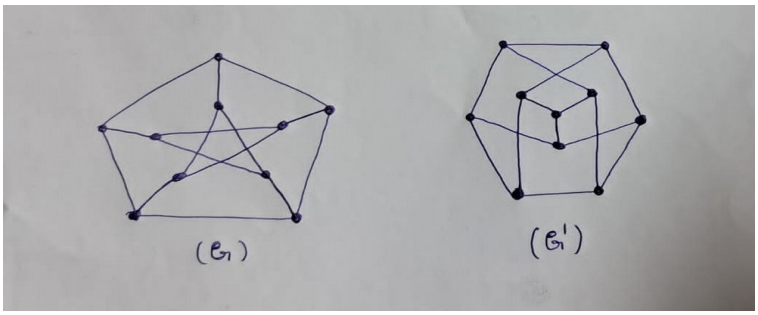
Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	Show that (P→Q) ➔Q => P∨Q.	K1	1	2M
	b	Define free and bounded variable.	K2	1	2M
	c	Illustrate partial ordering of a set.	K4	2	2M
	d	P.T A-(B∪C)=(A-B)∪(A-C)	K5	2	2M
	e	Find the number of permutations of the letters of the word “SUCCESS”.	K2	3	2M
	f	Find the recurrence relation for the sequence $a_n = 3.2^n, n \geq 1$ with $a_0 = 3$.	K3	3	2M
	g	Solve $a_n - 3a_{n-1} - 4a_{n-2} = 0$ where $a_0 = 1$, $a_1 = 1$.	K6	4	2M
	h	a) Draw the graph represented by the given adjacency matrix. $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$	K2	4	2M
	i	Define bipartite graph with one example.	K1	5	2M
	j	Define the spanning tree of a graph.	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) Show that the following is a tautology without constructing truth table (P∧ (P→Q)) →Q.	K2	1	5M
		ii) Let X= {1, 2, 3, 4} and R = {(x, y) / x>y}. Draw the graph of R and write matrix representation of a relation.	K2	1	5M
		OR			
	b	i) Compute $(p \rightarrow q) \rightarrow r$ and $p \rightarrow (q \rightarrow r)$ logically equivalent? Justify your answer by using truth table.	K3	1	5M
		ii) Prove or disprove the following arguments. a. Some dogs are animals. b. Some cats are animals. c. Therefore some dogs are cats.	K5	1	5M

3		Unit-II			
	a	i) Prove that the relation R= {(x, y) / x ≡ y (mod m) Over the set of positive integers is an equivalence relation	K5	2	5M
		ii) How many integral solutions are there of $x_1+x_2+x_3+x_4+x_5=30$ where $x_1\geq 2, x_2\geq 3, x_3\geq 4, x_4\geq 2 \wedge x_5\geq 0$	K2	2	5M
		OR			
	b	i) Illustrate $A \cup (B\cap C)=(A \cup B)\cap(A \cup C)$.	K4	2	5M
		ii) Let f(x) = x+2,g(x)=x-2 ,h(x)=3x are defined in R where, R is the set of real numbers. Find gof, fog ,fof, gog, foh, hog, hof, fohog	K1	2	5M
4		Unit-III			
	a	i) Solve the recurrence relation a_n-7a_{n-}+10a_{n-2}=0 for n≥2,a_0=10,a_1=41by using generating function method	K6	3	5M
		ii) Find the number of permutations of letters of the word MASSSAUGA. In how many of these all 4A'S are together. How many of them begin with S.	K2	3	5M
		OR			
	b	i) If $P(n,4)=42\times P(n,2)$, write n?	K6	3	5M
		ii) How many integral solutions are there of $x_1+x_2+x_3+x_4+x_5=30$ where $x_1\geq 2$, $x_2\geq 3$, $x_3\geq 4$, $x_4\geq 2$, $x_5\geq 0$	K2	3	5M
5		Unit-IV			
	a	i) Describe matrix representation of a graph.	K2	4	5M
		ii) Determine whether the following graphs G and H are isomorphic or not. Justify your answer 	K3	4	5M
		OR			
	b	i) Define graph, sub graph, walk, closed walk, open walk of a graph with suitable example.	K2	4	5M
		ii) Construct six regular bipartite graphs along with description of vertex and edge sets respectively.	K3	4	5M
6		Unit-V			
	a	i) Define chromatic number of a graph and find the chromatic number of the graphs (a) C_n (b) K_n (c)$K_{m,n.}$	K2	5	5M
		ii) check the following graphs are isomorphic or not. 	K6	5	5M
		OR			
	b	i) State and prove Euler's formula for a plane connected graph.	K5	5	5M
		ii) Describe Prim's algorithm with one example.	K5	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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	Discuss the Right Understanding.	2	1	2M
	b	Define Self Exploration.	1	1	2M
	c	Explain nurturing Human Body.	2	2	2M
	d	List out the characteristics of Self.	1	2	2M
	e	Define the role of Family in Harmony.	1	3	2M
	f	Explain the meaning of Respect.	2	3	2M
	g	Discuss the nature of Existence.	2	4	2M
	h	Illustrate the Co-Existence.	1	4	2M
	i	Define Human conduct.	1	5	2M
	j	Outline the concept of Professional Ethics	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)	Discuss the relationship between holistic development and Education.	3	1	5M
		ii)	Explain the sources of Self Exploration.	3	1	5M
			OR			
	b	i)	Write about the Basic aspirations of Individuals.	3	1	5M
		ii)	Examine the objectives of Value Education.	3	1	5M
3			**Unit-II**			
	a	i)	Distinguish between the needs of the self and body.	4	2	5M
		ii)	Examine the basic understanding of Human being	3	2	5M
			OR			
	b	i)	Describe the characteristics of Self and body.	3	2	5M
		ii)	Write a detailed note on body as instrument for self.	3	2	5M
4			**Unit-III**			
	a	i)	Examine the relationship between the family and society.	3	3	5M
		ii)	Illustrate the fundamentals of value in Relationship.	4	3	5M
			OR			
	b	i)	Discuss the relationship between the feelings and human relationships.	3	3	5M
		ii)	Classify the various Human orders.	3	3	5M

5	**Unit-IV**					
	a	i)	Write a short note on Animal Order and Bio Order.	**3**	**4**	**5M**
		ii)	Classify the four order of the nature.	**3**	**4**	**5M**
	OR					
	b	i)	Write about the levels of Co-Existence.	**3**	**4**	**5M**
		ii)	Illustrate the Holistic Perception of Harmony in Existence	**4**	**4**	**5M**
6	**Unit-V**					
	a	i)	Illustrate the features of Professional Ethics	**4**	**5**	**5M**
		ii)	Write a short note on Human Values.	**3**	**5**	**5M**
	OR					
	b	i)	Discuss the Humanistic Constitution and Humanistic Education.	**3**	**5**	**5M**
		ii)	Critically evaluate the Holistic Technologies	**3**	**5**	**5M**

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

II B.Tech I Semester Supple. Examinations, May-2026

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	Write the 2's complement of 1011011	K3	CO1	2M
	b	Simplify the Boolean function with minimum literals F= (X+Y)(X+Y^{I})	K2	CO1	2M
	c	Define Flip flop	K1	CO2	2M
	d	Demonstrate how a multiprocessor system executes multiple tasks simultaneously	K3	CO2	2M
	e	What is Booth's algorithm used for?.	K2	CO3	2M
	f	Apply the concept of microprogram sequencing to explain how control signals are executed step-by-step.	K3	CO3	2M
	g	State the relationship between speed, size, and cost of memory.	K2	CO4	2M
	h	Demonstrate how direct mapping assigns a main memory block to a specific cache line.	K3	CO4	2M
	i	What is an I/O Interface?	K1	CO5	2M
	j	Compare synchronous and asynchronous buses.	K3	CO5	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) Convert the hexadecimal number F3A7C2 to binary and octal with procedures	K3	CO1	5M
		ii) Convert the decimal number 8620 into (a) BCD (b)excess-3 code (c) 2421 code (d) binary number	K3	CO1	5M
		OR			
	b	i) Simplify the following Boolean function using four variables K-map. $F(A,B,C,D)=\sum m(1,2,6,7,8,13,14,15)+\sum d(0,3,5,12)$	K2	CO1	5M
		ii) Draw and explain the full adder using 8 to 1 multiplexer	K2	CO1	5M
3		Unit-II			
	a	i) Explain JK and T flip-flops with neat diagrams	K2	CO2	5M
		ii) Demonstrate how a shift register can be used to perform serial-to-parallel data conversion with a suitable timing diagram	K3	CO2	5M

		OR			
	b	i) Explain the basic operational concepts in a computer	K2	CO2	5M
		ii) Illustrate the organization of a bus system and explain how data, address, and control buses are used for communication.	K3	CO2	5M
4		Unit-III			
	a	i) Explain with an example how to multiply two unsigned binary numbers	K2	CO3	5M
		ii) Describe the algorithm for integer division with suitable examples	K2	CO3	5M
		OR			
	b	i) What is a bus organization? Illustrate multiple bus organization with a neat diagram	K3	CO3	5M
		ii) Write short notes on Hardwired Control	K4	CO3	5M
5		Unit-IV			
	a	i) Discuss the Memory Hierarchy in computer system with regard to Speed, Size and Cost.	K2	CO4	5M
		ii) Explain about main memory and its types.	K2	CO4	5M
		OR			
	b	i) Illustrate the working of Direct Mapping in cache memory with a neat diagram and example.	K3	CO4	5M
		ii) Explain the principle of Set-Associative Mapping and derive the address format used in this technique	K4	CO4	5M
6		Unit-V			
	a	i) Differentiate between programmed I/O, interrupt-driven I/O, and DMA.	K4	CO5	5M
		ii) What is DMA? Discuss DMA Controller.	K2	CO5	5M
		OR			
	b	i) Explain Standard I/O Interface.	K2	CO5	5M
		ii) Compare synchronous and asynchronous buses in terms of design, speed, and complexity.	K4	CO5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

II B.Tech I Semester Supple. Examinations, May-2026

Sub Code: R23CC2104 **ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS**

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

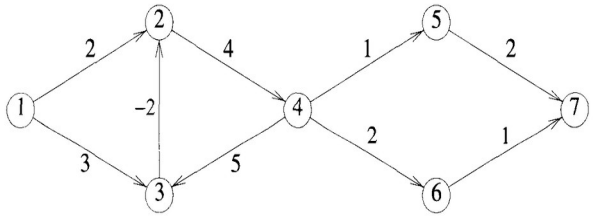
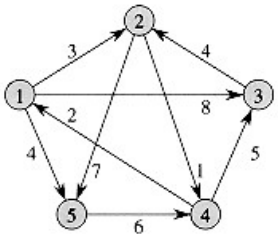
Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

Q.No		Questions	KL	CO	M
1	a	what is average, best and Worst complexities of an algorithm?	1	1	2M
	b	What are the different types of Rotations in AVL Tree?	1	1	2M
	c	What is the time complexity of Merge sort?	2	2	2M
	d	How do you measure the efficiency of an algorithm for divide and conquer method?	1	2	2M
	e	Write the difference between freasible solution and optimal solution	1	3	2M
	f	Contrast Greedy algorithm and Dynamic programming.	1	3	2M
	g	How is lower bound found by problem reduction?	1	4	2M
	h	Define backtracking	1	4	2M
	i	Give examples of NP complete problems	1	5	2M
	j	Compare class P and class NP.	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 Pseudo code conventions for designing an algorithm with help of example.	2	1	5M
		ii) Show that the following statements are true. i. 17 is $O(1)$. ii) $n(n-1)/2$ is $O(n2)$.	3	1	5M
		OR			
	b	What is a B-Tree? Specify its properties and describe the construction of a B-Tree for the following elements 5, 2, 13, 3, 45, 72, 4, 6, 9, 22.	3	1	10M
3		Unit-II			
	a	Explain BFS and DFS algorithms with suitable examples.	2	2	10M
		OR			
	b	i) Write the MERGESORT algorithm and derive its time complexity	3	2	10M
4		Unit-III			
	a	i) Find the optimal solution for the given Knapsack instance for n=5, m=100 and profits (p1, p2, p3, p4, p5) = (10, 22, 33, 66, 50) and (w1, w2, w3, w4, w5) = (10, 20, 30, 40, 50).	3	3	5M
		ii) Using the directed graph of below Figure, explain why *ShortestPaths* will not work properly. What is the shortest path between vertices v1 and v7?	3	3	5M

					
		OR			
	b	i) Explain one Scenario, where the Dynamic Programming can find out the optimal solution and Greedy method can't find out.	2	3	5M
		ii) Find the minimum number of multiplications required for the below given matrices using Dynamic Programming: A1=5×4, A2=4×6, A3=6×2, A4=2×7.	2	3	5M
5		Unit-IV			
	a	i) Present a backtracking algorithm for solving the knapsack optimization problem using the variable tuple size formulation.	2	4	5M
		ii) Determine the order of magnitude of the worst-case computing time for the backtracking procedure that finds all Hamiltonian cycles.	2	4	5M
		OR			
	b	Solve the following travelling salesperson problem by using branch and bound. ∞ 10 8 9 6 8 ∞ 5 3 4 8 4 ∞ 4 8 8 7 5 ∞ 5 6 9 4 5 ∞	3	4	10M
6		Unit-V			
	a	i) Describe Traveling Salesperson Decision Problem(TSP).	2	5	5M
		ii) Find all pairs shortest paths for the following graph. 	3	5	5M
		OR			
	b	Explain the relationship between NP-Hard and NP-complete problems? Discuss with an example.	2	5	10M

NARASARAOPETA ENGINEERING COLLEGE
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II B.Tech I Semester Supple. Examinations, May-2026

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	List the primitive data types in JAVA.	L1	1	2M
	b	Write the difference between break and continue statement.	L1	1	2M
	c	How private members of a class can be accessed in JAVA? Give example.	L1	2	2M
	d	Define nested class. Give example.	L1	2	2M
	e	How 2D arrays can be represented in memory? Explain.	L2	3	2M
	f	Write the use of default methods in interface.	L1	3	2M
	g	Explain the use of PATH and CLASSPATH in JAVA.	L2	4	2M
	h	Which class is super class for all classes in Exceptions? Draw the hierarchy.	L1	4	2M
	i	List the methods of Scanner class in JAVA.	L1	5	2M
	j	List and explain thread priorities in JAVA.	L2	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 features of JAVA.	L2	1	5M
		ii) Develop a JAVA program to check whether the given number is prime or not.	L3	1	5M
		OR			
	b	i) List and explain different types of operators supported by JAVA.	L2	1	5M
		ii) Develop a JAVA program to find the biggest of given three numbers.	L3	1	5M
3		Unit-II			
	a	i) Describe the process of declaring and initializing class and objects in Java with suitable example.	L2	2	5M
		ii) Differentiate constructor overloading and method overloading. Give suitable examples.	L2	2	5M
		OR			
	b	i) Write the use of final keyword in JAVA. Explain different usages of final keyword with simple examples.	L2	2	5M
		ii) Explain the concept of passing of object as parameters to methods of a class in JAVA.	L2	2	5M

4	Unit-III				
	a	i) What is meant by inheritance? Explain multi-level inheritance with an example.	L2	3	5M
		ii) What is an interface? Construct a program to illustrate multiple inheritance using interfaces.	L3	3	5M
	OR				
	b	i) 'Super is used to invoke immediate parent class constructor'. Interpret this statement with example program.	L3	3	5M
		ii) Explain how many classes can implement an interface. Give suitable example.	L2	3	5M
5	Unit-IV				
	a	i) Illustrate the procedure of creating and importing packages in JAVA with example.	L2	4	5M
		ii) Explain, what does the JVM do when an exception occurs? How do you catch an exception?	L2	4	5M
	OR				
	b	i) Explain different ways that the members of a package can be used in JAVA. Give suitable example.	L2	4	5M
		ii) Explain the usage of finally keyword in JAVA	L2	4	5M
6	Unit-V				
	a	i) Analyze different procedures for creating a thread in Java. Explain any one mechanism with example program.	L4	5	5M
		ii) Illustrate the difference between byte streams and character streams in Java. Draw the stream hierarchies.	L2	5	5M
	OR				
	b	i) Explain how you can modify a string with example program.	L2	5	5M
		ii) What is synchronization? Explain with an example, how synchronization is implemented in Java.	L2	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
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R23

II B. Tech I Semester Supple. Examinations, May-2026

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	Define Artificial Intelligence?	K1	1	2M
	b	What are the basic components of AI problem solving methodology?	K1	1	2M
	c	What are the advantages of Heuristic search?	K1	2	2M
	d	Compare informed search and un-informed search techniques?	K4	2	2M
	e	What is Reasoning under Uncertainty? Why is it important in AI?	K1	3	2M
	f	Differentiate between Semantic Nets and Frames.	K4	3	2M
	g	What are statistical Learning Methods?	K1	4	2M
	h	Give the logic behind in Reinforcement Learning?	K1	4	2M
	i	What are Expert System Shells?	K1	5	2M
	j	Write the concept of Meta-Knowledge and its importance in Expert Systems.	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) Discuss about the structure of Intelligence agents?	K2	1	5M
		ii) Explain with a table the PEAS description of the task environment for an automated taxi.	K4	1	5M
		OR			
	b	i) Distinguish between thinking humanly and thinking rationally?	K4	1	5M
		ii) Describe about simple reflex agent using a schematic diagram?	K2	1	5M
3		Unit-II			
	a	i) Give A* Algorithm with an example? What are the limitations of A* algorithm?	K3	2	5M
		ii) Design an evaluation function for a simple two-player game and explain how it influences decision-making within the game.	K5	2	5M
		OR			
	b	i) Describe the heuristic search technique applied to a hill-climbing problem with an example?	K2	2	5M
		ii) Explain the strengths and weaknesses of alpha-beta pruning in adversarial search. How does it impact the efficiency of the mini-max algorithm in real-time strategy games?	K2	2	5M
4		Unit-III			
	a	i) Explain the various issues in Knowledge Representation?	K2	3	5M
		ii) Discuss Rule-Based Knowledge Representation and Inference Mechanisms.	K4	3	5M

	OR				
	b	i) Describe Bayes' Theorem and explain how it is used for probabilistic inference.	K2	3	5M
		ii) Discuss Dempster-Shafer Theory of Evidence in detail.	K4	3	5M
5	Unit-IV				
	a	i) Give the complete grammar of first order logic using BNF?	K2	4	5M
		ii) Differentiate between Forward Vs. Backward reasoning	K4	4	5M
	OR				
	b	i)What is the logic behind in the completeness of resolution?	K2	4	5M
		ii) Explain about the Decision trees?	K2	4	5M
6	Unit-V				
	a	i) Explain the architecture of an Expert System in detail?	K2	5	5M
		ii) Discuss the role of Heuristics in Expert Systems?	K4	5	5M
	OR				
	b	i) Describe the design and functioning of the MYCIN Expert System?	K5	5	5M
		ii) Compare MYCIN, DART, and XCON expert systems in terms of domain, reasoning approach, and applications.	K4	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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**	Demonstrate Newton- Raphson method.	K3	1	2M
	b	Write Lagrange Interpolation formula.	K6	1	2M
	c	Write Simpson's $1/3^{rd}$ rule formula.	K6	2	2M
	d	If $\frac{dy}{dx} = -y, y(0) = 1, h = 0.001$,then find the value of y_1 using Euler's method.	K3	2	2M
	e	Demonstrate mean, median and mode of a discrete random variable.	K3	3	2M
	f	The mean and variance of a binomial distribution are 4 and 4/3 respectively. Find p(x≥2).	K3	3	2M
	g	A sample of size 400 is taken from a population whose S.D is 16.Find the standard error.	K3	4	2M
	h	Define point estimation with an example.	K4	4	2M
	i	Illustrate Type II error?	K4	5	2M
	j	Find $F_{0.05}$ with $\nu_1 = 7$ and $\nu_2 = 15$	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) Find a real root of equation $x^3 - x - 11 = 0$ by bisection method.	K3	1	5M
		ii) Find $\sqrt{28}$ by Newton's iteration method.	K3	1	5M
		OR			
	b	i)Applying Newton's Forward difference formula, Evaluate $\sqrt{5.5}$, given that $\sqrt{5}$ =2.236, $\sqrt{6}$ =2.449, $\sqrt{7}$ =2.646 and $\sqrt{8}$ =2.828.	K4	1	5M
		Find the Interpolating polynomial for the following data x: 0, 1, 2, 3 F(x): 2, 3, 12, 147	K3	1	5M
3		Unit-II			
	a	Evaluate $\int_0^6 \frac{e^x}{1+x} dx$ using (a) Trapezoidal rule (b) Simpson's $1/3^{rd}$ rule	K3	2	10 M

		OR			
	b	i) Evaluate y(0.1) and y(0.2) by Euler's method for $\frac{dy}{dx} = x + y, \quad y(0) = 2$	K3	2	5M
		ii) Using R-K method of 4^{th} order, find y (0.2) given that $y' = y - x, \quad y(0) = 2$, taking h=0.2.	K3	2	5M
4		Unit-III			
	a	A random variable X has the following probability function Find (i) K (ii)Mean (iii)Variance *x*: -3, -2, -1, 0, 1, 2, 3 *P(x)*: *K*, *0.1*, *K*, *0.2*, *2K*, *0.4*, *2K*	K3	3	10 M
		OR			
	b	i) 20% of items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random (i) none is defective (ii) one is defective (iii) P(1<x<4)	K3	3	5M
		ii) In a Normal distribution 31% of the items are under 45 and 8% are 64. Find the mean and standard deviation of the distribution.	K3	3	5M
5		Unit-IV			
	a	A population consists of five numbers 2, 3, 6, 8 and 11. Consider all possible samples of size two which can be drawn with replacement from this population. Find i)The mean of the population ii)The standard deviation of the population iii)The mean of the sampling distribution of means and iv)The standard deviation of the sampling distribution of means.	K4	4	10 M
		OR			
	b	i)What is the maximum error one can expect to make with probability 0.90when using the mean of a random sample of size n=64 to estimate the mean of population with variance 2.56.	K3	4	5M
		ii) Among 900 people in a state 90 are found to be chapatti eaters. Construct 99% confidence interval for the true proportion	K4	4	5M
6		Unit-V			
	a	i) A sample of 64 students has a mean weight of 70 kgs. Can this be regarded as a sample from a population with mean weight 56 kgs and standard deviation 25 kgs.	K3	5	5M
		ii) Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. test the hypothesis that proportions of men and women in favour of the proposal are same, at 5%.	K3	5	5M
		OR			
	b	Two horse A and B were tested according to the time (in seconds) to run a particular track with the following results. Horse-A: 28, 30, 32, 33, 33, 29 Horse- B: 29, 30, 30, 24, 27, 29 Test whether the two horses have the same running capacity.	K2	5	10 M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

Sub Code: R23CE2103 **SURVEYING**

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	Classify surveying based on the instruments used.	1	1	2M
	b	Distinguish between true bearing and magnetic bearing.	2	1	2M
	c	What is meant by M.S.L?	1	2	2M
	d	Sketch the contours for a) hill b) pond.	2	2	2M
	e	Mention the types of theodolites.	1	3	2M
	f	What is traversing?	1	3	2M
	g	What is the difference between LiDAR survey and drone survey?	2	4	2M
	h	List out the types of curves.	1	4	2M
	i	What is the use of stereoscopy?	1	5	2M
	j	Compare aerial triangulation and radial triangulation.	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	A steel tape 20 m long standardized at 55ºF with a pull of 10 kg was used for measuring a base line. Find the correction per tape length, if the temperature at the time of measurement was 80 ºF and the pull exerted was 16 kg. Weight of 1 cubic cm of steel = 7.86 g, weight of tape = 0.8 kg and E = 2.109 x 10^6 kg/cm^2. Coefficient of expansion of tape per 1ºF = 6.12 x 10^{-6}.	3	1	10M
		OR			
	b	The following bearings were observed while traversing with a compass. Mention which stations were affected by local attraction and determine the corrected bearings. LINE F.B B.B AB 45° 45' 226°10' BC 96°55' 277° 5' CD 29°45' 209°10' DE 324° 48' 144° 48'	3	1	10M
3		Unit-II			
	a	In order to find the difference in elevation between two points A and B, a level was set upon the line AB, 60 metres from A and 1280 metres from B. The readings obtained on staff kept at A and B was 0.545 m and 3.920 m respectively. Find the true difference in elevation between A and B.	3	2	10M

		OR			
	b	An embankment of width 8 m and side slopes 1.5:1 is required to be made on the ground which is levelled in a direction transverse to the centre line. The centre height at 24 m intervals is as follows 0.80, 1.42, 1.90, 2.20, 2.65, 2.20, 2.20, 1.65, 1.30 and 0.90. Calculate the volume of earthwork to be carried out informing the embankment.	3	2	10M
4		Unit-III			
	a	Explain the temporary adjustments of theodolite.	2	3	10M
		OR			
	b	Discuss the methods of traversing.	2	3	10M
5		Unit-IV			
	a	Describe the tacheometric surveying in detail.	2	4	10M
		OR			
	b	Illustrate the principle and types of E.D.M. instruments.	2	4	10M
6		Unit-V			
	a	Elucidate the terrestrial photogrammetry in detail.	2	5	10M
		OR			
	b	Elaborate the mapping using stereo-plotting instruments.	2	5	10M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

II B.Tech I Semester Supple. Examinations, May-2026

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	How stress and strain are related in elastic region.	1	1	2M
	b	State Hooke's law	1	1	2M
	c	List various types of supports in beams.	1	2	2M
	d	Draw the bending moment diagram for cantilever beam having uniformly distributed load throughout its length. Show its value.	3	2	2M
	e	What do you mean by pure bending?	1	3	2M
	f	Define neutral axis. Write the location of neutral axis.	1	3	2M
	g	When the Macaulay's method is preferred to calculate the deflections in beam.	1	4	2M
	h	Write the differential equation for deflection.	3	4	2M
	i	What are the limitations of Euler's theory	1	5	2M
	j	Differentiate thin cell and thick cell.	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 stress strain curve for mild steel mark the salient features.	3	1	5M
		ii) A mild steel rod 20mm diameter and 300mm long is enclosed centrally inside a hallow copper tube of same length, external diameter 30mm and internal diameter 25mm.The end of the tube are brazed together and the composite bar is subjected to axial pull of 40kN. If E for steel and copper is 200 GN/m^2 and 100 GN/m^2 respectively .Find the stress developed in the rod the tube find the extension of the rod.	3	1	5M
		OR			
	b	i) Derive equation for the relation between three elastic constants i.e. E, G and K.	4	1	5M
		ii) A bar of 25 mm. diameter is subjected to a pull of 70 kN. The extension measured on a gauge length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. Find poisson's ratio and values of three elastic constants i.e. E, G and K	3	1	5M
3		Unit-II			
	a	i) A cantilever 1.5m long is loaded with a uniformly distributed load of 2kN/m run over a length of 1.25m from the free end. It also carries a point load of 3kN	3	2	5M

		at a distance of 0.25m from the free end. Draw the shear force and bending moment diagrams of the cantilever.			
		ii) A beam of 10m long is simply supported and carries a load of uniformly varying from 50kN/m at the left end to 150kN/m at the right end. Draw the shear force and bending moment diagrams.	3	2	5M
		OR			
	b	i) A simply supported beam of length 8m rests on supports 6m apart, the right hand end is overhanging by 2m. The beam carries a uniformly distributed load of 1500N/m over the entire length. Draw S.F. and B.M. diagrams and find the point of contraflexure, if any	3	2	5M
	b	ii) A beam 6m long rests on two supports 5m apart. The right end is overhanging by 1m. The beam carries a uniformly distributed load of 1.5kN/m over the entire length of the beam. Draw S.F. and B.M. diagram and find the amount and position of maximum bending moment	3	2	5M
4		Unit-III			
	a	i) A steel plate is bent into a circular arc of radius 12metres. If the plate section be 100mm wide and 20mm thick find the maximum stress induced and the bending moment which can produce this stress. Take $E=2x10^5$ N/mm^2.	3	3	5M
	a	ii) A rectangular beam 300mm deep is simply supported over a span of 4 metres. Determine the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed 120 N/mm^2. Take $I = 8x10^5$ mm^4.	3	3	5M
		OR			
	b	i) Derive the bending equation from fundamentals M/I= f/y=E/R	4	3	5M
	b	ii) A square of 30mm side is used as a beam with its diagonal in the horizontal position. If the vertical shear force at a section is 3kN, determine the value and the location of the maximum shear stress occurring in the cross section. Also, determine the shear stress at the bottom.	3	3	5M
5		Unit-IV			
	a	i) A simply supported beam AB of span 4 metres is carrying a uniformly distributed load of 2kN/m over the entire span. Find the maximum slope and deflection of the beam. Take EI=80X10^9 N-mm^2.	3	4	5M
	a	ii) A beam of length 10m is simply supported at its ends and carries two point loads of 100kN and 60kN at a distance of 2m and 5m respectively from the left support. Calculate the deflections under each load. Find also the maximum deflection. Take $I=18x10^8$ mm^4 and $E=2x10^5$ N/mm^2.	3	4	5M
		OR			
	b	i) A cantilever of length 3m carries a uniformly distributed load of 10kN/m over a length of 2m from the free end. If $I=10^5$ mm^4 and $E=2x10^5$ N/mm^2 ; find: (i) slope at the free end and (ii) deflection at the free end	3	4	5M
	b	ii) A cantilever of uniform section is loaded with 20kN at the free end. In addition to this a uniformly distributed load of 10kN/m run is provided over entire span. Calculate the maximum deflection and slope. The cantilever is 3m long, 10cm wide and 30cm deep $E=210x10^6$ kN/m^2	3	4	5M
6		Unit-V			
	a	i) A hollow cylindrical cast iron column is 4m long with, both ends fixed. Determine the minimum diameter of the column if it has to carry a safe load of 250kN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take $\sigma c=550$N/mm^2 and $\alpha=1/1600$ in Rankine's formula.	3	5	5M
		ii) Derive the expressions for the circumferential stress and longitudinal stress for thin cylindrical shell subjected to internal pressure 'p'.	4	5	5M
		OR			

		i) A steel column is of length 9m and diameter 500mm with both ends fixed. Determine the crippling load by Euler's formula. Take E=2.1x10^5 N/mm^2	3	5	5M
	b	ii) A Thin cylindrical shell 3m long has 1m internal diameter and 15mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions of the shell, if it is subjected to an internal pressure of1.5 N/mm 2 Take E=2x10^5 N/mm^2 and Poisson's ratio =0.3. Also calculate change in volume.	3	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

Sub Code: R23CE2105 **FLUID MECHANICS**

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 compressibility and bulk modulus.	1	1	2M
	b	State Newton's law of Viscosity.	1	1	2M
	c	What is meant by the intensity of pressure? How does it vary with the depth of fluid?	1	2	2M
	d	State Pascal's law.	1	2	2M
	e	Define ideal and real fluid.	1	3	2M
	f	Define stream function and potential function.	1	3	2M
	g	Write Bernoulli's equation.	1	4	2M
	h	Define Mach number. Give its equation.	1	4	2M
	i	Define the major energy loss and minor energy loss.	1	5	2M
	j	Define Total Energy Line.	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) An oil of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m × 0.9 m slides down an inclined plane inclining 20° with the horizontal. The weight of the square plate is 392.4 N, and it slides down the plane with a uniform velocity of 0.2 m/s. Find the kinematic viscosity of oil. The specific gravity of the oil is 0.7.	3	1	5M
		ii) The capillary rise in a glass tube is not to exceed 0.2mm of water. Determine its minimum size given that surface tension for water in contact with air is 0.0725N/m.	4	1	5M
		OR			
	b	i) Determine the specific gravity of a fluid having a viscosity of 0.05 poise and a kinematic viscosity of 0.035 stokes.	4	1	4M
		ii) Define capillarity. Derive an expression for the capillary rise of water in a glass tube.	2	1	6M
3		Unit-II			
	a	i) A simple manometer is used to measure the pressure of oil (s = 0.8) flowing in a pipeline. Its right limb is open to the atmosphere, and the left limb is connected to the pipe. The centre of the pipe is 90mm below the level of mercury in the right limb. If the difference in mercury level in the two limbs is 150mm, determine the absolute pressure of oil in the pipe in KPa.	4	2	6M
		ii) Derive an expression for total pressure force and depth of pressure for a vertical surface submerged in water.	2	2	4M

	OR				
	b	i) Distinguish between (i) Absolute pressure, (ii) Gauge pressure, (iii) Gauge vacuum, and (iv) Atmospheric pressure. Indicate their relative positions on a chart.	2	2	6M
		ii) What are the conditions of equilibrium of a floating body? Explain them.	2	2	4M
4	Unit-III				
	a	i) Define compressible and in compressible flow.	1	3	2M
		ii) Derive the general three-dimensional continuity equation in Cartesian coordinates and then reduce it to the continuity equation for steady, three-dimensional in compressible flow.	2	3	8M
	OR				
	b	i) Define steady and unsteady flow.	1	3	2M
		ii) For the two-dimensional flow defined by u = x - 4y and v = -y - 4x, obtain stream and velocity potential function.	3	3	8M
5	Unit-IV				
	a	i) Write the Momentum equation. Mention the different applications of the Momentum equation.	2	4	4M
		ii) A 45^0 reducing bend is connected to a pipeline, with diameters at the inlet and outlet of the bend being 600 mm and 300 mm, respectively. Find the force exerted by the bend on water if the intensity of pressure at the inlet to bend is 8.829 N/cm2 and the rate of water flow is 600 litres/s.	2	4	6M
	OR				
	b	i) Derive an expression for discharge through a horizontal venturimeter.	2	4	6M
		ii) What is the physical significance of Reynold's number?	3	4	4M
6	Unit-V				
	a	i) What are the various minor losses?	2	5	2M
		ii) Determine the rate of flow of water through a pipe with a diameter of 20 cm and a length of 50 m when one end of the pipe is connected to a tank and the other end of the pipe is open to the atmosphere. The pipe is horizontal, and the height of the water in the tank is 4 m above the centre of the pipe. Consider all minor losses and take f = 0.009. Also, draw the hydraulic gradient line and total energy line.	4	5	8M
	OR				
	b	i) Explain pipes in series and parallel.	2	5	2M
		ii) In a pipe of 400 mm diameter and 100 mm length, water is flowing at a velocity of 3.5 m/s. Find the head loss due to friction using (i) Darcy – Weisbach formula and (ii) Chezy's formula for which c = 55.	3	5	8M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

Sub Code: R23DS2107 **INTRODUCTION TO DATA SCIENCE**

Time: 3 hours (DS) 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 Big Data and its relationship with Data Science.	K1	1	2M
	b	Give two Differences between Data Science and Big Data.	K1	1	2M
	c	What are the applications of Machine Learning in Data Science?	K2	2	2M
	d	What is feature engineering and why is it important?	K2	2	2M
	e	Explain the concept of ACID properties.	K2	3	2M
	f	What are the types of NoSQL databases?	K1	3	2M
	g	What is Neo4j and why is it used in Data Science?	K2	4	2M
	h	Define text mining and its uses.	K1	4	2M
	i	List different Data Visualization tools.	K1	5	2M
	j	State the key features of dc.js library.	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) Explain the Data Science process with neat diagram.	K2	1	5M
		ii) Discuss the major challenges faced during data collection and cleaning.	K3	1	5M
		OR			
	b	i) Describe how goals are defined in a Data Science project.	K3	1	5M
		ii) Explain data retrieval, cleansing, and transformation in data science.	K3	1	5M
3		Unit-II			
	a	i) Explain the importance of semi-supervised learning.	K2	2	5M
		ii) Explain the model selection, validation and prediction process.	K2	2	5M
		OR			
	b	i) Describe the problems in handling large data and general techniques to solve them.	K3	2	5M
		ii) Explain the use of sklearn for implementing ML algorithms.	K2	2	5M
4		Unit-III			
	a	Discuss the CAP theorem and its significance in distributed systems.	K3	3	10M

		OR			
	b	i) Explain the differences between ACID and BASE principles.	K2	3	5M
		ii) Write a short note on BASE principle and its importance.	K4	3	5M
5		Unit-IV			
	a	i) Explain the concept of graph queries using Cypher language.	K2	4	5M
		ii) Illustrate graph database applications with examples.	K4	4	5M
		OR			
	b	Describe Python libraries for text mining and analytics.	K3	4	10M
6		Unit-V			
	a	i) Explain the role of Data Visualization in understanding data insights.	K2	5	5M
		ii) Explain how Crossfilter is used for interactive data filtering.	K3	5	5M
		OR			
	b	Apply the Data Science process for a real-world problem-solving case study	K5	5	10M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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	Define a sample space with a suitable example.	1	1	2M
	b	Differentiate between discrete and continuous random variables.	1	1	2M
	c	Define the expected value of a random variable.	1	2	2M
	d	What is a moment generating function.	1	2	2M
	e	Define joint distribution function for two random variables.	1	3	2M
	f	What is a marginal distribution function.	1	3	2M
	g	What is an autocorrelation function.	1	4	2M
	h	What is the difference between deterministic and non-deterministic processes?	1	4	2M
	i	Define the cross-power spectral density function.	1	5	2M
	j	Define Narrow band process.	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) A random variable X has pdf $f_X(x) = k(1 + 4x)$, for $0 \le x \le 1$. Find the constant k and Cumulative distribution function of random variable	3	1	5M
		ii) A fair coin is tossed 5 times. Let X be the number of heads obtained. Find the probability of getting exactly 3 heads.	3	1	5M
		OR			
	b	i) State and explain Bayes' Theorem.	2	1	5M
		ii) The number of calls arriving at a call centre follows a Poisson distribution with a mean of 5 calls per minute. What is the probability that exactly 3 calls arrive in a given minute?	3	1	5M
3		Unit-II			
	a	i) If a random variable X has PDF: $f(x)=\frac{3}{8}(2-x)^2, 0 \le x \le 2$ and 0 otherwise. Find the **expected value**, **variance**, and the **characteristic function** of X.	3	2	5M
		ii) For a random variable X with PDF $f(x)=e^{-x}$, $x \ge 0$ find the moment generating function $M_X(t)$.	2	2	5M
		OR			
	b	i) State and prove Chebyshev's Inequality for a random variable.	2	2	5M
		ii) Let X be uniformly distributed over [−1,1]. Find the PDF of $Y=X^2$.	3	2	5M

4	Unit-III				
	a	i) Explain the properties of a joint cumulative distribution function (CDF) for two random variables.	2	3	5M
		ii) If $f_{X,Y}(x,y)=1/4$, $0 \le x \le 2$, $0 \le y \le 2$ Determine whether whether X and Y are independent.?	3	3	5M
	OR				
	b	i) State and prove central limit theorem.	2	3	5M
		ii) Let the joint PDF be: $f_{X,Y}(x,y)=6(1-y), 0 < x < y < 1$, Find the conditional PDF $f_{X \mid Y}(x \mid y)$.	3	3	5M
5	Unit-IV				
	a	i) Define the cross-correlation function of two random processes. Explain its properties.	2	4	5M
		ii) Given a WSS random process X(t) with autocorrelation function, $R_X(\tau)=4e^{-2\lvert\tau\rvert}$. Find the mean, variance.	3	4	5M
	OR				
	b	i) Explain time averages and ensemble averages.	2	4	5M
		ii) Find the autocorrelation function $R_X(\tau)$ for a random process $X(t) = A\cos(\omega t+\theta)$, where A and ω are constants, and $\theta \sim U[0,2\pi]$.	3	4	5M
6	Unit-V				
	a	i) State and prove Wiener–Khinchin theorem.	2	5	5M
		ii) Find the power spectral density $S_X(f)$ given the autocorrelation function of a wide-sense stationary (WSS) random process: $R_X(\tau)=e^{-\lvert\tau\rvert}$.	3	5	5M
	OR				
	b	i) Show that the power spectral density of a real WSS process is an even function.	2	5	5M
		ii) Derive the expression for the output power spectral density $S_{YY}(\omega)$ of a wide-sense stationary (WSS) random process passed through a linear time-invariant (LTI) system.	3	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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	Write the expression for a unit step and unit ramp signals and give the relation between them.	3	1	2M
	b	Define Aliasing effect and write the conditions to avoid aliasing in signal reconstruction.	1	1	2M
	c	Define mean square error (MSE) in signal approximation.	1	2	2M
	d	State Dirichlet's conditions for the existence of a Fourier series.	1	2	2M
	e	Find the Fourier Transform of an exponential signal $x(t)=e^{-at}u(t)$.	3	3	2M
	f	State time convolution property of a Fourier Transform.	1	3	2M
	g	Find the Laplace Transform of $x(t)=t\ e^{-3t}u(t)$	3	4	2M
	h	State Initial and Final Value theorems of Z transform	1	4	2M
	i	Differentiate between Linear Time Invariant and Linear Time Invariant Systems.	4	5	2M
	j	Describe the differences among ideal low-pass, high-pass, and band-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) Define signal. Classify signals with examples.	1	1	5M
		ii) Sketch the waveforms of the Signal $x(t)=2u(t+2)-2u(t-3)$	3	1	5M
		OR			
	b	i) Check whether the signal y(t)=2x(t) is Linear, causal and time variant or not.	3	1	5M
		ii) State and prove sampling theorem for low pass signals.	1	1	5M
3		Unit-II			
	a	i) Define the error function while approximating signals and hence derive the expression for condition for orthogonality between two waveforms $f_1(t)$ and $f_2(t)$.	1	2	5M
		ii) Evaluate the Trigonometric Fourier series expansion for the Periodic waveform x(t)= A for $0 \le t \le \pi$ -A for $\pi \le t \le 2\pi$	3	2	5M
		OR			
	b	i) Discuss the Orthogonal Signal Space and obtain the expression for mean signal error	2	2	5M
		ii) State and prove any three properties of Fourier Series	1	2	5M

4	Unit-III				
	a	i) Find the Fourier transform of the DC Signal	3	3	5M
		ii) State and prove any three Fourier transform properties.	1	3	5M
	OR				
	b	i) Determine the Fourier Transform of $x(t)=\cos(\omega_0 t)u(t)$	3	3	5M
		ii) Discuss about Hilbert transform with required equations	2	3	5M
5	Unit-IV				
	a	i) Find the Laplace transform of $x(t)=\sin(\omega t)u(t)$	3	4	5M
		ii) State and prove any three properties of z-transform	1	4	5M
	OR				
	b	i) Discuss various properties of ROC of Laplace transform.	2	4	5M
		ii) Find the inverse z-transform of using $x(t)=\frac{3z}{(z-1)(z-4)}$ using Partial fraction method.	3	4	5M
6	Unit-V				
	a	i) Define LTI system? Explain its properties. Derive an expression for the transfer function of an LTI system.	1	5	5M
		ii) Distinguish between Static and dynamic systems, Causal and Non-Causal systems, Stable and Unstable systems.	4	5	5M
	OR				
	b	i) Discuss the conditions for the Distortionless transmission through a system.	2	5	5M
		ii) Sketch the ideal filter characteristics. What is the condition for realizability of these filters?	3	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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	Distinguish between intrinsic and extrinsic semiconductors	2	1	2M
	b	Define static and dynamic resistance of a PN diode	1	1	2M
	c	Draw the symbols of Zener diode and photo diode also give one application	1	2	2M
	d	Write the importance of capacitor in filter circuits	1	2	2M
	e	Write a Short note on current components of BJT	1	3	2M
	f	Define the early effect of BJT	1	3	2M
	g	What is Need for biasing	1	4	2M
	h	Define thermal runaway	1	4	2M
	i	Give the Relation among the $\mu, g_{m,} \wedge r_d$	1	5	2M
	j	Draw the symbols MOSFETS	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 V-I characteristics of PN diode in forward bias condition	2	1	5M
		ii)	Discuss about transition and diffusion capacitance	2	1	5M
	OR					
	b	i)	Derive the expression of diode current equation	4	1	5M
		ii)	Explain the effect of temperature dependance on PN Diode V-I characteristics	2	1	5M
3	Unit-II					
	a	i)	Derive the expression of efficiency for half wave rectifier circuit	4	2	5M
		ii)	Describe how Zener diode act as voltage Regulator	2	2	5M
	OR					
	b	i)	with neat sketch explain the tunnelling phenomena of tunnel diode	2	2	5M
		ii)	Draw the circuit diagram of Bridge rectifier and explain its operation	2	2	5M
4	Unit-III					
	a	i)	With necessary equations explain how transistor act as an Amplifier	2	3	5M
		ii)	Explain the input and out characteristics of common base configuration	2	3	5M
	OR					
	b	i)	Give the relation among $\alpha, \beta \wedge \gamma$	3	3	5M
		ii)	Explain the input and out characteristics of common emitter configuration	2	3	5M

5		Unit-IV				
	a	i)	Derive the expression of stability factor S for collector to base bias circuit	4	4	5M
		ii)	Define Quiescent point, explain how to fixup the Q-point on a DC Load line	2	4	5M
		OR				
	b	i)	write a short note on (a) Thermistor (b) Stability factor	2	4	5M
		ii)	For self-bias circuit the values of components V_{cc}=12v.R_1=50KΩ, R_2=70 KΩ, R_c=2 KΩ, R_e=1 KΩ, β=40, V_{be}=0.7V. Determine (a) I_B, (b) I_C and stability factor	4	4	5M
6		Unit-V				
	a	i)	Explain the drain characteristics of JFET with neat sketches	2	5	5M
		ii)	Describe the working principle and characteristics of Depletion-type MOSFET	2	5	5M
		OR				
	b	i)	Distinguish between JFET and MOSFET	2	5	5M
		ii)	Explain the negative resistance property of SCR	2	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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	Convert the following: $(57.67)_{10}$ to base 2.	K3	1	2M
	b	Convert the following: $(AB03)_{16}$ to base 8.	K3	1	2M
	c	Construct a Half Adder using NOR gates.	K3	2	2M
	d	State the De Morgan theorems.	K1	2	2M
	e	Draw an Excess-3 adder circuit.	K2	3	2M
	f	Compare Combinational and Sequential Circuits.	K1	3	2M
	g	Compare synchronous and Asynchronous counters.	K2	4	2M
	h	Draw the 4-bit PIPO shift register.	K2	4	2M
	i	Write the merits and demerits of PROM.	K1	5	2M
	j	Compare CPLD and FPGAs.	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) Perform BCD arithmetic on the following: a) $45_{10}+37_{10}$ b) 00010011+00100110	K3	1	5M
	a	ii) (a) Subtract 1011-1101 using 2's complement. (b) Convert the following to Gray numbers: (i) $2A4_{16}$, (ii) 479_{10}	K3	1	5M
		OR			
	b	i) Perform the excess-3 arithmetic of the following numbers: a) $(8)_{10}-(6)_{10}$ b) $(6)_{10}+(8)_{10}$	K3	1	5M
	b	ii) (a) Convert Hexadecimal Number $(AF8.01)_{16}$ to binary. (b) Convert Hexadecimal Number $(7EBF.B1)_{16}$ to decimal.	K3	1	5M
3		Unit-II			
	a	i) Realize OR and X-OR gates using NAND gates.	K3	2	5M
	a	ii) Minimize the following logic function using K-maps and realize using NOR gates. $F(A,B,C,D) = \Sigma(0,1,2,5,7,8,9,10,13,15)$	K3	2	5M

		OR			
	b	i) Simplify the following Boolean function F, using the K-MAP method F(A,B,C,D) = Σ (0,1,3,5,7,8,9,11,13,15)	K3	2	5M
		ii) Draw the multi-level two-input NOR circuit for the following expression: F=(A'+B)C+F'+DE).	K3	2	5M
4		Unit-III			
	a	i) Design a full adder using 4×1 MUX.	K3	3	5M
		ii) Design a Full Adder using NAND gates.	K2	3	5M
		OR			
	b	i) Define Decoder. Construct a 4x16 Encoder using logic gates and a truth table.	K2	3	5M
		ii) Implement the following Boolean function using 8x1 Multiplexers. F(A, B, C, D)=Σ(1, 3, 4, 11, 12, 13, 14, 15).	K3	3	5M
5		Unit-IV			
	a	i) Convert the JK flip flop to a T flip flop.	K2	4	5M
		ii) Draw and explain the 4-bit SIPO and SISO shift registers with their timing diagrams.	K3	4	5M
		OR			
	b	i) Construct a Ring counter and explain its working principle with proper diagrams.	K2	4	5M
		ii) Explain the operation of the JK Master Slave Flip-Flop with the excitation table.	K3	4	5M
6		Unit-V			
	a	i) Implement the following Boolean functions using PLA $F_1(X, Y, Z) = \sum m(3, 5, 6, 7)$ $F_2(X, Y, Z) = \sum m(5, 6, 7)$ $F_3(X, Y, Z) = \sum m(3, 5)$	K3	5	5M
		ii) Write the different types of PLDs and compare the combinational PLDs.	K2	5	5M
		OR			
	b	i) Implement the following Boolean functions using the PAL: W(A,B,C,D) = Σ m(4, 13, 14) X(A,B,C,D) = Σ m(8, 9, 10, 11, 12, 13, 14, 15) Y(A,B,C,D) = Σ m(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12) Z(A,B,C,D) = Σ m(1, 2, 8, 12, 13).	K3	5	5M
		ii) Design and implement a Full Adder with PLA.	K3	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
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R23

II B.Tech I Semester Supple. Examinations, May-2026

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	State the principle of the Bisection method**.**	L2	1	2M
	b	Write the iterative formula for the Newton–Raphson method.	L1	1	2M
	c	Compute $\int_0^1 x^3 dx$ with five sub-intervals by Trapezoidal rule	L3	2	2M
	d	Write the Trapezoidal rule for numerical integration.	L1	2	2M
	e	Test whether the function f(z) = z^2 is analytic or not.	L3	3	2M
	f	Write the Cauchy's Integral formula.	L1	3	2M
	g	Obtain the Taylors series expansion of $\frac{Z+2}{Z}$	L2	4	2M
	h	Calculate the residue of the function $f(z) = \frac{z^2}{(z-1)^2(z+2)}$ at the pole z=2.	L3	4	2M
	i	Define *conformal mapping*.	L1	5	2M
	j	Find the invariant points of the transformation w = $\frac{z-1}{z+1}$	L2	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 equation $x^3 - x - 11 = 0$ by bisection method.	L4	1	5M
		ii) Find $f(2.5)$ using Newton's forward formula from the following table.	L3	1	5M

x	0	1	2	3	4	5	6
y	0	1	16	81	256	625	1296

		OR					
	b	i) Find the real root of the equation $x\ e^x = 3$ by Regular-falsi method.	L3	1	5M
		ii) Using Lagrange is interpolation formula find the value of $f(10)$ from the following table	L3	1	5M

x	5	6	9	11
y	12	13	14	16

3		Unit-II			
	a	i) Use Simpson's 1/3rd rule and Simpson's 3/8th rule to estimate $\int_0^6 \frac{1}{1+x^2}dx$	L4	2	5M
	a	ii) Using Taylor's series method, compute the value of y at x=0.2 from $\frac{dy}{dx}=x+y$, $y(0)=1$.	L4	2	5M
		OR			
	b	Compute $y(0.1)$ and $y(0.2)$, if $y(x)$ is the solution of initial value problem $y'=y^2+xy$, $y(0)=1$ by Runge-Kutta method.	L2	2	10M
4		Unit-III			
	a	Show that the function f(z) = $\sqrt{\lvert xy \rvert}$ is not analytic at the origin even though C-R equations are satisfied there of ?	L2	3	10M
		OR			
	b	Find $\int_c \frac{1}{(z-1)(z-3)}dz$ with C: $\lvert z \rvert = 2$ using Cauchy's integral formula.	L3	3	10M
5		Unit-IV			
	a	i) Expand the function $f(z)=\frac{1}{(z-1)(z-3)}$ as Laurent's series in the region $0<\lvert z-1 \rvert<2$	L2	4	5M
	a	ii) Using Taylor's series, find expansion of $f(z)=\frac{2z^3+1}{z^2+z}$ about the point i) z=1, ii) z=i	L2	4	5M
		OR			
	b	Evaluate $\oint_c \frac{\sin\pi(z)^2+\cos\pi(z)^2}{(z-1)^2(z-2)}$dz, where C is the circle $\lvert z \rvert = 3$ by using Residue theorem.	L3	4	10M
6		Unit-V			
	a	i) Define bilinear transformation. Find the bilinear transformation which maps the points $z=1,i,-1$ onto the points $w=i,0,-i$	L2	5	10M
		OR			
	b	i) Show that the transformation $w=\frac{2z+3}{z-4}$ changes the circle $x^2+y^2-4x=0$ into the straight line 4u+3=0.	L2	5	10M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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 do you mean by Gaussian surface?	K1	1	2M
	b	State Gauss's law.	K1	1	2M
	c	Distinguish between conductors and insulators.	K2	2	2M
	d	Write ohm's law in point form.	K1	2	2M
	e	States the Ampere's circuital law.	K1	3	2M
	f	Write the maxwell's third equation and its significance.	K1	3	2M
	g	What is solenoid?	K1	4	2M
	h	What is a magnetic dipole?	K1	4	2M
	i	State Poynting Theorem.	K1	5	2M
	j	What is mean by displacement current?	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) Derive Poisson's and Laplace's equations from fundamentals	K3	1	5M
		ii) What do you mean by potential difference and state its salient features?	K2	1	5M
		OR			
	b	i) Explain the concept of electric field and write down expression for the electric field due to a point charge.	K2	1	5M
		ii) Calculate electric field E at a point P (3, -4, 2) in free space due to (i) a charge Q1 = 4μC at A (0, 0, 0) (ii) a charge Q2 = 2μC at B (-1, 2, 4)	K3	1	5M
3		Unit-II			
	a	i) Derive the expression of Electric Potential and Electric Field Intensity due to an electric dipole.	**K2**	2	5M
		ii) Derive the continuity equation and Ohm's law in point form.	**K2**	2	5M
		OR			
	b	i) Derive the boundary conditions of electric filed for perfect dielectric materials.	**K2**	2	5M
		ii) Derive the expression of capacitance for a co-axial cable.	**K2**	2	5M
4		Unit-III			
	a	i) Explain and derive Lorentz force equation.	**K2**	3	5M
		ii) Derive the expression for field intensity due to infinity long straight conductor using Biot-Savart's law.	**K2**	3	5M

		OR			
	b	i) Derive the expression for force between two parallel current carrying conductors, if currents are in the same direction?	**K2**	3	5M
		ii) Determine the inductance of a solenoid of 2500 turns wound uniformly over a length of 0.25m on a cylindrical paper tube, 4 cm in diameter and the medium is air.	**K3**	3	5M
5		Unit-IV			
	a	i) Derive the expression for Inductance of toroid.	**K2**	4	5M
		ii) Derive an expression for the mutual inductance between two coaxial solenoids.	**K2**	4	5M
		OR			
	b	i) Derive the expression for self-inductance of a coaxial cable of inner radius 'a' and outer radius 'b'.	**K2**	4	5M
		ii) Derive an expression for energy stored in a magnetic field.	**K2**	4	5M
6		Unit-V			
	a	i) Describe the modification of Maxwell's equations for time varying fields	**K2**	5	5M
		ii)Describe the statically and dynamically induced EMFs with necessary expressions.	**K2**	5	5M
		OR			
	b	i) State and explain faraday's laws of electromagnetic induction.	**K2**	5	5M
		ii) A parallel-plate capacitor with plate area of 5 cm2 and plate separation of 3 mm has a voltage 50 sin 103 t V applied to its plates. Calculate the displacement current assuming $\varepsilon = 2\varepsilon 0$	**K3**	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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

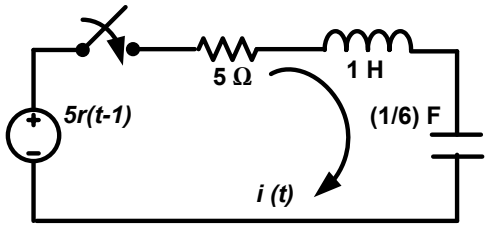
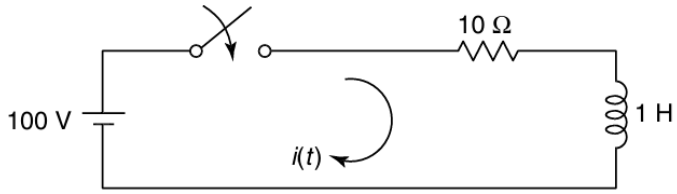
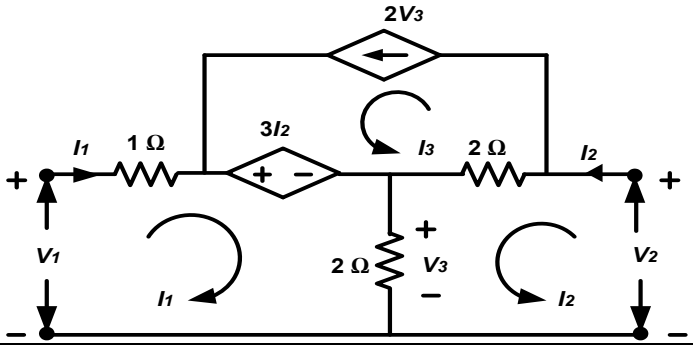
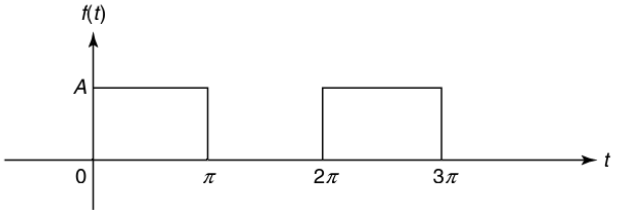
Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

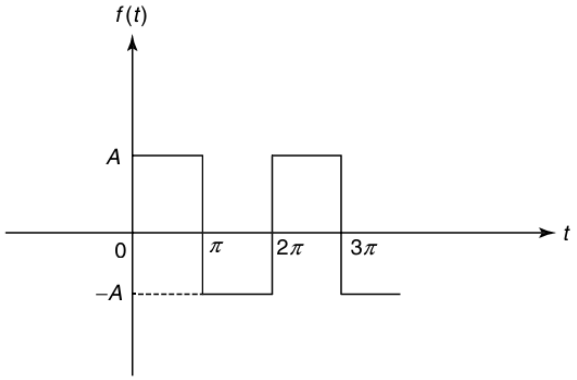
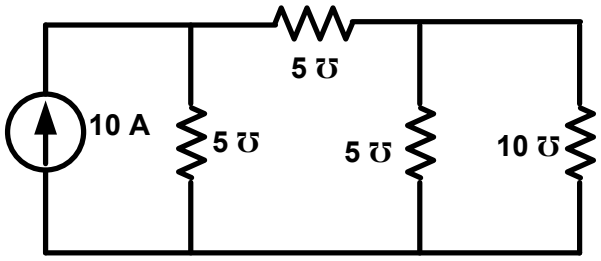
Q.No		Questions	KL	CO	M
1	a	Why three phase systems are preferred over single-phase systems for the transmission of power?	K2	1	2M
	b	How do you convert to unbalanced star to unbalanced delta system?	K2	1	2M
	c	Find the Laplace transform of function $f(t)=cos3t+e^{-4t}, t \geq 0$	K2	2	2M
	d	Draw the transient voltage response of series RL circuit with DC excitation.	K2	2	2M
	e	Define one port and what is the need of two-port networks?	K2	3	2M
	f	Write Y parameters and H-parameter equations	K2	3	2M
	g	What are the effects of harmonics in electrical systems?	K2	4	2M
	h	Explain the Quarter-wave symmetry.	K2	4	2M
	i	The reduced incident matrix of a directed graph is $A=\begin{bmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$, draw the graph.	K2	5	2M
	j	List the advantages and disadvantages of active filters.	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) With the aid of complete phasor diagram obtain the relation between line, phase voltage and currents of a three-phase Star (Y) - connected system.	K3	1	5M
		ii) Three equal star-connected inductors, consume 10 kW power at 0.85 power factor lagging when connected to 415 V, three-phase, three-wire, 50 Hz supply. Determine the line currents.	K3	1	5M
		OR			
	b	i) With the aid of phasor diagram, explain how the active and reactive powers of a three-phase unbalanced star and delta connected loads are measured in an cost-effective way.	K3	1	5M
		ii) Three coils each having a resistance of 25 Ω and reactance of 20 Ω are connected in (A) star, and (B) delta, across a three-phase, 415 V, 50 Hz supply. Calculate in each case, the readings on two wattmeter's connected to measure the power input.	K3	1	5M
3		Unit-II			
	a	For the network shown in below, determine the current ***i (t)*** when the switch is closed at ***t=0*** with zero initial conditions.	K3	2	10M

					
		OR			
	b	i) Obtain and sketch the current and voltage response of series RC circuit with DC excitation.	K2	2	5M
		ii) In the given network below, the switch is closed at t = 0. With zero current in the inductor, find i, (di/dt) and (d^2i/dt^2) at t = 0^+. 	K3	2	5M
4		Unit-III			
	a	i) Solve the network to find the ABCD-parameters as shown below. 	K3	3	10M
		OR			
	b	Derive the Z-parameters in terms of H and ABCD parameters.	K2	3	10M
5		Unit-IV			
	a	i) Evaluation of Fourier Coefficients a_0, a_n and b_n.	K2	4	5M
		ii) Find the trigonometric Fourier series of the waveform shown below. 	K3	4	5M
		OR			
	b	i) Find the value of R if the average power dissipated in the resistor is 1200 W if the voltage has the following Fourier series: v(t)=210sinωt+110sin3ωt+60sin5ωt	K3	4	5M
		ii) Find the exponential Fourier series of the waveform shown below and also draw its magnitude spectrum.	K3	4	5M

					
6		Unit-V			
	a	i) The reduced incident matrix of a directed graph is $A=\begin{bmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$, find the number of possible trees for this graph and develop the fundamental loop matrix for the same.	K3	5	4M
		ii) For the network shown below, obtain the equilibrium equation on node basis. 	K3	5	6M
		OR			
	b	i) Design a constant-k band-stop filter having cut-off frequencies at 2100 Hz and 5200 Hz and characteristic resistance of 650 Ω.	K3	5	5M
		ii) A low-pass filter is composed of a symmetrical π section. Each series branch is a 0.02 H inductor and shunt branch is a 2 μF capacitor. Find (A) cut-off frequency, (B) nominal impedance, (C) characteristic impedance at 200 Hz and 2000 Hz, (D) attenuation at 200 Hz and 2000 Hz, and (E) phase shift constant at 200 Hz and 2000 Hz.	K3	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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

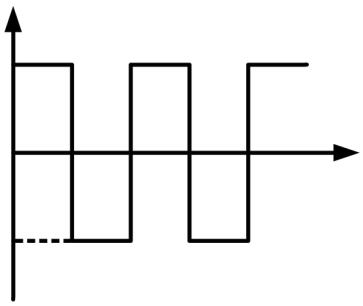
Answering all the questions from Part-A is compulsory (10 x 2M = 20M)

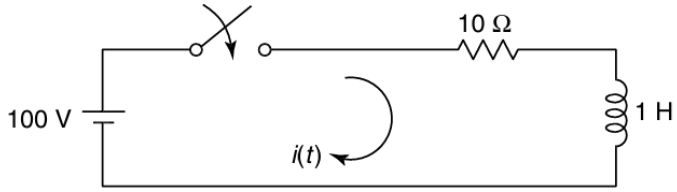
Q.No		Questions	KL	CO	M
1	a	Why three phase systems are preferred over single-phase systems for the transmission of power?	K2	1	2M
	b	How do you convert to unbalanced star to unbalanced delta system?	K2	1	2M
	c	Find the Laplace transform of function $f(t)=\cos 3t+e^{-4t}, t\geq 0$	K2	2	2M
	d	Draw the transient voltage response of series RL circuit with DC excitation.	K2	2	2M
	e	Define one port and what is the need of two-port networks?	K2	3	2M
	f	Derive the Y parameters in terms of H-parameters.	K2	3	2M
	g	Write the equations for the exponential form of the Fourier series.	K2	4	2M
	h	Explain the Quarter-wave symmetry.	K2	4	2M
	i	The reduced incident matrix of a directed graph is $A=\begin{bmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$, draw the graph.	K2	5	2M
	j	List the advantages and disadvantages of active filters.	K2	5	2M

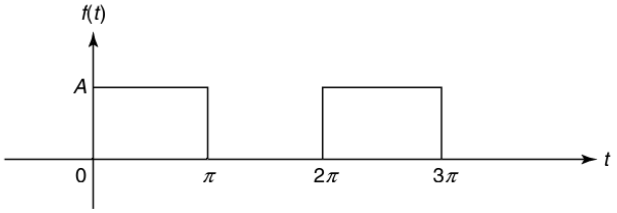
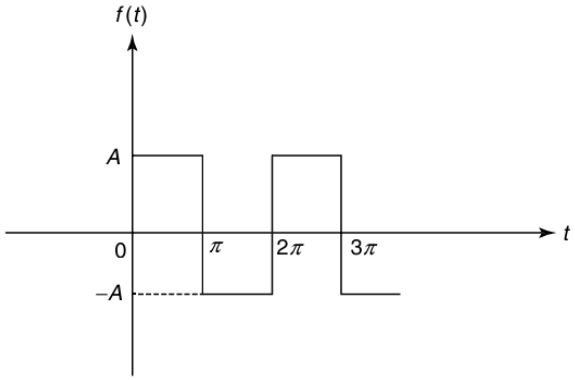
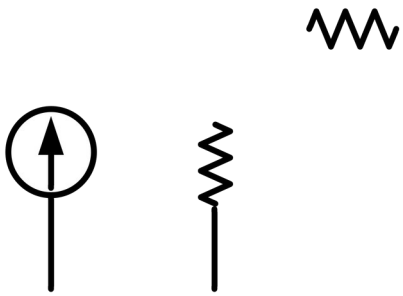
PART-B

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) With the aid of complete phasor diagram obtain the relation between line, phase voltage and currents of a three-phase Star (Y) - connected system.	K3	1	5 M
		ii) Three equal star-connected inductors, consume 10 kW power	K3	1	5

		at 0.85 power factor lagging when connected to 415 V, three-phase, three-wire, 50 Hz supply. Estimate the load parameters per phase and determine the line currents.			M
		OR			
	b	i) With the aid of phasor diagram, explain how the active and reactive powers of a three-phase unbalanced star and delta connected loads are measured in an cost-effective way.	K3	1	5 M
	b	ii) Three coils each having a resistance of 25 Ω and reactance of 20 Ω are connected in (A) star, and (B) delta, across a three-phase, 415 V, 50 Hz supply. Calculate in each case, the readings on two wattmeter's connected to measure the power input.	K3	1	5 M
3		Unit-II			
	a	i) Calculate the Laplace transform of the wave form shown below. 	K3	2	5 M
	a	ii) For the network shown in below, determine the current ***i (t)*** when the switch is closed at ***t=0*** with zero initial conditions. 	K3	2	5 M
		OR			
	b	i) Obtain and sketch the current and voltage response of series RC circuit with DC excitation.	K2	2	5 M
	b	ii) In the given network below, the switch is closed at t = 0. With zero current in the inductor, find i, (di/dt) and (d^2i/dt^2) at t = 0^+.	K3	2	5 M

					
4		Unit-III			
	a	i) Solve the network to find the ABCD-parameters as shown below. 	K3	3	5 M
		ii) Derive the Y-parameters in terms of H and ABCD parameters.	K2	3	5 M
		OR			
	b	i) Derive the Z-parameters in terms of H and ABCD parameters.	K2	3	4 M
		ii) Design equivalent T, equivalent π and lattice networks from the network shown below, comment if any. 	K3	3	6 M
5		Unit-IV			
	a	i) Evaluation of Fourier Coefficients a_0, a_n and b_n.	K2	4	5 M
		ii) Find the trigonometric Fourier series of the waveform shown below.	K3	4	5 M

					
		OR			
	b	i) Find the value of R if the average power dissipated in the resistor is 1200 W if the voltage has the following Fourier series: $v(t) = 210\sin\omega t + 110\sin 3\omega t + 60\sin 5\omega t$	K3	4	5 M
	b	ii) Find the exponential Fourier series of the waveform shown below and also draw its magnitude spectrum. 	K3	4	5 M
6		Unit-V			
	a	i) The reduced incident matrix of a directed graph is $A = \begin{bmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}$, find the number of possible trees for this graph and develop the fundamental loop matrix for the same.	K3	5	4 M
	a	ii) For the network shown below, obtain the equilibrium equation on node basis. 	K3	5	6 M
		OR			
	b	i) Design a constant-k band-stop filter having cut-off frequencies	K3	5	5 M

		at 2100 Hz and 5200 Hz and characteristic resistance of 650 Ω.			
		ii) A low-pass filter is composed of a symmetrical π section. Each series branch is a 0.02 H inductor and shunt branch is a 2 μF capacitor. Find (A) cut-off frequency, (B) nominal impedance, (C) characteristic impedance at 200 Hz and 2000 Hz, (D) attenuation at 200 Hz and 2000 Hz, and (E) phase shift constant at 200 Hz and 2000 Hz.	K3	5	5 M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

II B.Tech I Semester Supple. Examinations, May-2026

Sub Code: R23EE2105 **DC MACHINES & TRANSFORMERS**

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	Define the term armature reaction in DC machines?	K1	1	2M
	b	Name the two different load characteristics of DC generators?	K1	1	2M
	c	Name any four applications of DC series motor?	K1	2	2M
	d	Why starters are used for DC motors?	K1	2	2M
	e	What is the function of a starter?	K1	3	2M
	f	Define function of a transformer?	K1	3	2M
	g	What is Sumpner's test?	K1	4	2M
	h	Why is the short circuit test performed on HV side?	K1	4	2M
	i	What are the advantages of Y-Y connection?	K1	5	2M
	j	Show the Scott connection diagram for obtaining single phase supply from a three phase supply?	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) Derive the EMF Equation from fundamentals of DC machine?	K	1	5M
		ii) A 04 pole DC generator running at 1500 rpm has an armature with 90 slots and 06 conductors per slot. The flux per pole is 10 mwb. Determine the induced EMF if the armature winding is i)Lap ii) Wave connected	K	1	5M
		OR			
	b	What are the different types of Dc generator? Draw the circuit diagram and voltage equations for the same?	K1	1	10M
3		Unit-II			
	a	Draw a neat a sketch of a th4ree point starter for a DC shunt motor and explain how the motor is protected against overloads and loss of supply voltage?	K3	2	10M
		OR			
	b	i) With a neat circuit diagram, describe the field's test a series motor?	K1	2	5M
		ii) A 240V Dc compound motor on brake test takes 52A and runs at 1500 rpm. The spring balance at the end of the 76cm brake arm reads 93.5N. Calculate the efficiency?	K2	2	5M

4		Unit-III			
	a	i) From first principles, derive the EMF equation of a transformer?	K2	3	5M
		ii) Explain how the core of transformers are constructed?	K2	3	5M
		OR			
	b	A 100 KVA, single phase transformer has an iron loss of 600W and a copper loss of 1.5 KW at full load. Calculate the efficiency at i) 100 KVA at 0.8 pf ii) 50 KVA at UPF	K3	3	10M
5		Unit-IV			
	a	A 220/440V single phase transformer has the following test results: OC test 220V, 1A, 70W on LV side SC test 20V, 12A, 100W on HV side Draw the equivalent circuit of the transformer referred to i) LV side and ii) HV side and fill in the values of circuit parameters?	K3	4	10M
		OR			
	b	Draw the circuit diagram for conducting OC and SC tests on a single phase transformers. Also explain how the efficiency and voltage regulation can be estimated by these tests?	K3	4	10M
6		Unit-V			
	a	Explain the various types of three phase transformer connections?	K2	5	10M
		OR			
	b	A 500 KVA, three phase, 50 HZ transformer has line to line voltage ratio of 33 KV/11 KV and is connected in delta-star. The resistances per phase are 24 ohm and 0.875 ohm. Its iron loss at normal voltage and frequency is 3.5 KW. Calculate its efficiency at i) full load 0.8 pf and ii) half load at 0.9 pf.	K3	5	10M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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	What is the rate of convergence and the condition for convergence in the Newton-Raphson method?	K2	1	2M
	b	Apply one iteration of the Bisection method to approximate a root of $f(x)=x^2-3$, in the interval of [1,2].	K3	1	2M
	c	State the limitation of Simpson's 3/8th rule.	K2	2	2M
	d	Approximate $\int_0^1 (1+x^2)\,dx$ using Trapezoidal rule with n=2.	K3	2	2M
	e	State linearity property of the Laplace transform.	K3	3	2M
	f	What is Laplace transform of $\cos h(at)$	K3	3	2M
	g	Define a periodic function.	K2	4	2M
	h	State Dirichlet's conditions for a Fourier series.	K2	4	2M
	i	State convolution theorem in the Fourier transform.	K2	5	2M
	j	State two applications of Fourier transform in engineering.	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)Solve $(x)^2-2x+1=0$ on interval [-3,6] using the Bisection method	K3	1	5M
		ii)Compute a root $(x)^3-4x-9=0$ of using Newton-Raphson's method.	K3	1	5M
		OR			
	b	i) Find the value of f (1.5) using Newton's forward interpolation for data f (1) =2, f (2) =8, f (3) =18	K3	1	5M
		ii) Compute the unique polynomial p(x) of degree 2 or less such that p (2) =4, p (5) =125, p (6) =216 using Lagrange's interpolation formula.	K3	1	5M
3		Unit-II			
	a	Compute by $\int_0^4 e^x\,dx$ using(i) Trapezoidal rule, (ii) Simpson's 1/3 rule,	K3	2	10 M
		OR			
	b	i) Compute y (0.1) and y (0.2) using Runge-kutta 4th order formula given that $\frac{dy}{dx}=x^2-y, y(0)=1.$	K3	2	5M
		ii) Solve $\frac{dy}{dx}=y, y(0)=1$ using Euler's method at x=0.1,0.2	K3	2	5M

4		Unit-III			
	a	i) Compute Laplace of a) te^{-2t}, b) $t\sin 2t$	K3	3	5M
		ii) Use Laplace transform to solve $y''+y=0\ y(0)=0, y'(0)=1$	K3	3	5M
		OR			
	b	i)Solve $L(t^3e^{-2t})$	K3	3	5M
		ii) Compute the L.T. of (i) $tu(t-1)$ (ii) $\sin^2(at)$ by using change of scale property	K3	3	5M
5		Unit-IV			
	a	i) Compute the Fourier expansion of $f(x)=x, -\pi<x<\pi$.	K3	4	5M
		ii) Compute the Fourier expansion of $f(x)=xcosx, 0<x<2\pi$.	K3	4	5M
		OR			
	b	i)a) Express $f(x)=x^2$ as a Fourier cosine series in $, 0<x<\pi$. b) Compare half-range sine series with half-range cosine series.	K3	4	5M
		ii) Compute the half range sine series for $f(x)=x(\pi-x), 0<x<\pi$.	K3	4	5M
6		Unit-V			
	a	Construct the Fourier cosine transform of $f(x)=x^2e^{-x}$	K3	5	10 M
		OR			
	b	i)Compute the Fourier transform of $f(x)=e^{\frac{-x^2}{2}}, -\infty<x<\infty$.	K3	5	5M
		ii) Compute Fourier cosine transform of $f(x)=x, 0<x<\infty$.	K3	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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	List the difference between a closed system and an open system.	K2	1	2M
	b	What do mean by property? Distinguish between intensive and extensive	K2	1	2M
	c	Define thermal efficiency of a heat engine cycle.	K2	2	2M
	d	What are the causes of irreversibility?	K2	2	2M
	e	Write the Maxwell's equations and its significance	K3	3	2M
	f	Define Gibb's Theorem	K2	3	2M
	g	Write a short note on Mollier Chart.	K3	4	2M
	h	What is critical state, critical pressure, and critical temperature?	K2	4	2M
	i	Explain the principle of air conditioning	K3	5	2M
	j	Describe the different components of a vapor compression refrigeration system	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 is meant by thermodynamics equilibrium? Explains its types briefly	K2	1	5M
		ii) What do you understand by path function and point function? What are the exact and inexact differentials?	K3	1	5M
		OR			
	b	i) Explain the following terms a) State b) Path c) Process d) Cyclic process e) System.	K2	1	5M
		ii) What is quasi static process? Explain in detail?	K3	1	5M
3		Unit-II			
	a	i) Define first law of thermodynamics. Justify that internal energy is a property of the system	K3	2	5M
		ii) A Stationary mass of gas is compressed without friction from an initial state of 0.3 m^3 and 0.105 Mpa to a final state of 0.15 m^3 and 0.105 Mpa, the pressure remaining constant during the process. There is a transfer of 37.6 KJ of heat from the gas during the process. How much does the internal energy of the gas change?	K2	2	5M
		OR			
	b	i) Analyze the coefficient of performance and heat transfer rate in the condenser of a refrigerator in KJ/h which has a refrigeration capacity of 12000 KJ/h when power input is 0.75KW	K2	2	5M

		ii) What is perpetual motion machine of first kind [PMM1]?	K2	2	5M
4	Unit-III				
	a	i) Define Statements of second law of thermodynamics i) Clausius statement ii) Kelvin-plank statement	K3	3	5M
		ii) A reversible heat pump is used to maintain a temperature of 0°C in a refrigerator when it rejects the heat to the surroundings at 25°C. If the heat removal rate from the refrigerator is 1440kJ/min, determine the COP of the machine and the work input required.	K2	3	5M
	OR				
	b	i) Write a short note on i) reversibility and irreversibility ii) availability and unavailability.	K2	3	5M
		ii) A heat engine receives heat at the rate of 1500 KJ/min and gives an output of 8.2 KW. Determine i) The thermal efficiency ii) The rate of heat rejection.	K3	3	5M
5	Unit-IV				
	a	i) Build the phase equilibrium diagram for a pure substance P-T plot with relevant constant property line	K2	4	5M
		ii) 3 kg of steam at 18 bar occupy a volume of 0.2550 m^3. During a constant volume process, the heat rejected is 1320 kJ. Determine final internal energy also find initial dryness and work done.	K3	4	5M
	OR				
	b	i) Explain the process of formation of steam with T-s diagram.	K3	4	5M
		ii) Recall a short note on dryness fraction	K3	4	5M
6	Unit-V				
	a	i) Explain the working principles of vapor compression system.	K2	5	5M
		ii) Define Coefficient of Performance (COP)**.** Derive the expression for COP of a refrigerator working on a Carnot refrigeration cycle**.**	K3	5	5M
	OR				
	b	i) Discuss about various psychometric processes used in engineering applications with schematic diagrams	K3	5	5M
		ii) Explain the different psychrometric properties of air (dry bulb temperature, wet bulb temperature, dew point temperature, relative humidity and specific humidity	K2	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

II B.Tech I Semester Supple. Examinations, May-2026

R23

Sub Code: R23ME2104 **MECHANICS OF SOLIDS**

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 Hooke's Law and state its limitations.	**K2**	1	2M
	b	Write the physical significance of the Factor of Safety (F.O.S.)	K3	1	2M
	c	Define the "Point of Contra flexure"	K1	2	2M
	d	Sketch and label the three primary types of loads encountered in beam analysis.	K3	2	2M
	e	Define Section Modulus (Z)	K3	3	2M
	f	State the two main assumptions made in the Theory of Simple Bending.	K1	3	2M
	g	What is the "Elastic Line" (or Elastic Curve) of a beam	K2	4	2M
	h	State the difference between shafts connected "in series" and "in parallel" regarding the distribution of Torque (T) and Angle of Twist (θ).	K3	4	2M
	i	Differentiate between 'Thin' and 'Thick' Cylinders based on their dimensions	K3	5	2M
	j	What is the "Effective Length" of a column	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	A short column is made of a steel tube of 50 mm internal diameter and 5 mm thickness, surrounded by a brass tube of 65 mm internal diameter and 5 mm thickness. The composite column supports an axial load of 200 kN. Calculate the stress induced in each tube. Take Young's Modulus for steel, E_s=200 GPa, and for brass, E_b=100 GPa.	K3	1	10M
		OR			
	b	A steel rod 2 m long and 20 mm in diameter is fixed at both ends. If the temperature of the rod is increased by 60∘C, calculate I. The thermal stress induced in the rod. II. The force exerted on the supports. Take Young's Modulus E=200 GPa and the coefficient of thermal expansion α =12×10^{-6}/∘C.	K3	1	10M
3		Unit-II			
	a	A cantilever beam 4 m long is fixed at the left end (A) and free at the right end (B). It is subjected to a point load of 10 kN at the free end B and a Uniformly Distributed Load (UDL) of 5 kN/m acting over the entire length. Draw the SFD and BMD and determine the maximum values.	K2	2	10M
		OR			
	b	A simply supported beam AB has a span of 6 m. It carries a Uniformly	K3	2	10M

		Varying Load (UVL) starting from zero intensity at end A and increasing linearly to 18 kN/m at end B. Draw the Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) and determine the position and magnitude of the maximum bending moment.			
4		Unit-III			
	a	An I-section beam has the following dimensions: Top and Bottom Flanges: 150 mm×10 mm Web: 10 mm×180 mm (Depth) The beam is subjected to a maximum bending moment (M) of 60 kN-m. Calculate the maximum bending stress(σ_{max}) developed in the beam.	K3	3	10M
		OR			
	b	A solid square beam of 100 mm×100 mm cross-section is subjected to a vertical shear force (F) of 25 kN. Calculate the maximum shear stress (τ_{max}).Calculate the shear stress (τ) at a point 25 mm above the Neutral Axis (NA).Draw a sketch of the shear stress distribution across the depth.	K2	3	10M
5		Unit-IV			
	a	A simply supported beam AB of length L= 6 m is subjected to a point load of 24 kN at a distance of 4 m from the left support A. Using Macaulay's Method (or Double Integration Method), find the deflection under the load. Assume EI=4×10^4 kN-m^2.	K3	4	10M
		OR			
	b	Starting from fundamental principles and assumptions, derive the Torsion Equation for a circular shaft: $$\frac{T}{J}=\frac{\tau}{R}=\frac{G\theta}{L}$$	K2	4	10M
6		Unit-V			
	a	A hollow circular steel column is 4 m long and has an external diameter (D) of 150 mm and a thickness (t) of 10 mm. The column is fixed at both ends. Using Euler's formula, calculate the crippling (buckling) load(P_{cr}). Take Young's Modulus E = 200 GPa.Also, state the limiting slenderness ratio for which Euler's formula is valid if the yield stress (σ_y) is 250 MPa.	K3	5	10M
		OR			
	b	A thick cylindrical pipe with an internal diameter(d_i)of 200 mm and an external diameter (d_o) of 300 mm is subjected to an internal fluid pressure (p_i)of 20 MPa. Assuming the external pressure (p_o) is zero, calculate the following stresses using Lame's Equation: The maximum hoop (circumferential) stress (σ_h,max).The hoop stress and radial stress (σ_h and σ_r) at a radius of 125 mm (mid-wall thickness).	K4	5	10M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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NARASARAOPETA ENGINEERING COLLEGE
(AUTONOMOUS)

R23

II B.Tech I Semester Supple. Examinations, May-2026

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	What do you mean by crystallization?	1	1	2M
	b	What is the Necessity of alloying?	1	1	2M
	c	How do you classify steels?	1	2	2M
	d	Define super alloys. And list out their application.	1	2	2M
	e	Define heat treatment.	1	3	2M
	f	What is the importance of TTT diagrams?	1	3	2M
	g	Explain the steps in powder metallugy method.	1	4	2M
	h	Define sintering.	1	4	2M
	i	Define crystalline ceramics with suitable example.	1	5	2M
	j	Define smart materials.	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) Calculate the packing factor for BCC and FCC.	3	1	5M
		ii) Experimental methods of construction of equilibrium diagrams.	4	1	5M
		OR			
	b	i)Draw the Fe-Fe_3C phase diagram and lable phases in it.	3	1	5M
		iii) Explain the two types of solid solutions with neat sketches.	4	1	5M
3		Unit-II			
	a	i) Explain the structure and properties of White Cast iron	4	2	5M
		ii)Explain the properties and applications of plain carbon steels.	4	2	5M
		OR			
	b	i)Explan the structure and properties of few copper alloys	4	2	5M
		ii) Explain the properties and applications of magnesium alloys.	4	2	5M
4		Unit-III			
	a	i) Explain the effect of alloying elements on Fe-Fe3C system.	4	3	5M
		ii)Differentiate between annealing and normaliizing methods.	3	3	5M

		OR			
	b	i) Explain any one surface - hardening methods.	4	3	5M
		ii)Explain age hardening treatment with a neat sketch.	4	3	5M
5		Unit-IV			
	a	i) Explain any two methods of producing metal powders.	4	4	5M
		ii) Explain any one compacting methods of metal powders.	4	4	5M
		OR			
	b	i)Explain any one secondary operations in powder metallurgy.	4	4	5M
		ii)Explain various applications of powder metallurgical products.	4	4	5M
6		Unit-V			
	a	i) Explain the classification of composites.	4	5	5M
		ii)Explain any one method of manufacturing methods of composite.	4	5	5M
		OR			
	b	i) Explain the properties and applications of glasses.	4	5	5M
		ii)Explain the properties and applications of abrasive materials. .	4	5	5M

KL: Blooms Taxonomy Knowledge Level CO: Course Outcome M: Marks

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