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Reg. No. : ....

Name : ....

Combined First and Second Semester B.Tech. Degree Examination, March 2018
(2008 Scheme)
08-101 : ENGINEERING MATHEMATICS – I (CMNPHETARUFBS)

Time : 3 Hours Max. Marks : 100

PART – A

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

1. Find the n^{th} derivative of $\frac{1}{x^2 - 6x + 8}$.

2. Find the radius of curvature at the point (3a/2, 3a/2) of the Folium $x^3 + y^3 = 3axy$.

3. If u = f (2x – 3y, 3y – 4z, 4z – 2x), prove that $\frac{1}{2}\frac{\partial u}{\partial x} + \frac{1}{3}\frac{\partial y}{\partial y} + \frac{1}{4}\frac{\partial u}{\partial z} = 0$.

4. If $u = \frac{x + y}{1 - xy}$ and $v = \tan^{-1} x + \tan^{-1} y$, find $\frac{\partial (u, v)}{\partial (x, y)}$.

5. Find the directional derivative of $f(x, y, z) = xy^2 + yz^3$ at the point (2, –1, 1) in the direction of the vector $\hat{i} + 2\hat{j} + 2\hat{k}$.

6. Find the Laplace transform of $\frac{1 - e^t}{t}$.

7. Solve $(2x - 1)^2 \frac{d^2y}{dx^2} - 4(2x - 1)\frac{dy}{dx} + 8y = 0$.

8. Define linear dependence and independence of vectors. Show that the vectors (2, 3, 0), (1, 2, 0) and (8, 13, 0) are linearly dependent.

P.T.O.

9. If λ is an eigen value of a matrix A, show that $\frac{|A|}{\lambda}$ is an eigen value of adjA.

10. Find the possible values of k such that the equations

$x + ky + 3z = 0$

$4x + 3y + kz = 0$

$2x + y + 2z = 0$ have non-trivial solution.

PART – B

Answer **two** questions from **each** Module. **Each** question carry **10** marks.

Module – I

11. If $2x = y^{1/m} + y^{-1/m}$ prove that

$(x^2 - 1) y_{n+2} + (2n+1) xy_{n+1} + (n^2 - m^2) y_n = 0$

12. Find the dimensions of the rectangular box, open at the top of maximum capacity whose surface area is 432 sq . cm.

13. Define gradient of a scalar point function. If ϕ is a scalar point function show that grad ϕ is a vector normal to the level surface ϕ = constant and has a magnitude equal to the rate of change of ϕ along this normal.

Module – II

14. a) Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 2\ \text{Sinh}2x$.

b) Using the method of variation of parameters, solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$.

15. a) Find the Laplace transform of $t^2 e^{-t} \sin 3t$.

b) Find the inverse Laplace transform of $\frac{s^2 + 6}{(s^2 + 1)(s^2 + 4)}$.

16. Find the orthogonal trajectory of $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$ where λ is the parameter.

Module – III

17. Reduce the following matrix to normal form and hence determine its rank

$$A=\begin{bmatrix}1 & 2 & 3 & 0\\ 2 & 4 & 3 & 2\\ 3 & 2 & 1 & 3\\ 6 & 8 & 7 & 5\end{bmatrix}$$

18. Verify Cayley-Hamilton theorem for the following matrix A and find A^{-1} where

$$A=\begin{bmatrix}7 & 2 & -2\\ -6 & -1 & 2\\ 6 & 2 & -1\end{bmatrix}.$$

19. Reduce the quadratic form

$3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to the canonical form. Specify the matrix of transformation. Also write the rank, index and signature.