

1<sup>ST</sup> SEMESTER/ COMMON/ 2020(W)(NEW)

TH-3 ENGINEERING MATHEMATICS-I

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2  
Figures in the right hand margin indicates marks

1. Answer **All** questions

2 x 10

- a. Find the value of  $\frac{\sin 15 + \cos 15}{\cos 15 - \sin 15}$
- b. Find the value of  $\tan^{-1} \left( 2 \cos \frac{\pi}{3} \right)$
- c. The maximum value of  $\begin{vmatrix} \sin^2 x & \sin x \cos x \\ -\cos x & \sin x \end{vmatrix}$
- d. Find the value of k if the lines  $2x - 3y + 7 = 0$  and  $x - ky + 2 = 0$  are perpendicular to each other.
- e. If  $A = \begin{pmatrix} 2 & 4 \\ 3 & 13 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & 5 \\ 2 & -2 \end{pmatrix}$ , then find the value of  $A - 2B$
- f. Find centre and radius of sphere  $x^2 + y^2 + z^2 - 2x - 2y - 2z - 1 = 0$
- g. If the distance between the points  $(-1, -1, z)$  and  $(1, -1, 1)$  is 2, then find the value of z
- h. Find the image of the point  $(3, -1, 5)$  with respect to XY - Plane
- i. Find the direction cosines of a line whose direction ratios are  $(1, 1, 1)$
- j. Find the Value of  $\sin 70 (4 \cos^2 20 - 3)$

2. Answer **Any Six** Questions

6 x 5 = 30

- a. Solve by Cramer's rule  $2x - 3y = 7$  and  $3x - 2y = 3$
- b. Find the equation of circle having centre at  $(2, 3)$  and circle passes through the point  $(1, 2)$ .
- c. Prove that  $\sin 20 \sin 40 \sin 60 \sin 80 = \frac{3}{16}$
- d. Find angle between the planes  $2x + y - 3z + 2 = 0$  and  $3x - y + 2z + 3 = 0$
- e. Find Inverse of the matrix  $\begin{pmatrix} 2 & 1 & -2 \\ 1 & 2 & 1 \\ 3 & 6 & 4 \end{pmatrix}$
- f. If  $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \pi$  then prove that  $x + y + z = xyz$

g Find the equation of line passing through the point  $(2, -4)$  and parallel to the line  $4x + y - 3 = 0$

10

3 Prove that without expanding

$$\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$$

4 a Find the equation of line passing through intersection of lines  $2x - y - 1 = 0$  and  $3x - 4y + 6 = 0$  and parallel to the line  $x + y - 2 = 0$

5

b Find the value of  $\sin^{-1} \frac{1}{\sqrt{5}} + \cos^{-1} \frac{3}{\sqrt{10}}$

5

5 Find the ratio and co-ordinate in which the line segment joining the points  $(1, 3, -1)$  and  $(2, 6, -2)$  is divided by ZX-Plane

10

6 Solve by matrix method

$$x - y + z = 4, 2x + y - 3z = 0, x + y + z = 2$$

10

7 Find the equation of plane passing through the points  $(2, -3, 1)$  and  $(-1, 1, -7)$  and perpendicular to the plane  $x - 2y + 5z + 1 = 0$

10