



I B.Tech I Sem Regular End Examination, July 2021

ENGINEERING MATHEMATICS - I**(CE, ME, ECE, CSC, CSD)****Time: 3 Hours.****Max. Marks: 70**

Note: 1. Answer any FIVE questions.

2. Each question carries 14 marks and may have a, b as sub questions.

- 1 a) Define Echelon form of a matrix 2M CO BL
 b) Solve the system of equations using Gauss-Seidel method 12M CO BL
 $2x - y = 7; -x + 2y - z = 1; -y + 2z = 1.$
- 2 For what values of λ , the system of equations 14M CO BL
 $x + y + z = 1, x + 2y + 4z = \lambda, x + 4y + 10z = \lambda^2$ have a solution and solve them completely in each case.
- 3 Determine a non-singular matrix P such that P^TAP is a diagonal matrix, 14M CO BL
 where $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 0 & 3 \\ 2 & 3 & 0 \end{bmatrix}$. Interpret the result in terms of quadratic form.
- 4 a) Show that $\beta(p, q) = \beta(p + 1, q) + \beta(p, q + 1)$. 5M CO BL
 b) Verify Lagrange's mean value theorem for $f(x) = \begin{cases} x \sin \frac{1}{x} & (x \neq 0) \\ 0 & (x = 0) \end{cases}$ in $[-1, 1]$. 9M CO BL
- 5 a) If A is an $n \times n$ matrix and $A^2 = A$, then show that each eigenvalue of A is 0 or 1. 5M CO BL
 b) Prove that $\frac{\pi}{6} + \frac{1}{5\sqrt{3}} < \sin^{-1}\left(\frac{3}{5}\right) < \frac{\pi}{6} + \frac{1}{8}$. 9M CO BL
- 6 a) Find the Jacobian $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ for $x = u, y = u \tan v, z = w$. 7M CO BL
 b) If $u = \frac{1}{\sqrt{x^2 + y^2 + z^2}}, x^2 + y^2 + z^2 \neq 0$ then evaluate $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}$. 7M CO BL
- 7 a) Find the shortest distance from origin to the surface $xyz^2 = 2$. 7M CO BL
 b) Find the volume bounded by the cylinders $x^2 + y^2 = 4$ and $z = 0$. 7M CO BL
- 8 a) By changing the order of integration, evaluate $\int_0^b \int_0^{\frac{a\sqrt{b^2 - y^2}}{b}} xy dy dx$ 9M CO BL
 b) Evaluate $\int_0^1 \int_1^{2-x} xy dx dy$. 5M CO BL