Register Number

SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Course & Branch: B.E/B.Tech-All Branches Except Biogroupts
Title of the Paper: Engineering Mathematics - II Max. Marks: 80
Sub. Code: 4ET202A /5ET202A (2004/05) Time: 3 Hours
Date: 04/12/2010 Session: AN

PART - A (10 X 2 = 20)

Answer ALL the Questions

1. Find the condition that the roots of the equation. $X^3 + px^2 + qx + r = 0$ may be in geometrical progression.

2. If α, β and γ are the roots of $x^3 - 3ax + b = 0$, show that $\Sigma (\alpha-\beta)(\alpha-\gamma) = 9a$.

3. Find the radius of curvature of the curve $xy = c^2$ at (c, c).

4. Find the stationary points of the function $f(x, y) = 4x^2 + 6xy + 9y^2 - 8x - 24y + 4$.

5. Find the particular integral of $(D^2 - 2D + 5)y = e^x \sin 2x$.

6. Convert the equation $x^4 y''' - x^3 y'' + x^2 y' = 1$ as a linear equation with constant coefficients.

7. Rewrite the equation $p = \log(px - y)$ as a Clairaut's equation and give its general solution.

8. Write down the differential equation satisfied by the current and charge in a capacitative circuit.

9. If $\bar{r}$ is the position vector of the point (x, y, z), $\bar{a}$ is a constant vector and $\phi = x^2 + y^2 + z^2$, then find (a) grad $(\bar{r} \circ \bar{a})$ and (b) $\bar{r} \circ \text{grad}\phi$.

10. If $\bar{F}$ is a solenoid vector, find the value of curl (curl(curl(curl $\bar{F}$)))

PART – B (5 x 12 = 60)

Answer All the Questions

11. (a) Solve $6x^3 - 11x^2 + 6x - 1 = 0$ given the roots are in harmonic progression.
(b) Transform the equation $x^4 - 8x^3 - x^2 + 68x + 60 = 0$ into one which does not contain the term x^3. Hence, solve it.

(or)

12. (a) If α, β and γ are the roots of $x^3 - 14x + 8 = 0$, find the value of $\Sigma\alpha^2$ and $\Sigma\alpha^3$.
(b) Solve $8x^5 - 22x^4 - 55x^3 + 55x^2 + 22x - 8 = 0$.

13. (a) Find the equation of the circle of curvature of the parabola $y^2 = 12x$ at the point (3, 6).
(b) Find the evolute of the curve $x^{2/3} + y^{2/3} = a^{2/3}$.

(or)

14. (a) Find the envelope of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, where a and b are connected by the relation $a^2 + b^2 = c^2$, c is a constant.
(b) Find the maximum value of $x^m y^n z^p$, when $x + y + z = a$.

15. (a) Solve $y = x + p^2 - 2p$, as an equation solvable for y.
(b) Solve $(D^2 + D + 1)\, y = e^{-x} \sin^2(x/2)$.

(or)

16. (a) Solve $(x^2D^2 - x\,D + 4)\, y = x^2 \sin(\log x)$
(b) Solve the differential equation $\frac{d^{2y}}{dx^2} + a^2 y = \tan ax$ by the method of variation of parameters.

17. (a) A particle falls under gravity from rest through a medium whose resistance varies as the velocity and whose terminal velocity is L. When the particle acquired a velocity L/2, show that it would have traversed a distance of $\frac{L^2}{2g}\log(\frac{4}{e})$

(b) An electromotive force E sin(wt) is applied to a circuit containing a resistance R and inductance L in series. If I = 0 at t = 0, show that the current L in the circuit at time t is given by

$$i = \frac{E}{\sqrt{R^2 + L^2 w}}[\sin(wt - \Phi) + \sin\Phi \exp(-Rt/L)],$$

Where $\Phi = \tan^{-1}(\frac{Lw}{R})$.

(or)

18. A particle is projected with velocity U along a smooth horizontal plane in a medium whose resistance per unit of mass is μ times the cube of the velocity. Show that the distance it has described in time t is $\frac{1}{\mu U}(\sqrt{1+2\mu U^2 t - 1})$ and that its velocity then $\frac{U}{\sqrt{1+2\mu U^2 t}}$

19. (a) Prove the relation: curl(curl $\overline{F}$) = $\nabla(\nabla \circ \overline{F}) - \nabla^2 \overline{F}$.

(b) Verify Gauss divergence theorem for $\overline{F} = x^2\bar{i} + y^2\bar{j} + z^2\bar{k}$, where S is the surface of the cuboid formed by the planes x=0, x=a, y=0, y=b, z=0 and z=c.

(or)

20. (a) Verify Stoke's theorem for $\overline{F} = -y\,\bar{i} + 2yz\,\bar{j} + y^2\bar{k}$, where S is the upper half of the sphere $x^2 + y^2 + z^2 = a^2$ and C is the circular boundary on the xoy plane.

(b) Evaluate $\iint_s \overline{F} \circ \overline{d}s, where\ \overline{F} = yz\overline{i} + zx\ \overline{j} + xy\hat{k}$ and S is the part of the sphere $x^2 + y^2 + z^2 = 1$ that lies in the first octant.