SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E /B.Tech – Common to ALL Branches
(Except to Bio Groups)
Title of the paper: Engineering Mathematics - II
Semester: II Max. Marks: 80
Sub.Code: ET202A/3ET202A/4ET202A/5ET202A Time: 3 Hours
Date: 24-05-2008 Session: FN

PART – A (10 x 2 = 20)

Answer All the Questions

1. Solve the equation $x^3 + 6x + 20 = 0$, are root being 1 + 3i.
2. Diminish the roots of $x^4 - 5x^3 + 7x^2 - 4x + 5 = 0$ by 2 and find the transformed equation
3. Find the radius of curvature $y^2 = 2x(3 - x^2)$ at the points where the tangents are parallel to x axis.
4. Find the maximum and minimum values of $f(x,y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$.
5. Solve the equation:
   $(x + 2y)\,dx + (2x + y)\,dy = 0$.
6. Solve the method of variation of parameters:
   $(D^2 - 2D)y = e^x \sin x$.
7. Compute the time required for a particle, in simple flarmonic motion with amplitude 20cm and periodic time 4 seconds, in passing between two points which are at distances 15 cm and 5cm from the origin 0.
8. Determine the change and current at time t > 0 in a RC-circuit with R = 10, c = 2 x 10^{-4}, E = 100 V given that Q(t = 0) = 0.
9. Prove that grade $\left(\frac{f}{g}\right) = \frac{fgradf - fgradg}{g^2}$

10. If $u = x^2 - y^2$, prove that $\nabla^2 u = 0$.

PART – B (5 x 12 = 60)

Answer All the Questions

11. (a) Find the condition that the roots of the equation $x^3 + px^2 + qx + r = 0$ may be in A-P.

(b)Solve $4x^4 - 20x^3 + 33x^2 - 20x + 4 = 0$.

(or)

12. (a) Find the condition that the roots of the education $x^3 - px^2 + qx - r = 0$ may be in G-P.

(b) Solve the equation:

$6x^6 - 35x^5 + 56x^4 - 56x^2 + 35x - 6 = 0$.

13. (a) Find the radius of curvature at the indicated point:

$$x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}} \text{ at } (x, y).$$

(b) Find the evolute of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1.$ Deduce the evolute of a rectangular hyperbola?

(or)

14. (a) Determine the envelope of the two parameter family of parabola $\sqrt{\frac{x}{a}} + \sqrt{\frac{y}{b}} = 1.$ where the two parameters a and b are connected by the relation a + b = c where c is a given constant.

(b) Find the minimum value of $x^2 + y^2 + z^2$ subject to the condition $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$

15. (a) Solve the equation

$(D^3 - 2D^2 - 5D + 6)\, y = 2e^x + 4e^{3x} + 7e^{-2x} + 8e^{2x} + 15.$

(b) Solve the differential equation by the method of variation of parameters $(D^2 - 3D + 2)\, y = \dfrac{1}{1 + e^{-x}}$

(or)

16. Solve $(D^2 + D + 1)\, x + (D^2 + 1)\, y = e^t$ and $(D^2 + D)\, x + D^2 y = e^{-t}$.

17. A circuit consists of an inductance of 0.05 henrys, a resistance of 5 ohms and a condenser of capacitance 4×10^{-4} farad. If Q = I = o when t = 0, find Q (t) and I(t) when
(a) there is a constant emf of 110 volts,
(b) there is an alternating emf 200 cos 100r.
(c) find the steady state solution in is (b)

(or)

18. Find the angular motion Q(t) of a forced undamped pendulum whose equation is given by $Q + w_o^2 t = F_o$ sinkt where w_o and F_o are constants. If x = x = 0 at t = 0.

19. Verify the Gauss divergince theorem for $\vec{F} = 4xz\,\vec{i} - y^2\,\vec{j} + yz\,\vec{k}$ over the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0 and z = 1.

(or)

20. (a) Find the directional derivative of f = xyz at (1, 1, 1) in the directions of i + j + k, i, -i.

(b) Evaluate $\iint_S \vec{F}.n^2\, ds, where \vec{F} = z\vec{i} + x\vec{j} - y^2 z\vec{k}$ and S is the surface of the cylinder $x^2 + y^2 = 1$, included in the first octant between the planes z = 0 and z = 2.