

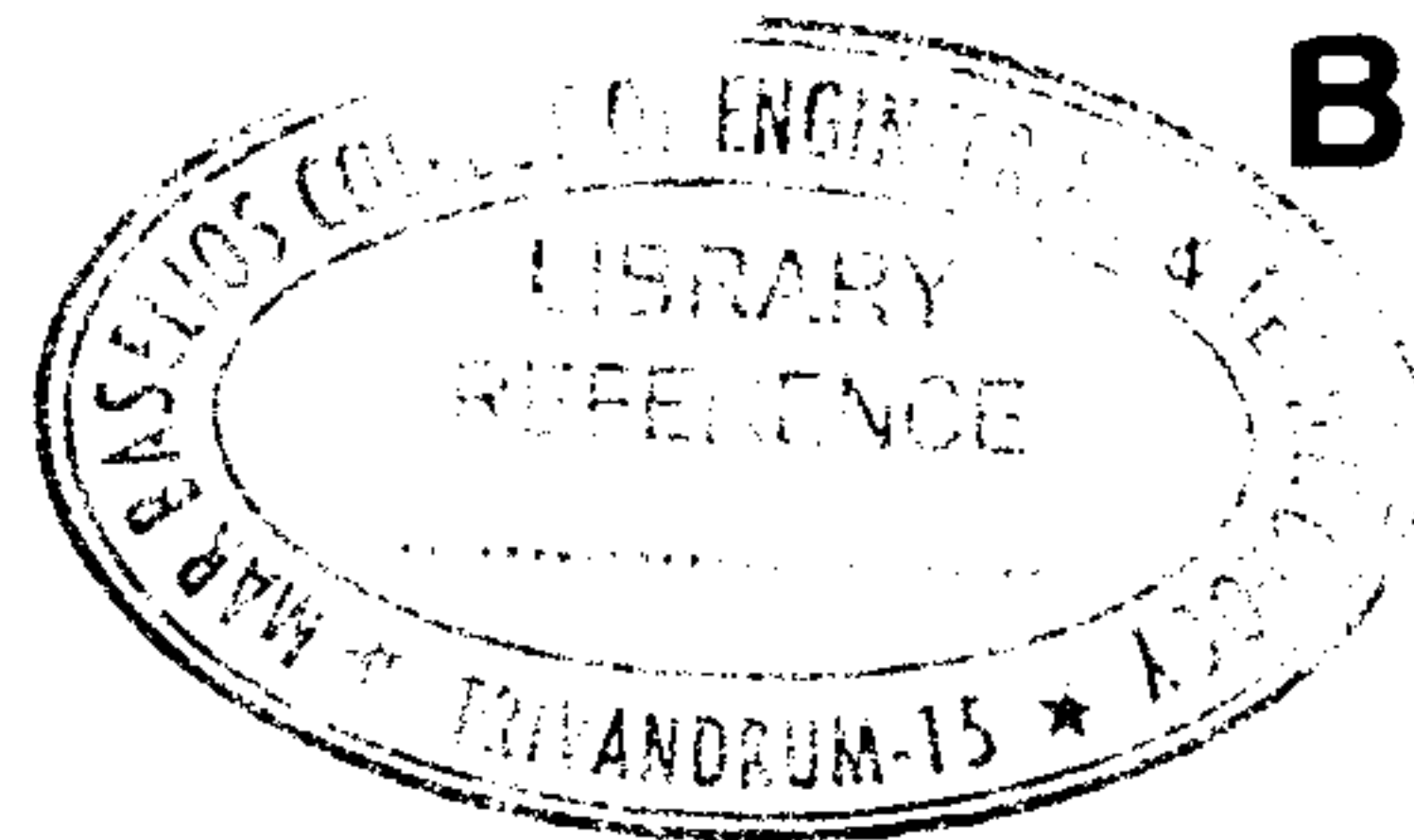


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B – 5226

Reg. No. :

Name :



**Combined First and Second Semester B.Tech. Degree
Examination, February 2017
(2008 Scheme)
08-101 : ENGINEERING MATHEMATICS – I
(CMNPHEARUFBS)**

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Find the n^{th} derivative of $x^2 \cos x$.

2. Expand $\log x$ in powers of $x - 1$.

3. If $x = r \sin \theta \cos \phi$, $y = r \sin \theta \sin \phi$ and $z = r \cos \theta$. Show that $\frac{\partial(x, y, z)}{\partial(r, \theta, \phi)} = r^2 \sin \theta$.

4. If \vec{u} and \vec{v} are irrotational, prove that $\vec{u} \times \vec{v}$ is solenoidal.

5. Solve $(D^2 - 8D + 9)y = 8 \sin 5x$.

6. Find $L\left(\frac{\sin t}{t}\right)$.

7. Find the orthogonal trajectories of parabolas $y = ax^2$.

8. Find the rank of the matrix $\begin{bmatrix} 1 & -1 & 0 & 2 & 1 \\ 3 & 1 & 1 & -1 & 2 \\ 4 & 0 & 1 & 0 & 3 \\ 9 & -1 & 2 & 3 & 7 \end{bmatrix}$

9. Prove that $X_1 = (2, -1, 4)$, $X_2 = (4, 0, 12)$, $X_3 = (0, 1, 2)$ are linearly dependent and find the relation between them.

10. Show that the sum of eigen values of a matrix are the sum of its diagonal elements.

P.T.O.



PART – B

Answer **two** question from **each** Module. **Each** question carries **10** marks.

Module – I

11. Show that the equation of the evolute of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is

$$(ax)^{2/3} - (by)^{2/3} = (a^2 + b^2)^{2/3}.$$

12. If $u = \sin^{-1}\left(\frac{x^2 + y^2}{x + y}\right)$. Prove that $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = \tan^3 x$.

13. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $r = |\vec{r}|$, then prove that $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$.

Module – II

14. Solve $\frac{dx}{dt} + 4x + 3y = t$, $\frac{dy}{dt} + 2x + 5y = e^t$.

15. Using method of variation of parameters, solve $\frac{d^2 y}{dx^2} + 3 \frac{dy}{dx} + 2y = 3e^{-2x} + x$.

16. Using Laplace transform, solve $y'' + 3y' + 2y = 8 \cos 2t$. Given : $y(0) = -1, y'(0) = 2$.

Module – III

17. Reduce $8x_1^2 + 7x_2^2 + 3x_3^2 - 12x_1x_2 - 8x_2x_3 + 4x_3x_1$ into canonical form by orthogonal reduction. Examine for definiteness.

18. Show that the matrix $A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 1 & 0 \\ 2 & 0 & 3 \end{bmatrix}$ satisfies its characteristic equation. Also

find A^{-1} and A^4 using Cayley Hamilton Theorem.

19. Find the values of a and b for which the equations $x + ay + z = 3$, $x + 2y + 2z = b$, $x + 5y + 3z = 9$ are consistent. When will these equations have i) unique solution ii) no solution iii) more than one solution.