S - 1250

Seat No.	

Total No. of Pages : 3

F.E. (Semester - II) Examination, May - 2015
ENGINEERING MATHEMATICS - II (New)
Sub. Code : 59933

Day and Date : Wednesday, 06 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Use of non-programmable calculator is allowed.

SECTION - I

Q1) Solve any THREE of the following : (5 marks each) **[15]**

a) $(a^2 - 2xy - y^2)dx - (x + y)^2 dy = 0$

b) $\sin y \dfrac{dy}{dx} = (1 - x\cos y)\cos y$

c) $2ydx + x(2\log x - y)dy = 0$

d) $ye^y dx = (y^3 + 2xe^y)dy$

Q2) Attempt any THREE of the following : (5 marks each) **[15]**

a) Find the orthogonal trajectories of the family of curves

$\dfrac{l}{r} = 1 + \cos\theta$ where l is parameter.

b) An inductance of 2 *henries* and a resistance of 20 *ohms* are connected in series with an e.m.f. E *volts*. If the current is *zero* when $t = 0$, find the current at the end of 0.01 *sec.* if E =100 *volts*.

c) The number N of bacteria in a culture grew at a rate proportional to N. The value of N was initially 100 and increased to 332 in one hour. What would be the value of N after $1\frac{1}{2}$ hours?

d) Find the orthogonal trajectory of the family of curves $y = x + ce^x$ Where 'c' is the parameter through the point (1, 0).

P.T.O.

Q3) Attempt any FOUR of the following: (5 marks each) **[20]**

a) Using Taylor's series method obtain the power series solution of $\frac{dy}{dx} = -xy^2$ with $x_0 = 0$ & $y_0 = 1$ upto x^4.

b) Using Euler's method find the approximate value of y at $x = 1.5$ in five Steps. Given that $\frac{dy}{dx} = y^2 - \frac{y}{x}; y(1) = 1$.

c) Apply modified Euler's method to obtain the numerical solution of the differential equation $\frac{dy}{dx} = 2 + \sqrt{xy}$ with y(1 .2) = 1.6403 for $x = 1.4$ by taking $h = 0.2$ correct upto four decimal places.

d) Apply Runge-Kutta method of order four in two steps, to find an approximate value of y when $x = 0.2$, given that $\frac{dy}{dx} = x + y^2$ and $y = 1$ when $x = 0$.

e) Solve the following simultaneous differential equations by Runge-Kutta method for x = 0.3.

$$\frac{dy}{dx} = xz + 1, \frac{dz}{dx} = -xy, \text{given } y = 0 \text{ and } z = 1, \text{ when } x = 0.$$

SECTION - II

Q4) Attempt any THREE from the following : (5 marks each) **[15]**

a) Evaluate $\int_5^6 (x-5)^5 (6-x)^6 \, dx$

b) Prove that $\int_0^\infty \frac{e^{-ax} - e^{-bx}}{x} dx = \log\left(\frac{b}{a}\right)$ where b is a parametar.

c) Evaluate $\int_0^1 (x \log x)^4 \, dx$

d) Find the series expression for erf(x) and hence the approximate value of erf(0.3).

Q5) Attempt any THREE from the following : (5 marks each) **[15]**

a) Trace the curve $x^{2/3}+y^{2/3}=a^{2/3}$

b) Trace the curve 'Lemniscate of Bernoulli', $r^2 = a^2 \cos 2\theta$.

c) Trace the curve 'Four Leaved Rose', $r = a \sin 2\theta$.

d) Show that the length of the arc of the curve $3y^2 = x^3$ from the origin to the point whose abscissa is 4 is $\frac{56}{9}$

Q6) Attempt any FOUR from the following : (5 marks each) **[20]**

a) Find the area bounded by $y^2 = 4ax$ and $x^2 = 4ay$ by double integration.

b) Evaluate $\int_0^1\int_{y^2}^{y}\left(1+xy^2\right)dxdy$.

c) Change into polar co-ordinates and hence evaluate $\int_0^a\int_{\sqrt{ax-x^2}}^{\sqrt{a^2-x^2}}\frac{1}{\sqrt{a^2-x^2-y^2}}dxdy$.

d) Evaluate $\int_0^{\pi}\int_0^{a(1-\cos\theta)}2\pi r^2\sin\theta\, d\theta dr$

e) Find the mass of an ellipse plate $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ if the density at any point $p(x, y)$ on it is μxy.

f) Change the order of integration and hence evaluate $\int_0^1\int_0^{\sqrt{1-y^2}}\frac{\cos^{-1}x\, dxdy}{\sqrt{\left(1-x^2-y^2\right)\left(1-x^2\right)}}$

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