

**1st Sem./CIVIL/ELECT/ETE/MECH/AUTO/AE
&IE/CSE/CHEM/METAL/MINING/DRILLING/ARCH/CERAMIC/IT/
ELECT[PT]/EEE/ 2021(W)
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. Find $(-i)^{4n+2}$
 - b. Find the number of terms in the expansion of $(1 + 2x + x^2)^7$.
 - c. With 4 different elements, how many determinants of order 2 are possible?
 - d. If $A = \begin{pmatrix} 2 & 4 \\ 3 & 13 \end{pmatrix}, I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, then find $A - \alpha I$
 - e. Find the value of $\cos^2 22\frac{1}{2} - \sin^2 22\frac{1}{2}$
 - f. Find the area of the triangle with vertices $(0, 0), (1, 0), (2, 3)$.
 - g. Find the centre and radius of the circle $x^2 + y^2 - 2x + 4y - 4 = 0$.
 - h. If the vector $\vec{a} = \alpha\hat{i} + 3\hat{j} - 6\hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$ are parallel, find α .
 - i. Find $\frac{\tan 15^\circ}{1 - \tan^2 15^\circ}$
 - j. Determine the distance between the parallel lines $x+5=0$ and $x-5=0$.
2. Answer **Any Six** Questions 5X6
- a. Prove that $(2 + 5\omega + 2\omega^2)^6 = 729$
 - b. Find the adjoint of the following matrix
$$\begin{bmatrix} -2 & 2 & 3 \\ 1 & 4 & 2 \\ -2 & -3 & 1 \end{bmatrix}$$
 - c. Find the maximum and minimum values of the following $8 \cos x - 15 \sin x - 2$
 - d. Find the term independent of x in the expansion of $\left(x^2 + \frac{1}{x}\right)^9$
 - e. Find the equation of circle whose end points of diameter are $(-5, 3)$ and $(7, 5)$.
 - f. Show that $\begin{vmatrix} y+z & x & y \\ z+x & z & x \\ x+y & y & z \end{vmatrix} = (x+y+z)(x-z)^2$
 - g. Find the area of the parallelogram whose adjacent sides are determined by the vectors $\vec{a} = \hat{i} + 2\hat{j} + 6\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + \hat{k}$.

- Answer any **three** questions
- 3 a. If $x + \frac{1}{x} = 2 \cos \theta$, then show that $x^n + \frac{1}{x^n} = 2 \cos n \theta$ 7
- b. If $A+B=45^\circ$ Prove that $(1+\tan A)(1+\tan B) = 2$. 3
- 4 Resolve into partial fractions $\frac{(2x+1)}{(x+1)(x-2)(x-3)}$ 10
- 5 Solve by using Cramer's rule $3x+2y+6z = 1$
 $2x-3y+4z = 3$
 $4x-3y+7z = 4$ 10
- 6 Find the vector and scalar projection of $\vec{a} = \hat{i} - \hat{j} - \hat{k}$ and $\vec{b} = 3\hat{i} - \hat{j} - 3\hat{k}$. 10
- 7 a. If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \frac{\pi}{2}$ Show that $xy+yz+zx=1$ 5
- b. If $\frac{a}{\sec A} = \frac{b}{\sec B}$ and $a \neq b$, then find C 5