Roll No .....

BE-102 (GS)

B.E. I & II Semester Examination, June 2020

Grading System (GS)

Engineering Mathematics - I

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any Five questions out of eight.

ii) All questions carry equal marks.

1. a) Find the Maclaurin expansion of $f(x) = \sin x$.
   b) Discuss maxima and minima of the function
   $f(x, y) = x^3 - 4xy + 2y^2$

2. If $u = \sec^{-1}\left(\frac{x^2 + y^2}{x - y}\right)$. Find the value of $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$.

3. a) Give the statement of Maclaurin's theorem and Taylor's theorem.
   b) Expand e^x by Maclaurin's theorem.

4. a) Explain the order and degree of a ordinary differential equation with example.
   b) Solve the differential equation

   $(1 - x^2)(1 - y)\,dx = xy(1 + y)\,dy$

5. a) Evaluate $\int_0^2 \int_0^1 \left(x^2 + y^2\right) dx\, dy$.

   b) Prove that $\left\lceil \frac{1}{2} = \sqrt{\pi} \right.$.

6. a) Define radius of curvature and centre of curvature.
   b) Find the percentage error in the area of an ellipse if 1% error is made in measuring the major and minor axes.

7. a) Find the rank of the matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{pmatrix}$.

   b) Find Eigen values and Eigen vectors of the matrix $A = \begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$.

OR

   a) Find rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$.

   b) Test the consistency and solve
   $5x + 3y + 7z = 4$
   $3x + 26y + 2z = 9$
   $7x + 2y + 10z = 5$

8. a) Explain Clairaut's equation with example.

   b) Prove that $(p \vee q) \wedge (\sim p) \wedge (\sim q)$ is a contradiction.

OR

Find the normal form of the matrix and hence find its rank.

$$A = \begin{bmatrix} 8 & 1 & 3 & 6 \\ 0 & 3 & 2 & 2 \\ -8 & -1 & -3 & 4 \end{bmatrix}$$

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