Q.17 Find the component statements for the following compound statements:

i) The sky is blue and the grass is green.

ii) 0 is a positive number or a negative number.

Q.18 Solve the following linear programming problem (LPP):

Maximize : $Z = 3x + 4y$

Subject to the constraints:

$x + y \leq 4,$

$x \geq 0, y \geq 0.$

Section-C

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

Q.19 Find A^{-1} if $A = \begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$.

Q.20 Find the equations of all lines having slope 2 and being tangent to the curve $y + \dfrac{2}{x+3} = 0$.

2nd Sem. / DVOC
Subject : Applied Mathematics

Time : 2 Hrs. M.M. : 50

Section-A

Note: Very short answer type questions. Attempt all ten questions. (10x2=20)

Q.1 A relation R in a set A is called empty relation, if no element of A is related to any element of A. (True/False)

Q.2 Let R be the relation on the set {1,2,3} defied by R= {(1, 1), (2, 2), (3,3), (1,2), (2,3)} then R is a _____ relation.

a) Reflexive b) Symmetric

c) Transitive d) None of these

Q.3 What is the degree of the differential equation

$$\left(\frac{dy}{dx}\right)^2 + 3y\left(\frac{d^2 y}{dx^2}\right)^3 = x^4$$

a) 2 b) 3

c) 4 d) None of these

Q.4 Fill in the blank :

The function $f(x) = x^2$ is a _____ function at $x=0$ (continuous/discontinuos)

Q.5 Fill is the blank :

$$\left(\frac{d}{dx}\right)(\sec x) = \underline{\hspace{2cm}}$$

Q.6 Fill in the blank :

$$\int cosecx.\cot x \; dx = \underline{\hspace{2cm}}.$$

Q.7 A quantity that has magnitude as well as direction is called a_____. (vector/scalar)

Q.8 The magnitude r, direction ratios (a,b,c) and direction cosines (l,m,n) of any vector are related as:

a) $a = lr, \; b = mr, \; c = nr$

b) $a = l/r, \; b = m/r, \; c = n/r$

c) $ar = l, \; br = m, \; cr = n$

d) None of these

Q.9 Write the negation of the following statement.

Every natural number is greater than 0.

Q.10 A problem which seeks to maximise or minimise a linear function (say of two variables x and y) subject to certain constraints as determined by a set of linear inequalities is called as_____problem.

(optimization / objective)

Section-B

Note: Short answer type questions. Attempt any four questions out of eight questions.   (4x5=20)

Q.11 Find AB if $A = \begin{bmatrix} 1 & 1 & -2 \\ 3 & -2 & -1 \\ -5 & 7 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -4 \\ 5 & -1 \\ -3 & 7 \end{bmatrix}$

Q.12 Let $f: N \to Y$ be a function defined as $f(x) = 4x+3$, where,

$Y = \{ y \in N: y = 4x+3 \text{ for some } x \in N \}$. Show that f is invertible and find the inverse of f.

Q.13 Prove that $\sin^{-1}\left(\frac{3}{5}\right) - \sin^{-1}\left(\frac{8}{17}\right) = \cos^{-1}\left(\frac{84}{85}\right)$

Q.14 Evaluate $\int_0^\pi \frac{x \sin x}{1 + \cos^2 x} dx$

OR

From a differential equation by eliminating arbitrary constants a and b from

$y = e^x (a \cos x + b \sin x)$

Q.15 Find angle 'θ' between the vector $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$.

Q.16 Find the Vector and Cartesian equations of the line that passes through the points (3, -2, -5) and (3, -2,6).