FE | Sem-II | CBGS | AM-II / All branch | 15/05/18

Q. P. Code : 22296

Duration – 3 Hours **Total Marks : 80**

(1) N.B.:- Question no 1 is compulsory.

(2) Attempt any THREE questions out of remaining FIVE questions.

Q.1) a) Solve $\frac{dy}{dx} = \frac{y+1}{(2+y)e^{y} - x}$ (4)

b) Solve $(D^2+1)^3 y = 0$ (3)

c) Evaluate $\int_0^4 x^2 \sqrt{4x - x^2}\, dx$ (3)

d) Express the following integral in polar co-ordinate (4)

$$\int_0^a \int_0^x f(x,y)\, dx\, dy$$

e) Prove that $E\,\nabla = \nabla\, E$ (3)

f) Evaluate $I = \int_0^{\pi/4} \int_0^{\sqrt{\cos 2\theta}} \frac{r}{(1+r^2)^2}\, dr\, d\theta$ (3)

Q.2 a) Solve $x\frac{dy}{dx} + y = y^2 (\log x)$ (6)

b) Change the order of integration and evaluate $I = \int_0^1 \int_{x^2}^{2-x} yx\, dy\, dx$. (6)

c) Evaluate $\int_0^{\pi/2} \frac{dx}{1 + a\sin^2 x}$ and hence deduce that (8)

$$\int_0^{\pi/2} \frac{\sin^2 x}{\left(3 + \sin^2 x\right)^2} dx = \frac{\pi\sqrt{3}}{96}$$

Q.3 a) Evaluate $I = \int_0^1 \int_{y^2}^1 \int_0^{1-x} x\, dz\, dx\, dy$. (6)

b) Find the mass of a plate in the form of a cardiode $r = a(1 - \cos\theta)$ if the density at any point of the plate varies as square of its distance from the plate. (6)

c) Solve $(3x+1)^2\frac{d^2y}{dx^2}-3(3x+1)\frac{dy}{dx}-12y=9x$ **(8)**

Q. 4 a) Show that the length of the curve $x=ae^{\theta}\sin\theta$ $y=ae^{\theta}\cos\theta$ from $\theta=0$ to $\theta=\pi/2$ (6)

b) *Solve* $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+13y=8e^{3x}\sin 4x+2^x$ (6)

c) Using fourth order Runge-Kutta method, solve numerically, the differential equation $\frac{dy}{dx}=x^2+y^2$ with the given condition x = 1, y = 1.5 in the interval (1, 1.2) with h = 0.1 **(8)**

Q. 5 a) Use method of variation of parameters to solve (6)

$$\frac{d^2y}{dx^2}+2\frac{dy}{dx}+5y=4e^{-x}\tan 2x+5e^{-x}$$

b) Using Taylor's series method, obtain the solution of $\frac{dy}{dx}=y-xy$, $y(0)=2$. Find the value of y for x = 0.1 correct to four decimal places (6)

c) Evaluate $\int_0^1\frac{dx}{1+x}$ by using (i) Trapezoidal Rule, (ii) Simpson's $(1/3)^{rd}$ Rule and (iii) Simpson's $(3/8)^{th}$ Rule. Compare the result with exact solution. **(8)**

Q. 6 a) In a circuit of resistance R, self inductance L, the current i is given by by $L\frac{di}{dt}+Ri=E\cos pt$ where E and p are constants. Find the current i at time 't' (6)

b) Find the area between the circles $r=\sin\theta$ and $r=2\sin\theta$ (6)

c) Find the volume of the paraboloid $x^2+y^2=4z$ cut off by the plane $z=4$ **(8)**

****

45C1BFB1EA9CA447BE1F1DFF7A24DF2E