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# SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E/B.Tech-All Branches Except Biogroups

Title of the Paper: Engineering Mathematics - I Max. Marks: 80

Sub. Code: 6C0002 (2006/07/08/09)

Time: 3 Hours

Date: 06/12/2010

Session: FN

PART - A

(10 X 2 = 20)

Answer ALL the Questions

- Find the sum of the squares of the eigen values of  $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$ .
- Determine the nature of the Quadratic form without reducing to the canonical form:  
$$x^2 + 3y^2 + 6z^2 + 2xy + 2yz + 4xz.$$
- Find the sum to infinity of the series  $1 + 2\left(\frac{1}{2}\right) + 3\left(\frac{1}{4}\right) + 4\left(\frac{1}{8}\right) + \dots$
- Find the coefficient of  $x^{10}$  in the expansion of  
$$\left(1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \dots\right) + \left(\frac{x}{1!} + \frac{x^3}{3!} + \frac{x^5}{5!} + \dots\right).$$
- Find the curvature of the circle  $x^2 + y^2 = 25$ .
- Find the envelope of the family of lines  $y = mx + am^2$ ,  $m$  being the parameter.
- Expand  $e^x \sin y$  in powers of  $x$  and  $y$  up to second degree terms.

8. If  $x = u(1-v)$ ,  $y=uv$  find  $J\left(\frac{x, y}{u, v}\right)$ .

9. Solve  $(D^2+4)y = e^x$ .

10. Solve the equation  $x^2y' - xy' + y = 0$ .

PART – B

(5 x 12 = 60)

Answer All the Questions

11. Reduce the quadratic form  $2x^2 + 6y^2 + 2z^2 + 8xz$  to canonical form by orthogonal reduction. Find also the nature of the quadratic form.

(or)

12. (a) Find the eigen values and eigen vectors of the matrix  $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$

(b) Verify Cayley Hamilton for the matrix  $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$

13. (a) When  $x$  is small, show that  $\sqrt{x^2+4}-\sqrt{x^2+1}=1-\frac{1}{4}x^2+\frac{7}{64}x^4$ , nearly.

(b) Find the sum to infinity of the series  $\frac{1}{1!} + \frac{1+5}{2!} + \frac{1+5+5^2}{3!} + \dots \infty$

(or)

14. Show that  $\frac{1}{1.2.3} + \frac{5}{3.4.5} + \frac{9}{5.6.7} + \frac{13}{7.8.9} + \dots \infty = \frac{5}{2} - 3\log 2$ .

15. Find the equation of the circle of curvature of the curve  $x^2+y^3=3axy$  at the point  $\left(\frac{3a}{2}, \frac{3a}{2}\right)$

(or)

16. Find the evolute of the parabola  $y^2 = 4ax$  considering it as the envelope of its Normals.

17. (a) If  $u = (x - y, y - z, z - x)$  prove that  $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$   
(b) Discuss the maxima and minima of the function,  
 $u = x^3 y^2 (1 - x - y)$ .

(or)

18. (a) The temperature  $T$  at any point in space is  $T = kxyz^2$  where  $k$  is a constant, find the highest temperature on the surface of the sphere  $x^2 + y^2 + z^2 = 1$ .  
(b) Evaluate  $\int_0^{\infty} e^{-x} \frac{\sin \alpha x}{x} dx$  using differentiation under the integral sign.

19. Solve  $Dx + y = \sin t$ ,  $x + Dy = \cos t$ , given  $x = 2$  and  $y = 0$  at  $t = 0$ .

(or)

20. (a) Use the method of variation of parameters and solve  
 $(D^2 + 1)y = x$ .  
(b) Solve  $(D^2 - 4D + 13)y = e^{2x} \cos 3x$ .