



R20 Regulation

# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

Subject code:3B1AF

## B.Tech I Semester Supplementary Examinations, September 2023

### LINEAR ALGEBRA & APPLIED CALCULUS

(Common to EEE and ME)

Maximum Marks: 70

Date:29.09.2023 Duration: 3 hours

- Note: 1. This question paper contains two parts A and B.  
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.  
3. Part B consists of 5 Units. Answer any one full question from each unit.  
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

#### Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

- 1 Define Rank of a matrix
- 2 Define symmetric matrix.
- 3 Determine the nature, index, and signature of the quadratic form  $x^2 - 6xy + y^2$ .
- 4 Express the following quadratic form matrix notation  
$$2x^2 + 3y^2 - 5z^2 - 2xy + 6xz - 10yz.$$
- 5 Evaluate  $\int_0^2 \int_0^x y \, dy \, dx$
- 6 Evaluate  $\int_0^1 \int_0^2 (x^2 + y^2) \, dy \, dx$
- 7 State Rolle's mean value theorem.
- 8 Define Beta and Gamma functions.
- 9 If  $u=e^x$ , find  $\frac{\partial^2 u}{\partial y \partial x}$ .
- 10 If  $x = r \cos \theta$ ,  $y = r \sin \theta$  then find  $\frac{\partial(r, \theta)}{\partial(x, y)}$ .

#### Part-B

Answer All the following questions.

(10M X 5=50Marks)

- 11 Find the rank of the matrix by reducing to Echelon form where  $A = \begin{bmatrix} 4 & 2 & 3 \\ 8 & 4 & 6 \\ -2 & -1 & -1 \end{bmatrix}$  [10]

OR

- 12 Find the rank of the matrix by reducing to Normal form where [10]

$$A = \begin{bmatrix} 2 & 3 & 1 & 4 \\ 5 & 2 & 3 & 0 \\ 9 & 8 & 0 & 8 \end{bmatrix}$$

- 13 Determine the Eigen values and Eigen vectors of the following matrices ; [10]

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

OR

- 14 Verify Cayley – Hamilton theorem for  $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$  [10]

- 15 Find the area of the region bounded by  $y^2 = 4ax$  and  $x^2 = 4ay$  [10]

OR

- 16 Evaluate  $\int_0^{\frac{\pi}{2}} \int_0^{\infty} \frac{r}{(a^2+r^2)^2} dr d\theta$  [10]

- 17 Verify Rolle's mean value theorem for the function  $f(x) = \log \frac{x^2+ab}{x(a+b)}$  in  $[a,b]; a>0, b>0$ . [10]

OR

- 18 S.T  $\beta(m, n) = \int_0^{\infty} \frac{x^{n-1}}{(1+x)^{m+n}} dx$  [10]

- 19 If  $x = e^r \sec \theta$ ,  $y = e^r \tan \theta$  then prove that  $JJ^I = 1$  [10]

OR

- 20 Determine whether  $u = \sin x + \sin y$ ;  $v = \sin(x+y)$  are functionally dependent or not. [10]