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MODEL QUESTION PAPER – III (May 2016)

F. E. SEMESTER – II

APPLIED MATHEMATICS – II (REVISED)

[Time: 3 hours] **[Marks: 80]**

N. B.: 1. Question No. 1 is compulsory.
2. Attempt any three from remaining five questions.
3. Figure to the right indicates full marks.

1. a) Prove that $\int_0^\infty \frac{e^{-x^3}}{\sqrt{x}}dx\int_0^\infty y^4 e^{-y^6}dy=\frac{\pi}{9}$. **(3)**

b) Find C.F. and P.I. of $2\frac{dy}{dx}-3y=e^{(2/3)x}$. **(3)**

c) Derive the following relations between the difference operators

i) $\Delta = E-1$ ii) $\nabla = 1-E^{-1}$ **(3)**

d) Express the following integrals in polar co-ordinates and hence evaluate: $\int_0^1\int_0^x (x+y)\,dy\,dx$ **(3)**

e) Solve: $\frac{dy}{dx}=\frac{\tan y-2xy-y}{x^2-x\tan^2 y+\sec^2 y}$ **(4)**

f) Evaluate $\iint \sin\left[\pi(ax+by)\right]dx\,dy$ taken over the triangle bounded by $x=0, y=0$ and $ax+by=1$. **(4)**

2. a) Solve: $\left(x^3y^3+xy\right)\frac{dy}{dx}=1$ **(6)**

b) Change the order of integration in the following $\int_0^a\int_0^x \frac{1}{(y+a)\sqrt{(a-x)(x-y)}}dy\,dx$ **(6)**

c) Evaluate $\int_0^{\pi} \frac{dx}{a+b\cos x}; (a>0)|b|<a$. Using this integral or otherwise evaluate

$\int_0^{\pi} \frac{\cos x}{(a+b\cos x)^2}dx$ and $\int_0^{\pi} \frac{1}{[(5+3\cos x)]^2}dx$ **(8)**

3. a) Evaluate: $\int_{-1}^{1} dz \int_0^z dx \int_{x-z}^{x+z} (x+y+z)\, dy$ **(6)**

b) Find the area bounded by the curve $y^2(2a-x)=x^3$ and its asymptote. **(6)**

c) Solve: $\left(\frac{d}{dx}+\frac{1}{x}\right)^2 y = \frac{1}{x^4}$ **(8)**

4. a) Find the arc length of the parabola $x^2=4y$ which lies inside the circle $x^2+y^2=6y$. **(6)**

b) Solve: $(D^2+2)y = e^x \cos x + x^2 e^{3x}$ **(6)**

c) Using Runge-Kutta method of order four find y(0.2) with h = 0.1. Given $\frac{dy}{dx}=\frac{1}{x+y}; y(0)=1$ **(8)**

5. a) Solve $(2xy^4e^y+2xy^3+y)dx+(x^2y^4e^y-x^2y^2-3x)dy=0$ **(6)**

b) Use Euler's modified method to find the values of y satisfying the equation $\frac{dy}{dx}=\log(x+y)$, for x = 1.2 and x = 1.4 correct to three decimals by taking h = 0.2 and y(1) = 2. **(6)**

c) Solve $\int_1^4 (e^x+x^3-2x+1)dx$ by using

i) Trapezoidal rule   ii) Simpson's $\frac{1}{3}$rd rule.

iii) Simpson's $\frac{3}{8}$th rule, Assume 6 divisions. **(8)**

6. a) The radial displacement u in a rotating dice at a distance r from the axis is given by $r^2\frac{d^2u}{dr^2}+r\frac{du}{dr}-u+kr^3=0$ where k is a constant. Find the displacement if u = 0 when r = a, and r = 0. **(6)**

b) Evaluate $\iint_R \frac{2xy^5}{\sqrt{1+x^2y^2-y^4}}dx\,dy$ where R is the are of triangle having vertices

$O\equiv(0,0), A\equiv(1,1)$ and $B\equiv(0,1)$ **(6)**

c) Find the volume bounded by the paraboloid $x^2+y^2=4z$ and the plane z = 5. **(8)**

Best of Luck

... By. Pathak Sir