Code: 15A54101

R15

B.Tech I Year I Semester (R15) Regular & Supplementary Examinations December 2017

MATHEMATICS - I

(Common to all branches)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define an ordinary differential equation with example.

(b) Find the general solution of $(4D^2 + 4D + 1)y = 0$

(c) To solve the D.E $(D^2 + a^2)y = \tan ax$ by the method of variation of parameters find 'B' when P.I = Ax + Bx.

(d) Transform the Caucy's homogeneous differential equation $\frac{d^2y}{dx^2} + \frac{1}{x}\frac{dy}{dx} = \frac{12\log x}{x^2}$ into a linear differential equation with constant coefficients.

(e) If $u = x^2 + y^2 + z^2, x = e^t, y = e^t sint, z = e^t cost$ then find $\frac{du}{dt}$.

(f) If $x = r\cos\theta\,, y = r\sin\theta\,, then\ find\ J\left(\frac{x,y}{r,\theta}\right)$

(g) Evaluate $\int_0^2\int_0^x (x + y)dydx$.

(h) Evaluate $\int_0^1\int_0^1\int_0^1 e^{x+y+z}dx\,dy\,dz$.

(i) If $\overline{f} = xy^2\overline{i} + 2x^2yz\overline{j} - 3yz^2\overline{k}$ then find $div\overline{f}$ at (1,-1,1).

(j) State the Gauss divergence theorem.

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2 (a) Solve $(x^2 - ay)dx + (y^2 - ax)dy = 0$.

(b) Solve $(xy\,sinxy + cosxy)ydx + (xysinxy - cosxy)xdy = 0$

OR

3 (a) A bacterial culture, growing exponentially increases from 200 to 500 grams in the period from 6 a.m to 9 a.m. How many grams will be present at noon?

(b) If a voltage of 20 Cos 5t is applied to a series circuit consisting of 10 ohm resistor and 2 Henry inductor, determine the current at any time t.

UNIT - II

4 Solve $(x^2D^2 + 3xD + 1)y = \frac{1}{(1-x)^2}$.

OR

5 A horizontal tie-rod is freely pinned at each end. It carries a uniform load w/b per unit length and has a horizontal pull P. Find the central deflection and the maximum bending moment taking the origin at one of its ends.

UNIT - III

6 (a) Verify Taylor's theorem for $f(x) = (1 - x)^{5/2}$ with Lagranges form of remainder 2 terms in the interval [0,1].

(b) If $u = \frac{yz}{x}, v = \frac{zx}{y}, w = \frac{xy}{z}$ show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} = 4$.

OR

7 (a) Examine for minimum and maximum values of $\sin x + \sin y + \sin(x + y)$.

(b) Find the radius of curvature of the curve $x^2y = a(x^2 + y^2)$ at (-2a, 2a).

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UNIT - IV

8 (a) Evaluate $\int_0^1 \int_x^{\sqrt{x}} x^2y^2(x+y)dy\,dx$.

(b) Evaluate $\int_1^e \int_0^{\log y} \int_1^{e^x} logz\,dz\,dx\,dy$

OR

9 (a) Find the whole area of the lemniscates $r^2 = a^2cos2\theta$.

(b) Find the volume bounded by the xy plane, the cylinder $x^2+y^2=1$ and the plane x+y+z=3.

UNIT - V

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

(b) Use divergence theorem to evaluate $\iint_s \overline{F}.ds\ where\ \overline{F} = 4x\overline{i} - 2y^2\overline{j} + z^2\overline{k}$ and S is the surface bounded by the region $x^2+y^2 = 4, z = 0\ and\ z = 3\ and\ z = 3$.

OR

11 Verify stokes theorem for $\overline{F} = (x^2+y^2)\overline{i} - 2xy\overline{j}$ taken round the rectangle bounded by the lines x = $\pm$ a, y=0, y=b.

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