SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act,1956)

Course & Branch :B.E/B.Tech - Common to ALL Branches (Excepts to Bio Groups)
Title of the Paper :Engineering Mathematics – II Max. Marks :80
Sub. Code :4ET202A-5ET202A Time : 3 Hours
Date :03/12/2009 Session :AN

PART - A (10 x 2 = 20)

Answer ALL the Questions

1. If α, β, γ are the roots of $x^3 - 14x + 8 = 0$, find $\sum\alpha^2$ *and* $\sum\alpha^3$.

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

3. What is the radius of curvature at (3,4) on $x^2+y^2 = 25$?

4. Find the envelope of the family of lines $y=mx+\sqrt{1+m^2}$, $m-$ parameter.

5. Find the particular integral of $(D^2 - 6D + 9)y = e^{3x}$.

6. Transform the equation $x^2y'' - xy' + y = 0$ into a linear equation with constant coefficients.

7. Define Simple harmonic motion.

8. What are the boundary conditions at the end of a beam that is perfectly free?

9. Find grad $\varnothing$ *if* $\varnothing = xyz$ at (1,1,1).

10. Show that $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ is a conservative vector field.

PART – B (5 x 12 = 60)

Answer All the Questions

11. Solve $x^5 - 5x^4 + 9x^3 - 9x^2 + 5x - 1 = 0$.

(or)

12. Diminish by '3' the roots of $x^4 + 3x^3 - 2x^2 - 4x - 3 = 0$.

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

(or)

14. A rectangular box open at the top, is to have a volume of 32cc. Find the dimensions of the box that requires the least material for its construction.

15. Solve $\frac{d^2y}{dx^2} + 4y = 4\tan 2x$, using method of variation of parameters.

(or)

16. Solve $\frac{dx}{dt} + y = e^t, x - \frac{dy}{dt} = t.$

17. If an electric circuit in a condenser of capacity C has a resistance R and inductance L and if there is a constant electromotive force E, the charge q on the condenser at time t is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{I}{C}q = E.$ Find the condition that the charge 'q' should be oscillatory and in this case show that $q = e^{\frac{-Rt}{2L}}\left[c_1\cos\left(\frac{kt}{L}\right) + c_2\sin\left(\frac{kt}{L}\right)\right] + CE.$

(or)

18. A light horizontal strut AB is freely pinned at A and B. It is under the action of equal and opposite compressive forces P at its ends and it carries a load 'w' at its center. Then for $0 < x < \frac{L}{2}, EI\frac{d^2y}{dx^2} + Py = -\frac{1w}{2}x. Also\ y = 0\ at\ x = 0\ and\ \frac{dy}{dx} = 0\ at\ x = \frac{l}{2}.$ Prove that $y = \frac{w}{2p}\left(\frac{\sin nx}{n\cos\frac{nl}{2} - x}\right), n^2 = \frac{P}{EI}.$

19. Verify Stokes theorem for $\vec{F} = xy\vec{i} - 2yz\vec{j} - zx\vec{k}$ where S is the open surface of the rectangular parallelepiped formed by the planes *x = 0, x=1, y=0, y=2 and z = 3* above the *XOY* plane.

(or)

20. Find the values of the constants *a,b,c* so that $\vec{F} = (axy + bz^3)\vec{i} + (3x^2 - cz)\vec{j} + (3xz^2 - y)\vec{k}$ may be irrotational. For these values of a,b,c find also the scalar potential of $\vec{F}$.