F.E. Sem-II (CBGS) Applied Maths-II (5801)
18 Nov. 2015

QP Code : 5801

(3 Hours) **[Total Marks : 80**

N.B. (1) Question No.1 is compulsory.
(2) Attempt any three questions out of the remaining five questions.
(3) Figures to right indicate full marks.

1. (a) Evaluate $\int_0^2 x^2 (2-x)^3 dx$ [3]

(b) Solve $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} - 6y = 0$ [3]

(c) Prove that $E = 1 + \Delta$ [3]

(d) Solve $\left[y\left(1+\frac{1}{x}\right) + \cos y\right]dx + (x + \log x - x\sin y)\,dy = 0$ [3]

(e) Change to polar coordinates and evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} (x^2+y^2)\,dy\,dx$ [4]

(f) Evaluate $\int_0^1 \int_0^x xy\,dy\,dx$ [4]

2. (a) Solve $\frac{dy}{dx} + \frac{4x}{x^2+1}y = \frac{1}{(x^2+1)^3}$ [6]

(b) Change the order of integration and evaluate
$$\int_0^2 \int_{\sqrt{2x}}^2 \frac{y^2\,dx\,dy}{\sqrt{y^4-4x^2}}$$ [6]

(c) Prove that $\int_0^{\pi/2} \frac{\log(1+a\sin^2 x)}{\sin^2 x}dx = \pi\left[\sqrt{a+1}-1\right], \quad a > -1$ [8]

3. (a) Evaluate $\int_0^1 \int_0^{1-x} \int_0^{1-x-y} \frac{1}{(x+y+z+1)^3}dz\,dy\,dx$ [6]

(b) Find by double integration the area enclosed by the curve $9xy = 4$ and the line $2x + y = 2$ [6]

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(c) Using method of Variation of Parameter solve $\frac{d^2y}{dx^2}+a^2y=\sec ax$ [8]

4. (a) Find the perimeter of the cardioide $r=a(1+\cos\theta)$ [6]

(b) Solve $(D^2+4)y=\cos 2x$ [6]

(c) Apply Runge-kutta Method of fourth order to find an approximate value of y for $\frac{dy}{dx}=\frac{1}{x+y}$ with $x_0=0, y_0=1$ at $x=1$ taking $h=0.5$ [8]

5. (a) Solve $(y-xy^2)dx-(x+x^2y)dy=0$ [6]

(b) Using Taylor Series Method obtain the solution of following differential equation $\frac{dy}{dx}=1+y^2$ with $y_0=0$ when $x_0=0$ for $x=0.2$ [6]

(c) Find the approximate value of $\int_0^6 e^x\,dx$

by i) Trapezoidal Rule , ii) Simpson's 1/3rd Rule, iii) Simpson's 3/8th Rule [8]

6. (a) A resistance of 100 ohms and inductance of 0.5 henries are connected in series with a battery of 20 volts. Find the current at any instant if the relation between L, R, E is $L\frac{di}{dt}+Ri=E$ [6]

(b) $\iint y\,dx\,dy$ over the area bounded by the $x=0,\ y=x^2,\ x+y=2$ [6]

(c) Find the volume bounded by the paraboloid $x^2+y^2=az$ and the cylinder $x^2+y^2=a^2$ [8]
