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: 10-12-2007 Session: AN

PART – A (10 x 2 = 20)
Answer ALL the Questions

1. If α, β, γ are the roots of the equation $x^3 - px^2 + qx - r = 0$ find the value of $\sum \frac{1}{\alpha}$.

2. Find one root of the equation $27x^3 + 42x^2 - 28 - 8 = 0$. given that the roots are in G.P.

3. Find the radius of curvature of the curve $y = e^x$ at the point where it cuts the x – axis.

4. Find the envelope of the family of curves $y = \tan^2\theta$, where θ is the parameter.

5. Solve $(D^2 + D + 1)\, y = 0$.

6. Solve $P^2 - 5P + 6 = 0$.

7. State the Kirchoff's law.

8. Define simple harmonic motion and write the differential equation corresponding to it.

9. If $\nabla\Phi = \left(2xy + z^3\right)\vec{i} + x^2\vec{j} + 3xz^2\vec{k}$ find Φ.

10. Prove that grad (r) = $\frac{\vec{r}}{r}$.

PART – B (5 x 12 = 60)

Answer ALL the Questions

11. (a) Solve $x^3 - 9x^2 + 26x - 24 = 0$. given that the roots are in A.P.

(b) Solve $6x^5 - x^4 - 4x^3 + 4x^2 + x - 6 = 0$.

(or)

12. (a) solve the equation $x^4 - 12x^3 + 49x^2 - 78x + 40 = 0$ by transforming it into one in which there is no term in x^3.

(b) If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$, form the equation whose roots are $\alpha + \beta$, $\beta + \gamma$, $\gamma + \alpha$.

13. (a) Find the radius of curvature for the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ at the point $\left(\frac{a}{4}, \frac{a}{4}\right)$.

(b) A rectangular Box open at the top is to have a given capacity 32CC. Find the dimensions of the box requiring least material for its construction.

(or)

14. (a) Prove that the evolute of the bractrix x = a(cost + log tan $\frac{t}{2}$), y = a sin t is the catenary y = a cosh$\left(\frac{x}{a}\right)$.

(b) Find the envelope of the family of straight lines $\frac{x}{a}+\frac{y}{b}=1$ where the parameters a and b connected by the relation $ab = c^2$.

15. (a) Solve $(D^2 + 6D + 8)\, y = e^{-2x} + \cos^2 x$.

(b) Solve by the method of variation of parameters $\frac{d^2 y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$.

(or)

16. (a) Solve $(x^3D^3 + 2x^2D^2 + 2)\, y = 10\left(x+\frac{1}{x}\right)$.

(b) Solve the simultaneous equations $\frac{dx}{dt}+2y+\sin t=0, \frac{dy}{dt}-2x-\cot=0.$

17. (a) A voltage e^{-at} is applied at $t = 0$ at a circuit containing inductance L and resistance r. Show that the current at any time t is $\left(\frac{E}{R-aL}\right)\left(e^{-at}-e^{\frac{-Rt}{L}}\right)$ assuming $i = 0$ at $t = 0$ and the governing equation as .

(b) Two particles fall freely. One in a medium whose resistance is equal to k times the velocity and the other in a medium whose resistance equal to k times the squares of the velocity. If L_1 and L_2 are their maximum velocities respectively, show that $L_1 = L_2^2$

(or)

18. (a) A point moves with SHM. If, when at distances 3m and 4m from the centre of its path, its velocities are 8m and 6m per second respectively. Find its period, maximum velocity and acceleration when at its greatest distance from the centre.

(b) A horizontal beam of length '2l' is freely supported at both ends. If the differential equation of the elastic curve is $EI\frac{d^2y}{dx^2}=\frac{\omega x^2}{2}-\omega lx$ where ω is the load per unit length, find the maximum deflection.

19. (a) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at (2, -1, 2).

(b) Apply stoke's theorem to evaluate $\int_C \{(x+y)dx + (2x-z)dy + (y+z)dz\}$ where c is the boundary of the triangle with vertices (2, 0, 0), (0, 3, 0) and (0, 0, 6).

(or)

20. (a) Find the constants a, b, c such that $\vec{F}=(x+2y+az)\vec{i}+(bx-3y-z)\vec{j}+(4x+cy+2z)\vec{k}$ is irrotational.

(b)Verify the Divergence 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.