

**1<sup>ST</sup> SEM. /COMMON TO / 2020(W) OLD**  
**BST-103 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. Express  $\frac{1+2i}{3-i}$  in the form of  $a+ib$
  - b. Find the number of terms in the expansion of  $(1 + x + x^2)^7$ .
  - c. Find the value of  $\cos 15^\circ$
  - d. Find the scalar projection of  $\vec{a} = (i-2j+\hat{k})$  on  $\vec{b} = (4\hat{i}-4\hat{j}+7\hat{k})$
  - e. Write the condition of matrix multiplication.  
If  $[3 \ 4 \ 2] B = [2 \ 1 \ 0 \ 3 \ 6]$ . Find the order of matrix B.
  - f. Find the value of "a", if the points (1,4), (2,7), and (3,a) are collinear.
  - g. Reduce  $3x+5y+4=0$  to the intercept form and find y-intercept.
  - h. Find the equation of a circle with centre (-3, 2) and radius 7.
  - i. Express  $\frac{1}{x^2-a^2}$  into partial fraction.
  - j. If  $a \cos B = b \cos A$ , then find  $\cos B$ .
2. Answer any **Six** questions 6 x 5
- a. If  $A = \begin{pmatrix} 5 & 3 \\ 12 & 7 \end{pmatrix}$ , Then verify that  $A^2 - 12A - I_2 = 0$ , where  $I_2$  is an identity matrix of order 2.
  - b. Split  $\frac{x}{(x+1)(x+2)}$  into partial fractions
  - c. If  $(A+B) = 45^\circ$ , find the value of  $(1+\tan A)(1+\tan B)$
  - d. Find the equation of a circle passing through the point (2,4) and the centre is the point of intersection of the lines  $x-y=4$  and  $2x+3y=-7$ .
  - e. Find the square root of  $8 - 5i$
  - f. Prove that the vectors  $2\hat{i}-\hat{j}+\hat{k}$ ,  $\hat{i}-3\hat{j}-5\hat{k}$  and  $3\hat{i}-4\hat{j}-4\hat{k}$  form a right angled triangle.
  - g. Find the term independent of  $x$  in the expansion of  $\left(\frac{3}{2}x^3 - \frac{1}{2x}\right)^9$
  - h. In a  $\Delta ABC$ , prove that  
 $a \sin(B - C) + b \sin(C - A) + c \sin(A - B) = 0$
3. i. Solve by using Cramer's rule 7
- $$\begin{aligned} 5x-7y+z &= 11 \\ 6x-8y-z &= 15 \end{aligned}$$

- $3x+2y-6z=7$
- ii Prove that  $\begin{vmatrix} x & 1 & 1 \\ 1 & x & 1 \\ 1 & 1 & x \end{vmatrix} = (x+2)(x-1)^2$  3
- 4 i Solve by matrix method 7
- $5x+3y+z=16$   
 $2x+y+3z=19$   
 $X+2y+4z=25$
- ii Find adjoint of the matrix  $A = \begin{pmatrix} 3 & 1 \\ -7 & 5 \end{pmatrix}$  3
- 5 i If  $A+B+C=\pi$  then prove that 7
- $\sin 2A + \sin 2B - \sin 2C = 4\cos A \cos B \cos C$
- ii In any triangle prove that if 3
- $(a+b+c)(b+c-a) = 3bc$  Then *angle of A* =  $60^\circ$
- 6 i Find the equation of the straight line which passes through the point of intersection of the lines  $x-y-1=0$  and  $2x-3y+1=0$  and is parallel to the line  $3x+4y=14$ . 7
- ii Find the acute angle between the lines  $x-2y+3=0$  and  $3x+y-1=0$  3
- 7 i Define unit vector? Find the unit vector perpendicular to the vectors 7
- $\hat{i}-3\hat{j}+\hat{k}$  and  $-\hat{i}+2\hat{j}-\hat{k}$
- ii Prove that 3
- $(1 - \omega + \omega^2)^5 + (1 + \omega - \omega^2)^5 = 32$