

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

			Marks	CO	Blooms Level
UNIT-I					
1.	a	Evaluate $L[e^{2t} + 4t^3 - 2\sin 3t + 3\cos 3t]$	5	1	K2
	b	Evaluate $L\left[\int_0^t te^{-t}\sin 4t \, dt\right]$	5	1	K2
(OR)					
2.	a	Evaluate $L[e^{-t}t \sin t]$	5	1	K2
	b	Evaluate $L\left[\int \frac{e^t \sin t}{t} dt\right]$	5	1	K2
UNIT-II					
3.	a	Evaluate $L^{-1}\left[\frac{s+2}{s^2-2s+5}\right]$	5	2	K2
	b	Using Convolution Theorem, evaluate $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$	5	2	K3
(OR)					
4.		Using Laplace transform, solve $(D^2 + 2D - 3)y = \sin t$, given $y(0) = 0, y'(0) = 0$	10	2	K3
UNIT-III					
5.		Using Fourier Integral Show that $e^{-ax} - e^{-bx} = \frac{2(b^2 - a^2)}{\pi} \int_0^\infty \frac{\lambda \sin(\lambda x)}{(\lambda^2 + a^2)(\lambda^2 + b^2)} d\lambda, \quad a, b > 0$	10	3	K3
(OR)					
6.	a	Show that the Fourier transform of $e^{-\frac{x^2}{2}}$ is $\sqrt{2\pi} e^{-\frac{p^2}{2}}$	5	3	K2
	b	Find the Fourier sine transform of $f(x) = \frac{e^{-ax}}{x}$ and deduce that $\int_0^\infty \frac{e^{-ax} - e^{-bx}}{x} \sin sx \, dx = \tan^{-1}\left(\frac{s}{a}\right) - \tan^{-1}\left(\frac{s}{b}\right)$	5	3	K2

UNIT-IV

7. If $F(p) = \frac{-4}{p^3}(p \cos p - \sin p)$ is the Fourier Transform of 10 4 K2

$f(x)$ defined by $f(x) = \begin{cases} 1 - x^2, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$, then evaluate

$$\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx \text{ and } \int_0^{\infty} \frac{x \cos x - \sin x}{x^3} dx.$$

(OR)

8. Find the cosine Fourier transform of $f(x)$ and $g(x)$ defined 10 4 K2
by $f(x) = e^{-ax} (a > 0)$ and $g(x) = e^{-bx} (b > 0)$ and hence
evaluate $\int_0^{\infty} \frac{dx}{(x^2 + a^2)(x^2 + b^2)}$.

UNIT-V

9. a Evaluate $Z(n^2)$ 5 5 K2
b Evaluate $Z[e^{-an} \sin nt]$ 5 5 K2

(OR)

10. If $Z(u_n) = \frac{2x^2 + 4x + 12}{(x-1)^4}$, find the values of u_2 & u_3 . 10 5 K2

UNIT-VI

11. a Evaluate by using Convolution theorem $Z^{-1} \left[\frac{x^2}{(x-a)(x-b)} \right]$ 5 6 K3
b Evaluate $Z^{-1} \left[\frac{x^2 + 3x}{(x-4)(x+2)} \right]$ 5 6 K2

(OR)

12. Solve the difference equation $u_{n+2} - 6u_{n+1} + 9u_n = 3^n$, given 10 6 K3
that $u_0 = 0$ & $u_1 = 1$ by using Z-transform

NUMERICAL METHODS

Time: 3 Hours

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UNIT-IMarks CO Blooms
Level

1. Find the root $x \log_{10} x = 1.2$ by using Bisection method.

10 1 K2

(OR)

2. Find the negative root of $x^3 + 2x^2 + 0.4 = 0$ by using Newton-Raphson Method.

10 1 K2

UNIT-IIMarks CO Blooms
Level

3. Find the Interpolating polynomial from the table & also find $f(2)$

10 2 K2

x	0	1	4	5
F(x)	4	3	24	39

(OR)

4. Find the Newton's Forward Difference interpolating polynomial for the following data and hence find $f(1.5)$.

10 2 K2

x	0	1	2	3
F(x)	1	3	7	13

UNIT-IIIMarks CO Blooms
Level

5. A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various values of the time t (in Seconds).

10 3 K3

t	0	0.2	0.4	0.6	0.8	1.0	1.2
θ	0	0.12	0.49	1.12	2.02	3.20	4.67

Calculate the angular velocity and the angular acceleration of the rod, when $t=0$.

(OR)

6. Compute the first two derivatives at $X=9$ from the following table

x	1	2	4	8	10
F(x)	0	0.12	0.49	1.12	2.02

10 3 K3

UNIT-IV

7. Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ using Simpson's 1/3 rule and Simpson's 3/8 rule.

Marks CO Blooms
Level

10 4 K3

(OR)

8. Evaluate the following integral $\int_0^1 \sqrt{1+x^2} dx$ by using Trapezoidal rule and Simpson's 3/8 rule.

10 4 K3

UNIT-V

9. Using Taylor's series method, solve the equation $\frac{dy}{dx} = x - y^2$ for $x=0.2$, 0.4 & 0.6 , given that $y(0)=1$.

Marks CO Blooms
Level

10 5 K3

(OR)

10. Obtain the values of y at $x=0.1$, 0.2 & 0.3 using Runge-Kutta method of Fourth order, for the differential equation $\frac{dy}{dx} + y = 0$, $y(0)=1$.

10 5 K3

UNIT-VI

11. Fit a second degree polynomial $y = a + bx + cx^2$ to the following data by the method of least squares.

Marks CO Blooms
Level

10 6 K3

X	1	2	3	4	5	6	7
Y	2.3	5.2	9.7	16.5	29.4	35.5	54.4

(OR)

12. Fit a exponential curve of the form $y = a e^{bx}$ by the method of least squares

10 6 K3

X	0	0.5	1	1.5	2	2.5
Y	0.10	0.45	2.15	9.15	40.35	180.75

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		Marks	CO	Blooms Level
<u>UNIT-I</u>				
1.	Determine g.c.d of 858 and 325, and express it in the form of $m.858+n.325$.	10	CO1	L3
(OR)				
2.	Prove that $9^n - 8^n - 1$ is divisible by 8	10	CO1	L3
<u>UNIT-II</u>				
3.	Show that $4^{2n+1} + 3^{n+2} \equiv 0 \pmod{13}$	10	CO2	L3
(OR)				
4.	Solve the congruence $259x \equiv 5 \pmod{11}$	10	CO2	L3
<u>UNIT-III</u>				
5.	Define Euler-Fermate theorem and Show that $n^5 - n$ is divisible by 30	10	CO3	L3
(OR)				
6.	Solve $x \equiv 2 \pmod{3}, x \equiv 4 \pmod{5}, x \equiv 5 \pmod{7}$, using Chinese remainder theorem	10	CO3	L3
<u>UNIT-IV</u>				
7.	Determine the number of divisors and sum divisors of 600	10	CO4	L3
(OR)				
8.	Define Mobius function . Determine $\mu(11), \mu(15), \mu(17), \mu(20)$	10	CO4	L3
<u>UNIT-V</u>				
9.	Evaluate $(2/7), (2/19), (73/383)$ and $(17/223)$	10	CO5	L3
(OR)				
10.	Determine whether 219 is quadratic residue of 383 or not	10	CO5	L3
<u>UNIT-VI</u>				
11.	Using Caesar cipher method , To encrypt the message " THIS MESSAGE IS TOP SECRET " by using transformation $C \equiv P + 3 \pmod{26}$	10	CO6	L3
(OR)				
12.	To encrypt the plaintext message "MILLENNIUM" using the key "YTWOK"	10	CO6	L3

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UNIT-I

1. a) What are the different types of the cement and role of the cement? 5M
- b) What are conventional building plans ? 5M

(OR)

2. a) Explain the use of different types aggregates 5M
- b) Explain the manufacturing of bricks 5M

UNIT-II

3. a) Write the principles and applications of the building bylaws? 5M
- b) Explain building bylaws 5M

(OR)

4. a) Explain minimum standard dimensions of building elements 10M

UNIT-III

5. a) Given standard dimensions for the following rooms of a residential building 5M
1)Bed room 2)Kitchen 3)Garage 4)Verandah 5)Sick room
- b) What are the factors to be considered by planner prior to planning of a residential building? 5M

(OR)

6. a) what are the requirements for the following rooms in planning of residential building 5M
1) dinning room 2) drawing room 3) kitchen
- b) What are the usual requirements of a normal residential building ? 5M

UNIT-IV

7. A revenue office is to be built at a site of 20mx15m. The shorter dimension is along E-W facing the road. Draw a line diagram of the building to accommodate 10M
a). Two office rooms b). Record room c). One verandah

(OR)

8. A primary health centre is to be constructed in a village, the site measured 15mx10m. Draw the line diagram of the building to accommodate 10M
1)waiting room 2) Doctors room 3)Examination room 4)Varandah

UNIT-V

9. a) What is sun path diagram? Give CBRI recommendation for obtaining optimum orientation of a building. 5M
- b) State the merit and demerit of English and Flemish bond 5M

(OR)

10. a) Discuss the orientation criteria for residential building of India with reference to climate zones? 5M
- b) What is meant by orientation of a building ? 5M

UNIT-IV

11. a) Draw the single roomed office building section and elevation with suitable dimensions 5M
- b) Draw the single roomed residential building plan and elevation with suitable dimensions 5M

(OR)

12. a) Draw the double roomed residential building plan and elevation with suitable dimensions 5M
- b) Draw the double roomed residential building plan and section with suitable dimensions 5M

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- | | | | Marks | CO | Blooms Level |
|------------------------|---|---|-------|-----|---------------|
| <u>UNIT-I</u> | | | | | |
| 1. | a | What is an instrument or measuring system? Explain with a neat block diagram. | 5M | CO | Understanding |
| | b | List and define the static type of performance characteristics. | 5M | CO1 | Remembering |
| (OR) | | | | | |
| 2. | a | Explain accuracy and precision with suitable diagrams. | 6M | | Understanding |
| | b | A moving coil voltmeter has a uniform scale with 100 divisions, the full scale division is 200V and $1/10^{\text{th}}$ of the reading can be estimated. Determine the resolution of the instrument? | 4M | CO1 | Applying |
| <u>UNIT-II</u> | | | | | |
| 3. | a | Explain the principle of DC voltmeter with necessary diagram | 6M | CO | Understanding |
| | b | A basic D 'Arsonval movement with a full scale deflection of 50 μA and internal resistance of 500Ω is used as a voltmeter. Determine the value of the multiplier resistance needed to measure a voltage range of 0 – 10 V? | 4M | CO2 | Applying |
| (OR) | | | | | |
| 4. | a | Describe various types of thermocouples with relevant diagrams | 6M | CO2 | Understanding |
| | b | What are the limitations of thermocouples? | 4M | | |
| <u>UNIT-III</u> | | | | | |
| 5. | | Explain the standard signal generator with necessary block diagram | 10M | CO | Understanding |
| (OR) | | | | | |
| 6. | | Explain harmonic distortion analyzer using (i) High Pass filter and (ii) Wien's Bridge Type | 10M | CO3 | Understanding |
| <u>UNIT-IV</u> | | | | | |
| 7. | | Describe about CRT in detail | 10M | CO | Understanding |
| (OR) | | | | | |
| 8. | a | Explain dual beam CRO with a neat block diagram | 5M | CO4 | Understanding |
| | b | Describe the modes of dual trace oscilloscope | 5M | | |
| <u>UNIT-V</u> | | | | | |
| 9. | a | Draw the circuit diagram of Wheatstone bridge and explain. | 6M | CO | Understanding |
| | b | Mention the applications of Wheatstone bridge | 4M | CO5 | Understanding |
| (OR) | | | | | |
| 10. | a | Describe Wien's Bridge for measurement of capacitance with relevant circuit diagram. | 6M | | Understanding |
| | b | A Maxwell bridge is used to measure inductive impedance. The bridge constants at balance are $C = 0.01 \mu\text{F}$, $R = 470 \text{ k}\Omega$, $R_2 = 5.1 \text{ k}\Omega$, and $R_3 = 100 \text{ k}\Omega$. Determine the series equivalent of the unknown impedance. | 4M | CO5 | Applying |
| <u>UNIT-VI</u> | | | | | |
| 11. | | Explain about capacitive transducers in detail | 10M | CO | Understanding |
| (OR) | | | | | |
| 12. | | Explain the construction and working of LVDT ? | 10M | CO6 | Understanding |

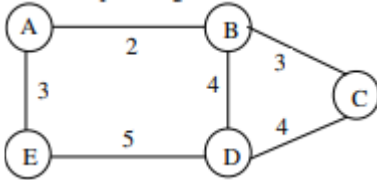
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			Marks	CO	Blooms Level
UNIT-I					
1.	a	Define Data Structure and Explain the types	5M	CO-1	K1
	b	What is the Complexity of Algorithm	5M		K1
(OR)					
2.	a	Define algorithm and explain the properties	5M	CO-1	K1
	b	Explain about Asymptotic Notations	5M		K2
UNIT-II					
3.	a	Write an algorithm for binary search and give its time complexity .	5M	CO-2	K1
	b	Write an algorithm for Bubble Sort with example (99,44,22,10,66,35)	5M		K3
(OR)					
4.		Write an Algorithm for Quick Sort and explain it with an example and give its time complexity. Sort list of elements 45, 55,20,95,75,60	10M	CO-2	K3
UNIT-III					
5.	a	Define stack principle and write operations of stack with suitable example.	5M	CO-3	K1
	b	Give the algorithm for converting an Infix Expression to Postfix Expression (A+B)*C+(D-E)/F+G	5M		K5
(OR)					
6.	a	Define Queue and write operations of Queue with suitable example	5M	CO-3	K1
	b	Distinguish between Stacks and Queues	5M		K4
UNIT-IV					
7.	a	Differentiate Arrays with Linked List.	5M	CO-4	K4
	b	Write an Algorithm to implement Stack using Linked List	5M		K1
(OR)					
8.		Define Single Linked List and Write the algorithms for Singly Linked List Insertion at the Beginning of the list , inserting at end of the list, inserting at specific position of the list.	10M	CO-4	K1
UNIT-V					
9.	a	Write in-order, pre-order and post-order traversal of a binary tree.	5M	CO-5	K1
	b	Explain Binary Search Tree and Create binary search tree for the following elements (23, 12, 45, 36, 5, 15, 39, 2, 19)	5M		K3
(OR)					
10.	a	Explain, in detail, deletion of a node from a binary search tree with one suitable example.	5M	CO-5	K2
	b	What operations can be performed on binary trees? Discuss.	5M		K1
UNIT-VI					
11.		Explain how Prim's algorithm is used for finding the minimum spanning tree of a graph. Find a minimum cost spanning tree of the following graph using Prim's algorithm.	10M	CO-6	K2
					
(OR)					
12.		Explain Depth First Search and Breadth First Search algorithms in detail.	10M	CO-6	K2

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UNIT-I

- | | | | Marks | CO | Blooms Level |
|----|---|--|-------|-----|--------------|
| 1. | a | Explain about built in functions and user defined functions with proper examples? | 5 | CO1 | K1 |
| | b | Given an array nums of size n, compute the majority element. The majority element is the element that appears more than $\lfloor n / 2 \rfloor$ times. You may assume that the majority element always exists in the array.
Input: [3,2,3]
Output: 3 | 5 | CO1 | K3 |

(OR)

- | | | | | | |
|----|---|---|---|-----|----|
| 2. | a | Explain about the arrays in detail and state the difference between char arrays and numerical arrays? | 5 | CO1 | K1 |
| | b | Given an array nums. We define a running sum of an array as <code>runningSum[i] = sum(nums[0]...nums[i])</code> . Compute the running sum of nums in array
Input: nums = [1,2,3,4]
Output: [1,3,6,10] | 5 | CO1 | K3 |

UNIT-II

- | | | | | | |
|----|---|--|---|-----|----|
| 3. | a | Explain about the Different Constructors and destructors present in C++? | 5 | CO2 | K1 |
| | b | Design a class of a person's bank account and design methods for depositing and withdrawal by using access specifiers? | 5 | CO2 | K3 |
- (OR)
- | | | | | | |
|----|---|--|---|-----|----|
| 4. | a | Explain about the Access specifiers and give suitable examples for each specifier? | 5 | CO2 | K1 |
| | b | Design a class circle and design methods for calculating area and circumference. Use constructor and destructor while designing the class? | 5 | CO2 | K2 |

UNIT-III

- | | | | | | |
|----|---|---|---|-----|----|
| 5. | a | Explain about tower of Hanoi problem? | 5 | CO3 | K2 |
| | b | Finding the time complexity of the following code segment
sum=0
for(i=1;i<=n;i++)
for(j=1;j<=n;j=j*3)
sum=sum+j | 5 | CO3 | K3 |

(OR)

- | | | | | | |
|----|---|--|---|-----|----|
| 6. | a | Explain about the Following.
a) Best case time complexity b) Worst case Time complexity
c) Average case time complexity | 5 | CO3 | K1 |
| | b | Finding the time complexity of the following code segment
sum=0
for(i=1;i<=n;i=2*i)
for(j=1;j<=n;j=j+2)
sum=sum+j | 5 | CO3 | K3 |

UNIT-IV

- | | | | | | |
|----|---|--|---|-----|----|
| 7. | a | Explain about Stack and Queue with the Help of Examples? | 5 | CO4 | K1 |
| | b | You are given a 0-indexed string num of length n consisting of digits. Return true if for every index i in the range $0 \leq i < n$, the digit i occurs num[i] times in num, otherwise return false.
Example 1:
Input: num = "1210"
Output: true | 5 | CO4 | K3 |

Explanation:

num[0] = '1'. The digit 0 occurs once in num.

num[1] = '2'. The digit 1 occurs twice in num.

num[2] = '1'. The digit 2 occurs once in num.

num[3] = '0'. The digit 3 occurs zero times in num.

The condition holds true for every index in "1210", so return true.

(OR)

- | | | | | | |
|----|---|--|---|-----|----|
| 8. | a | Explain about set and Map with the Help of Examples? | 5 | CO4 | K1 |
| | b | Given two strings s and t, determine if they are isomorphic. Two strings s and t are isomorphic if the characters in s can be replaced to get t. All occurrences of a character must be replaced with another character while preserving the order of characters. No two characters may map to the same character, but a character may map to itself.
Example 1:
Input: s = "egg", t = "add"
Output: true | 5 | CO4 | K3 |

UNIT-V

- | | | | | | |
|----|---|---|---|-----|----|
| 9. | a | Give a brief description about backtracking and present a valid Example? | 5 | CO5 | K1 |
| | b | Given a list of non-negative integers nums, arrange them such that they form the largest number and return it. Since the result may be very large, so you need to return a string instead of an integer.
Input: nums = [10,2]
Output: "210" | 5 | CO5 | K3 |

(OR)

- | | | | | | |
|-----|---|--|---|-----|----|
| 10. | a | Explain about N-queens Arrangement? | 5 | CO5 | K2 |
| | b | Given an integer array nums and an integer k, compute the k th largest element in the array. Note that it is the k th largest element in the sorted order, not the k th distinct element. using quick sort as base idea.
Input: nums = [3,2,1,5,6,4], k = 2
Output: 5 | 5 | CO5 | K3 |

UNIT-VI

- | | | | | | |
|-----|---|--|---|-----|----|
| 11. | a | Give a brief description about modular arithmetic? | 5 | CO6 | K1 |
| | b | Given an integer n, write a function that returns count of trailing zeroes in n!.
Input: n = 5
Output: 1
Factorial of 5 is 120 which has one trailing 0 | 5 | CO6 | K3 |

(OR)

- | | | | | | |
|-----|---|--|---|-----|----|
| 12. | a | Write an algorithm to determine if a number n is happy. A happy number is a number defined by the following process:
Starting with any positive integer, replace the number by the sum of the squares of its digits.
Repeat the process until the number equals 1 (where it will stay), or it loops endlessly in a cycle which does not include 1. Those numbers for which this process ends in 1 are happy. Return true if n is a happy number, and false if not.
Input: n = 19
Output: true
Explanation:
12 + 92 = 82
82 + 22 = 68
62 + 82 = 100
12 + 02 + 02 = 1 | 5 | CO6 | K2 |
| | b | Given three numbers x, y and p, compute (x ^y) % p.
Input: x = 2, y = 3, p = 5
Output: 3
Explanation: 2 ³ % 5 = 8 % 5 = 3. | 5 | CO6 | K3 |

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UNIT-I

Mark s	CO	Bloom s Level
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1. Explain user defined and predefined functions with example programs.

10	CO1	
----	-----	--

(OR)

2. Given an integer array nums of 2n integers, group these integers into n pairs (a₁, b₁), (a₂, b₂), ..., (a_n, b_n) such that the sum of min(a_i, b_i) for all i is maximized. Return the maximized sum.

10	CO1	Understand
----	-----	------------

input: 3

6 2 6 5 1 2

Output: 9

Explanation: The optimal pairing is (2, 1), (2, 5), (6, 6). min(2, 1) + min(2, 5) + min(6, 6) = 1 + 2 + 6 = 9.

UNIT-II

3. What is exception? Explain try, catch and throw keywords with an example program.

10	CO2	Apply
----	-----	-------

(OR)

4. Alice has n candies, where the ith candy is of type candyType[i].

10	CO2	
----	-----	--

Alice

noticed that she started to gain weight, so she visited a doctor.

The doctor advised Alice to only eat n / 2 of the candies she has

(n is

always even). Alice likes her candies very much, and she wants to eat the

maximum number of different types of candies while still following the

doctor's advice.

Given the integer array candyType of length n,

return the maximum number of different types of candies she can eat if she

only eats n / 2 of them.

Example 1:

Input: candyType = [1,1,2,2,3,3]

Output: 3

Explanation: Alice can only eat 6 / 2 = 3 candies. Since there are only 3

types, she can eat one of each type.

UNIT-III

5. What is an algorithm? How to calculate time complexity and space complexity? Explain with an algorithm

10	CO3	Apply
----	-----	-------

(OR)

- 6 Given an array of integers arr, a lucky integer is an integer that has a frequency in the array equal to its value. Print the largest lucky integer in the array. If there is no lucky integer return -1.
Input: arr = [2,2,3,4]
Output: 2
Explanation: The only lucky number in the array is 2 because frequency[2] == 2.

UNIT-IV

7. What is queue? Explain queue operations and applications. 10 CO4
(OR)
- 8 Here is a biker going on a road trip. The road trip consists of n + 1 points at different altitudes. The biker starts his trip on point 0 with altitude equal 0.
You are given an integer array gain of length n where gain[i] is the net gain in altitude between points i and i + 1 for all (0 ≤ i < n).
print the highest altitude of a point.

Example 1:

Input: gain = [-5,1,5,0,-7]

Output: 1

UNIT-V

9. Explain DML and TCL commands with syntaxes. 10 CO5
(OR)
- 10 You are given an integer array nums (0-indexed). In one operation, you can choose an element of the array and increment it by 1.
• For example, if nums = [1,2,3], you can choose to increment nums[1] to make nums = [1,3,3].
print the minimum number of operations needed to make nums strictly increasing.

An array nums is strictly increasing if nums[i] < nums[i+1] for all 0 ≤ i < nums.length - 1. An array of length 1 is trivially strictly increasing.

UNIT-VI

11. What is correlated subquery and Non correlated subquery? Explain. 10 CO6
(OR)
- 12 Given an integer n, write a function that returns count of trailing zeroes in n!.
Input: n = 5
Output: 1
Factorial of 5 is 120 which has one trailing 0

MECHANICS OF SOLIDS-II
(Civil Engineering)

Time: 3 Hours

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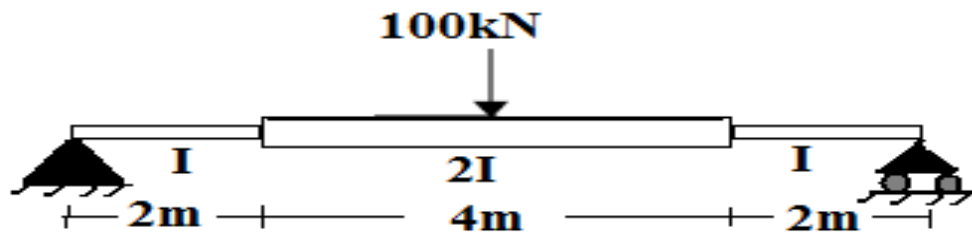
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UNIT-I

1. Derive the differential equation for a cantilever beam carrying a concentrated load at the free end. 12M

(OR)

2. Determine the slopes at the ends and deflection at the mid span section of a beam shown in Figure using Moment area method. 12M
Take elastic modulus as 'E'.

**UNIT-II**

3. Derive the formula for the thickness of the thin cylindrical shell and solve the following problem. A thin cylindrical shell of 1 m diameter is subjected to an internal pressure of 1 N/mm². Calculate the suitable thickness of the shell, if the tensile strength of the plate is 400 N/mm² and factor of safety is 4. 12M

(OR)

4. a) Derive the formula for longitudinal and circumferential stresses for a thin spherical shell subjected to internal fluid pressure 6M
b) A thin cylindrical shell of 1.5m diameter, 15mm thick and 8m long is subjected to internal fluid pressure of 5Mpa. Calculate change in length, diameter and change in volume. Take E = 210Gpa and 1/m = 0.3 6M

UNIT-III

5. Two mutually perpendicular planes of an element of material are subjected to direct stress of 10MPa (tensile) and 3MPa (Comp) and shear stress of 7 MPa. Find the (i) magnitude and direction of principal stress (ii) magnitude of the normal and shear stress on a plane on which the shear stress is maximum 12M
- (OR)
6. A rectangular block of material is subjected to a tensile stress of 100N/mm² on one plane and a compressive stress of 60 N/mm² on the plane at right angle to the previous one . Draw the Mohr circle for the above stress system 12M

UNIT-IV

7. Determine the ratio of buckling strengths of two columns one hollow and other solid. Both are made of the same material and have the same length, cross sectional area and end conditions. The internal diameter of hollow column is half its external diameter. 12M
- (OR)
8. a) Derive an expression for the Euler's crippling load for the fixed-fixed ends column. 6M,
- b) A tubular strut pin-jointed at both the ends has outer and inner diameters as 40 mm and 36mm respectively and is 2.4 m long. Compare the crippling loads given by Euler's and Rankine's formulae. $E = 204 \text{ GPa}$; yield stress = 310 MPa; $a = 1/7500$. If the elastic limit stress is taken as 220MPa, find the length below which the Euler's formula ceases to apply. 6M

UNIT-V

9. A trapezoidal masonry dam having top width 1.5m and height 8.0m is retaining water up to a height of 7m. The water face of the dam is vertical. The density of masonry is 2300 Kg/m³ and co-efficient of friction between the dam and soil is 0.5. Find the minimum bottom width of the dam required. 12M
- (OR)
10. Derive euler's theory for long column when both ends are fixed and mention the limitations of Euler's Theory. 12M

**POWER SYSTEMS-I
(Electrical and Electronics Engineering)****Time: 3 Hours****Max Marks: 60**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Explain the operation of Thermal Power Station with a neat line diagram 6M
b) What is the significance of condenser in the operation of a thermal power station? 6M
Explain the types of condensers?

(OR)

2. a) What are the functions of economiser and super heater in a thermal plant? 6M
b) List out the advantages and disadvantages of hydroelectric plants? 6M

UNIT-II

3. a) Explain the working of a gas power plant with schematic diagram? 6M
b) List the factors to be considered for the selection of site of a nuclear power plant 6M

(OR)

4. a) What are the types of radiation hazards and clearly explain each type? 6M
b) Explain the working of Boiling Water Reactor (BWR) with a neat diagram? 6M

UNIT-III

5. a) Explain in detail about the radial and ring main distribution systems? 6M
b) Explain about the AC and DC Distribution systems? 6M

(OR)

6. a) Derive an expression for the voltage drop in a uniformly loaded DC distributor fed from both ends at equal voltages? 6M
b) A 2-wire distributor cable AB is 2 km long and supplies loads of 100 A, 150 A, 200 A and 50 A situated 500 m, 1000 m, 1600 m, and 2000 m from the feeding point A. Each conductor has a resistance of 0.01Ω per 1000 m. Calculate the voltage at each point if a voltage of 300 V is maintained at point A? 6M

UNIT-IV

7. a) What is substation? Classify the substations according to the service and constructional features? 6M
b) Give the Comparison of Indoor and Outdoor Sub-Station in detail? 6M

(OR)

8. a) List the advantages of Gas insulated substation? 6M
b) What are the different types of gas insulated substations? 6M

UNIT-V

9. a) Define the following with respect to the economic aspects of power generation. i) Connected load ii) Diversity factor iii) Plant capacity factor iv) Maximum demand? 6M
b) A generating station has a maximum demand of 15000 KW, annual load factor is 50% and the plant capacity factor is 40%. Determine the reserve capacity of the plant? 6M

(OR)

10. a) What is meant by electric tariff and Explain the following terms in brief 6M
i) Power factor tariff ii) Three part tariff.
b) Calculate annual bill of a consumer whose maximum demand is 100 kW, 6M
p. f = 0.8 lagging and load factor = 60%. The tariff used is Rs75 per kVA of maximum demand plus 15 paise per kWh consumed.

AR18

CODE: 18MET207

SET-1

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

II B. Tech II Semester Supplementary Examinations, July-2022

**INSTRUMENTATION AND CONTROL
(Mechanical Engineering)**

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Sketch and explain generalized measurement system and it's functional elements? 6M
b) List out and explain the different errors involved in measurement process? 6M
- (OR)**
2. a) With a neat sketch explain the working of LVDT to measure linear displacement? 6M
b) Explain the principle and working of Seismic instrument with a neat sketch? 6M

UNIT-II

3. a) Describe the working of Strain gauge load cell? 6M
b) How stroboscope is used in measurement of speed? Explain 6M
- (OR)**
4. a) How do you measure the tensile and compressive strain using electrical resistance strain gauge? 6M
b) Derive an expression for Gauge factor? 6M

UNIT-III

5. a) Explain the working of bellow gauge in pressure measurement? 6M
b) Describe the working of Ionization type pressure gauge? 6M
- (OR)**
6. a) Explain any three principles of thermo-couple? 6M
b) What is pyrometer? Explain any one type of Pyrometers? 6M

UNIT-IV

7. a) Explain the working of Hot-Wire Anemometer in flow measurement? 6M
b) Describe the working of Magnetic flow meter? 6M
- (OR)**
8. a) Explain the working of Sling Psycho meter? 6M
b) Describe the working of Absorption Hygrometer? 6M

UNIT-V

9. a) What is the importance of control system? 6M
b) Describe the working of closed loop control system with a neat sketch? 6M
- (OR)**
10. a) Describe the RH stability criterion with an example.? 12M

AR18

CODE: 18CST208

SET-1

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

II B. Tech II Semester Supplementary Examinations, July-2022

DESIGN & ANALYSIS OF ALGORITHMS

(Common to CSE and IT)

Time: 3 Hours

Max Marks: 60

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Calculate space and time complexity for matrix multiplication algorithm. 6M
b) Show that $4n^2 + 2n + 10 = O(n^2)$. 4M
(OR)
2. Explain about the asymptotic notations with suitable examples. 10M

UNIT-II

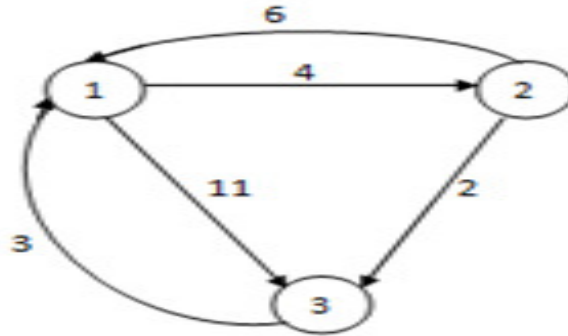
3. a) Show the result of running Merge sorting technique on the sequence 38,27,43,3,9,82,10. 6M
b) Prove that the worst case time complexity of the QuickSort is $O(n^2)$. 4M
(OR)
4. a) Write a greedy algorithm to find optimal solution to the knapsack problem. 5M
b) State Job sequencing with deadlines problem. Find the optimal sequence to the instance when $n=5$, profits(p_1, p_2, p_3, p_4, p_5) = (20,15,10,5,1) and deadlines (d_1, d_2, d_3, d_4, d_5) = (2,2,1,3,3) 5M

UNIT-III

5. a) Find the minimum number of operations required for the following chain matrix multiplication using dynamic programming. 5M
 $A(30,40) * B(40,5) * C(5, 15) * D(15, 6)$.
b) What is principle of optimality? Explain how travelling sales person problem uses the dynamic programming technique with example. 5M

(OR)

6. a) Find an optimal solution for the dynamic programming 0/1 knapsack instance for $n=3$, $m=6$, profits are $(p_1, p_2, p_3) = (1, 2, 5)$, weights are $(w_1, w_2, w_3) = (2, 3, 4)$. 5M
- b) Describe the all-pairs shortest paths algorithm and find the shortest paths between all pairs of nodes in the given graph. 5M



UNIT-IV

7. a) What is connectivity in a graph? How connected graphs are different from other graphs? 5M
- b) Write an algorithm to find Bi-connected components of a graph, 5M
- (OR)
8. a) Briefly explain 8-queens problem using backtracking. Explain its application. 5M
- b) Draw the state space tree for m coloring when $n=3$ and $m=3$. 5M

UNIT-V

9. Apply the least cost branch and bound method to solve the TSP for the following cost matrix. Draw a state space tree and find the optimum cost of the tour? 10M

$$\begin{bmatrix}
 \infty & 11 & 10 & 9 & 6 \\
 8 & \infty & 7 & 3 & 4 \\
 8 & 4 & \infty & 4 & 8 \\
 11 & 10 & 5 & \infty & 5 \\
 6 & 9 & 5 & 5 & \infty
 \end{bmatrix}$$

(OR)

10. a) Explain the classes of NP-Hard and NP-Complete. 5M
- b) Discuss about deterministic and non-deterministic algorithms. 5M

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

II B.Tech II Semester Supplementary Examinations, July-2022

HYDRAULICS AND HYDRAULIC MACHINERY

(Civil Engineering)

Time: 3 Hours

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Describe the Rayleigh's method of analysis. 7 M
- b) Find the density of a metallic body which floats at the interface of mercury of sp. Gr 13.6 and water such that 40% of its volume is sub-merged in mercury and 60% in water. 7 M

(OR)

2. a) What do you understand by Continuity Equation? 7 M
- b) Water flows through a pipe AB 1.2m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter at C, the pipe branches. Branch CD is 0.8m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE 7 M

UNIT-II

3. An open channel of most economical section, having the form of a rectangular with horizontal bottom is required to give a maximum discharge of $20.7 \text{ m}^3/\text{s}$ of water. The slope of the channel bottom is 1 in 3000. Taking Chezy's constant=50 in Chezy's equation, determine the dimensions of the cross section. 14 M

(OR)

4. a) Calculate the specific energy of $12 \text{ m}^3/\text{s}$ of water flowing with a velocity of 1.5 m/s in a rectangular channel 7.5 m wide. Find the depth of water in the channel when the specific energy would be minimum. What would be the value of critical velocity as well as minimum specific energy? 7 M
- b) What do you understand by critical depth of an open channel when the flow is not uniform 7 M

UNIT-III

5. a) Derive an expression for the force exerted by a jet of water on stationary inclined plate in the direction of jet. 7 M
- b) A jet of water from a nozzle is deflected through 60° from its original direction by curved plate which it enters tangentially without the shock with a velocity of 30 m/s and leaves with a mean velocity of 25 m/s. If the discharge from the nozzle is 0.8 kg/s, Calculate the magnitude and direction of the resultant force on the vane, if the vane is stationary. 7 M

(OR)

6. a) Write an expression for the force exerted by the jet on the stationary plate in the direction of jet (i) When flat plate is held normal to the jet (ii) When the flat plate is held inclined to the jet 7 M
- b) Explain the concepts of velocity triangles by considering a jet striking an unsymmetrical moving curved vane tangentially at one of the tips. 7 M

UNIT-IV

7. a) Explain the working of draft tube with neat sketch and also advantages. 7 M
- b) Draw the characteristic curves for the Francis turbines and also explain the working of Francis turbine with neat sketch. 7 M

(OR)

8. a) With the help of neat sketch explain the construction and working of a pelton wheel turbine. 7 M
- b) What is governing? Explain the governing of reaction turbines with neat sketch. 7 M

UNIT-V

9. a) A multistage centrifugal pump has four identical impellers, keyed to the same shaft. The width and diameter of each impeller at outlet are 50 mm and 600 mm respectively. The vanes of each impeller are having outlet angle as 45° . The speed of the pump is 400 rpm and the total manometric head developed is 40 m. If the discharge through the pump is $0.2 \text{ m}^3/\text{s}$. find the manometric efficiency 7 M
- b) Define the Mechanical efficiency and Overall efficiency of the centrifugal pump? 7 M

(OR)

10. a) Enumerate the losses which occur when a centrifugal pump operates 7 M
- b) Define the specific speed of the turbine and also derive the expression for the specific speed of the centrifugal pump 7 M

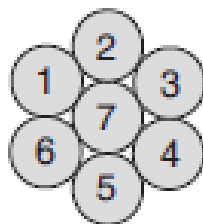
Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

UNIT-I

1. a) Brief about composite conductors? 7M
b) Derive the equation for the inductance of composite conductors. 7M
- (OR)
2. a) What are ACSR conductors? Explain the advantages of ACSR 7M
conductors when used for overhead lines
b) A conductor consists of seven identical strands each having a radius of 7M
'r'. Determine the factor by which 'r' should be multiplied to find the
self GMD of the conductor

**UNIT-II**

3. a) Obtain the ABCD constants for medium transmission line with 7M
Nominal - Π configuration. Also draw the phasor diagrams for the
lagging power factor loads.
b) A 100 km long, 3-phase, 50 Hz transmission line has the following line 7M
constants. Resistance/phase/km = 0.1Ω , reactance/phase/km = 0.5Ω
and susceptance/phase/km = $10 \times 10^{-6} \text{ S}$. If the line supplies load of 20
MW at 0.9 pf lagging at 66 kV at the receiving end. Calculate by
nominal Π method (1) sending end power factor, (2) regulation and (3)
transmission efficiency.
- (OR)
4. a) Discuss the performance of single phase short transmission lines with a 7M
neat phasor diagram.
b) An overhead 3-phase transmission line delivers 5000 kW at 22 kV at 7M
0.8 pf lagging. The resistance and reactance of each conductor is 4Ω
and 6Ω respectively. Determine (1) sending end voltage (2)
percentage regulation and (3) transmission efficiency.

UNIT-III

5. Evaluate the equations for sending voltage and sending current for the 14M long transmission lines (use rigorous calculations) 14M
- (OR)
6. a) Discuss the equivalent T - network of a long transmission line and obtain the ABCD constants in that case. 7M
- b) A 132kV, 3-phase, 50Hz 200km long transmission line has the following distributed parameters: 7M
- $l = 1.3 \times 10^{-3} \text{ H/km}; \quad c = 9 \times 10^{-9} \text{ F/km}; \quad r = 0.2 \text{ } \Omega/\text{km};$
 $g=0$
- find the sending end voltage, current and power factor.

UNIT-IV

7. a) Derive reflected and refracted coefficient of voltages and currents when line is terminated with Resistance. 7M
- b) A 500KV, $2\mu\text{s}$ rectangular surge travels along the line terminated by a capacitor of 2,500PF. Determine the voltage across the capacitance and reflected voltage wave if the surge impedance loading of line is $400 \text{ } \Omega$. 7M
- (OR)
8. a) Discuss in detail about the following (a) skin effect and (b) proximity effect? 7M
- b) A 132KV line with 1.956 cm diameter is built so that corona takes place if the line voltage exceeds 210 KV (rms). If the value of potential gradient at which ionisation occurs can be taken as 30 km per cm, find the spacing between the conductors. 7M

UNIT-V

9. a) Explain the various methods of improving the string efficiency. 7M
- b) A 3-phase transmission line is being supported by three-disc insulators. The potentials across top unit (i.e., near to the tower) and middle unit are 8 kV and 11 kV respectively. Calculate (i) the ratio of capacitance between pin and earth to the self-capacitance of each unit (ii) the line voltage and (iii) string efficiency. 7M
- (OR)
10. a) Deduce an approximate expression for sag in overhead lines when supports are at unequal levels. 7M
- b) A transmission line has a span of 150 m between level supports. The conductor has a cross-sectional area of 2 cm^2 . The tension in the conductor is 2000 kg. If the specific gravity of the conductor material is 9.9 gm/cm^3 and wind pressure is 1.5 kg/m length , calculate the sag. What is the vertical sag? 7M

AR13

Code: 13ME2009

SET I

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

**II B.Tech II Semester Supplementary Examinations July, 2022
KINEMATICS OF MACHINERY
(Mechanical Engineering)**

Time: 3 Hours

Max. Marks: 70

PART –A

ANSWER ALL QUESTIONS

1. 10M
- a. Define Kinematic pair
 - b. Differentiate between Mechanism and machine
 - c. What is the application of Pantograph
 - d. Define velocity Ratio
 - e. What is a configuration diagram
 - f. What is the tangential acceleration component
 - g. What is a displacement diagram
 - h. List any two types of followers
 - i. Define Law of gearing
 - j. What is a reverted Gear train?

PART –B

Answer one question from each unit

[5 x 12=60M]

UNIT I

2. How are the kinematic pairs classified? Explain with examples. 12M

OR

3. Enumerate the inversions of a double slider crank chain, give examples. 12M

UNIT II

4. Sketch a Paucellier mechanism. Show that it can be used to trace a straight line. 12M

OR

5. Derive an expression for the ratio of angular velocities of the shafts of a Hook's joint. 12M

UNIT III

6. What is the Coriolis acceleration component? In which cases does it occur? How is it determined? 12M

OR

7. In a four- link mechanism, the crank AB rotates at 36 rad/s. The lengths of the links are AB=200mm, BC=400mm, CD= 450mm and AD=600mm. AD is the fixed link. At the instant when AB is at right angles to AD determine the velocity of (i) the midpoint of link BC (ii) a point on the link CD, 100mm from the pin connecting the links CD and AD. Use instantaneous centre method. 12M

UNIT IV

8. Deduce expressions for the velocity and acceleration of the follower when it moves with simple harmonic motion. 12M

OR

9. A cam with 50 mm as minimum diameter is rotating clock-wise at a uniform speed of 1000 rpm and has to give the following motion to a roller- follower 15mm in diameter.

- a) Follower to complete outward stroke of 25mm during 120° of cam rotation with equal uniform acceleration and retardation
- b) Follower to dwell for 30° of cam rotation
- c) Follower to return to its initial position during 90° of cam rotation with uniform velocity
- d) Follower to dwell for the remaining 120° of cam rotation.

Draw the cam profile if its axis of the roller follower passes through the axis of the cam. Determine the maximum velocity and uniform acceleration of the follower during the outstroke. 12M

UNIT V

10. Two gear wheels mesh externally and are to give a velocity ratio 3:1. The teeth are involute form. Module= 6mm, addendum= one module, Pressure angle: 20° . The pinion rotates at 100 rpm. Find: a) Number of teeth on pinion to avoid interference on it and the corresponding no. of teeth on the wheel. b) The length of path and arc of contact. c) The no. of pairs of teeth in contact. d) The velocity of sliding at engagement, disengagement and pitch point. 12M

OR

11. An epicyclic gear train consists of sun wheel S, a stationary internal gear E and 3 identical planet wheels P carried on a star – shaped planet carrier C. The sizes of different toothed wheels are such that the planet C rotates at 1/5 of the speed of the sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 Nm. Determine a) Number of teeth on different wheels of the train b) Torque necessary to keep the internal gear stationary 12M.