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FE Sem. II (Rev) Applied Maths II

AGJ 2nd half (q) 30

Con. 5822-11. **MP–2522**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Out of remaining questions, attempt any **four** questions.
(3) In all **five** questions to be **attempted**.
(4) Answer to each new question to be started on a **fresh page**.
(5) **Figures** in brackets indicate **full** marks.

Q.1 **a)** Prove that $\left|\overline{\frac{3}{2}-x}\right. \left|\overline{\frac{3}{2}+x}\right. = \left(\frac{1}{4}-x^2\right)\pi \sec \pi x$ provided $-1 < 2x < 1$ *(5)*

b) Solve $\left(D^4 - 4D^3 + 8D^2 - 8D + 4\right)y = e^x + 1$ *(5)*

c) Find the length of the curve *(5)*
$y = \log\left(e^x+1\right) - \log\left(e^x-1\right)$ from x = 1 to x = 2

d) Find the area bounded by the curves $xy = 2$, $4y = x^2$ and $y = 4$ *(5)*

Q.2 **a)** Change the order of integration in $\int_0^a \int_0^{b/(b+x)} f(x,y)\,dx\,dy$ *(6)*

b) Solve by the method of variation of parameters $\left(D^2+3D+2\right)y = \frac{1}{1+e^x}$ *(6)*

c) Solve $\frac{dy}{dx} = 2 + \sqrt{xy}$ with $x_0 = 1.2$ $y_0 = 1.6403$ by Euler's modified formula for x = 1.6 correct the four places of decimals by taking h = 0.2. *(8)*

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Q.3 **a)** Evaluate $\int_0^e \int_0^{\log y} \int_1^{e^x} \log z\,dx\,dy\,dz$ *(6)*

b) Change to polar coordinates and evaluate $\int_0^{a/\sqrt{2}} \int_y^{\sqrt{a^2-y^2}} \log\left(x^2+y^2\right)dx\,dy$ *(6)*

c) Solve the differential equation $\frac{dy}{dx} = x + y^2$, y(0) = 1 for the interval (0, 0.2) in steps of h = 0.1 by using Rauge-Kutta method of fourth order *(8)*

[TURN OVER

Q.4 a) Solve $\left(D^2-2D+1\right)y = x e^x \sin x$ **(6)**

b) Evaluate $\int_0^\infty \frac{e^{-x}}{x}\left(a-\frac{1}{x}+\frac{1}{x}e^{-ax}\right)dx$ **(6)**

c) Solve $(1+2x)^2\frac{d^2y}{dx^2}-6(1+2x)\frac{dy}{dx}+16y=8(1+2x)^2$ **(8)**

Q.5 a) Solve $\frac{dy}{dx}=e^{x-y}\left(e^x-e^y\right)$ **(6)**

b) Solve $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}-y=\frac{x^3}{x^2+1}$ **(6)**

c) Find the volume of the tetrahedron bounded by the planes $x = 0$, $y = 0$, $z = 0$ and $x + y + z = a$ **(8)**

Q.6 a) Find the mass of the lamina bounded by the curves $ay^2 = x^3$ and the line $by = x$, if the density at a point varies as the distance of the point from the x axis. **(6)**

b) Using duplication formula prove that $B(n,n).B\left(n+\frac{1}{2},\, n+\frac{1}{2}\right)=\frac{\pi}{n}2^{1-4n}$ **(6)**

c) Solve $\left(D^2-1\right)y = x^2\sin 3x$ **(8)**

Q.7 a) Evaluate $\iint\left(x^2+y^2\right)dx\,dy$ over the area of the triangle whose vertices are (0, 1), (1, 1) and (1, 2). **(6)**

b) Solve $\frac{dy}{dx}=\frac{y^3}{e^{2x}+y^2}$ **(6)**

c) Evaluate $\int_0^\infty \frac{e^{-\beta x}\sin 2x}{x}dx$ and hence deduce that $\int_0^\infty \frac{\sin 2x}{x}dx=\frac{\pi}{2}$ **(8)**

* Good Luck *