

$$\begin{aligned}x+3y &\leq 60, \\x+y &\geq 10, \\x \leq y, \quad x \geq 0, \quad y \geq 0\end{aligned}$$

### SECTION-C

**Note:** Long answer type questions. Attempt any one questions out of two questions. (1x10=10)

Q.19 Solve the following system of equation by matrix method.

$$\begin{aligned}x+y+z &= 6 \\x-y+z &= 2 \\2x+y-z &= 1\end{aligned}$$

Q.20 Find all the points of maxima & minima and the corresponding maximum and minimum values of the function:

$$f(x) = 2x^3 + 21x^2 + 36x - 20$$

(140)

(4)

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Level 3 / 2nd. Sem. / DVOC  
(Ref. & Air Cond., Auto Servicing, ITM,  
PT, SD, AMT, FP, EMS, GM)  
Subject : Mathematics

Time : 2 Hrs.

M.M. : 50

### SECTION-A

**Note:** Very short answer type questions. All questions are compulsory (10x1=10)

Q.1 If R be the relation in the set N (set of natural numbers) given by  $R=\{(a, b):a+b=7\}$

Choose the correct answer

- |                    |                    |
|--------------------|--------------------|
| (a) (2, 1) $\in R$ | (b) (2, 4) $\in R$ |
| (c) (2, 5) $\in R$ | (d) (2, 6) $\in R$ |

Q.2 What is the order of the differential equation

$$\left(\frac{dy}{dx}\right)^2 + \sin(x) = 0$$

- |       |          |
|-------|----------|
| (a) 1 | (b) 2    |
| (c) 5 | (d) None |

Q.3 If  $(a,a) \in R$  for all  $a \in X$ , then R is a \_\_\_\_\_ relation in X.

- |                |                   |
|----------------|-------------------|
| (a) Symmetric  | (b) Reflexive     |
| (c) Transitive | (d) None of these |

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**Q.4** Fill in the blank:

The function  $f(x) = 2x + 3$  is a \_\_\_\_\_ function at every real number. (continuous/discontinuous)

Q.5 Fill in the blank :  $\frac{d}{dx}(e^{3x}) =$  \_\_\_\_\_

Q.6 Fill in the blank :  $\int 2\sec^2 x \, dx =$

O.7 If  $\vec{A} = \hat{i} + 2\hat{j} - 2\hat{k}$  then magnitude of vector  $\vec{A}$  is



Q.8 The matrix  $\begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$  is an example of

- (a) Column matrix      (b) Identity matrix  
 (c) Square matrix      (d) Row matrix

Q.9 Points within and on the boundary of the feasible region represents feasible solutions of the constraints? (True/False)

Q.10 The value of the determinant  $\begin{bmatrix} 1 & -2 \\ 1 & 2 \end{bmatrix}$  is



## **SECTION-B**

**Note:** Short answer type questions. Attempt any six questions out of eight questions. (6x5=30)

Q.11 Define Row Matrix. Also find the values of  $x, y, z$

and  $w$  if  $\begin{bmatrix} x & 3x-y \\ 2x+z & 3y-w \end{bmatrix} = \begin{bmatrix} 3 & 2 \\ 4 & 7 \end{bmatrix}$

Q.12 Let  $f : \mathbb{N} \rightarrow \mathbb{N}$  and  $g : \mathbb{N} \rightarrow \mathbb{N}$  be given by  
 $f(x) = x+1$  and  $g(x) = 2x+3$ ,  
show that  $gof \neq fog$

**Q.13** Prove that  $\tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) = \tan^{-1}\left(\frac{2}{9}\right)$

Also write the formula which are used to prove.

**Q.14** Form a differential equation by eliminating arbitrary constant A and B from  $y = Ax^2 + Bx$

**Q.15** Find  $|\vec{a} \times \vec{b}|$  &  $|\vec{a} \times \vec{a}|$  if  $\vec{a} = \hat{i} + \hat{j} - \hat{k}$  and  $\vec{b} = \hat{i} - \hat{j} + \hat{k}$

**Q.16** Evaluate  $\int_{-2}^4 \frac{2x^3 + 4x + 1}{x} dx$

**Q.17** Find the angle between the two planes

$$3x - 6y + 2z = 7 \text{ and } 2x + 2y - 2z = 5$$

**Q.18** Solve the following linear programming problem graphically

Minimize :  $z = 3x + 9y$

Subject to the constraints: