Seat No.	

	W-1462

Subject : Engineering Mathematics II Code : 59933
F.E. SEM. – I and II (New Syllabus : Introduced from July 2013)

Day and Date Friday, 06-06-2014 **Time : 10 a.m. to 1.00 p.m.**

Instructions : 1) All the questions are compulsory **Total Marks : 100**
2) Figures to the right indicate full marks
3) Non-programmable calculator is allowed
4) Assume suitable data if necessary

SECTION - I

Q.1. Attempt any **THREE** from the following (15)

a) Solve $\frac{dy}{dx}=\frac{1+y^2+3x^2y}{1-2xy-x^3}$

b) Solve $(x+\tan y)\,dy=\sin 2y\,dx$

c) Solve $y\,dx-x\,dy+3x^2y^2e^{x^3}dx=0$

d) Solve $3y^2\frac{dy}{dx}+2xy^3=4xe^{-x^2}$

Q.2. Attempt any **THREE** from the following (15)

a) Find the orthogonal trajectories to the family of coaxial circles
$x^2+y^2+2\lambda x+c=2$ where λ being a parameter

b) Bacteria in a culture multiply at a rate proportional to the number present. If initially there are 100 in number of bacteria and incresed to 332 in one hour. What would be the number of bacteria after $1\frac{1}{2}$ hours ?

c) The charge q on plate of condenser C charged through a resistance R by a steady voltage V, if $q=0$ initially, show that the charge q at any time t is given by $q=CV\left(1-e^{-t/RC}\right)$

d) A body originally at $80^\circ C$ cools down to $60^\circ C$ in 20 minutes, the temperature of the air being $40^\circ C$. What will be the temperature of the body after 40 minutes from the original.

Q.3. Attempt any **FOUR** from the following (20)

a) Solve $\frac{dy}{dx}=2x-y$ with $x_o=0$, $y_o=0$ by Taylor's series method and obtain solution y as a power series of x upto x^4. Also compare your solution with exact solution.

b) Solve using Euler's method to approximate y for $x=0.1$ given that
$\frac{dy}{dx}=y+x+xy$, $y(0)=1$ in four steps.

c) Solve using Runge-Kutta fourth order method $\frac{dy}{dx} = 3x + y^2$ given that $y = 1.2$ when $x = 1$, find y when $x = 1.1$

d) Use Euler's modified method to find $y(0.1)$ if $\frac{dy}{dx} = x + 3y$ with $y(0) = 1$ taking $h = 0.05$

e) Solve the following simultaneous differential equations by Runge-Kutta method fourth order $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y$ given that $y = 0, z = 1$ when $x = 0$ taking $h = 0.1$

SECTION - II

Q.4. Attempt any **THREE** from the following (15)

a) Evaluate $\int_0^1 \sqrt{x \log(1/x)}\, dx$

b) Evaluate $\int_0^1 \frac{x - 2x^2 + x^3}{(1+x)^5}\, dx$

c) Prove that $\int_0^1 \frac{x^a - 1}{\log x}\, dx = \log(1+a)$, $a \geq 0$

d) Prove that $\int_0^x \text{erf}(at)\, dt = x\, \text{erf}(ax) + \frac{1}{a\sqrt{\pi}}\left(e^{-a^2x^2} - 1\right)$

Q.5. Attempt any **THREE** from the following (15)

a) Trace the curve $x^3 + xy^2 - 4y^2 = 0$

b) Trace the curve $r^2 = a^2 \sec 2\theta$

c) Find the length of curve $\theta = \frac{1}{2}\left(r + \frac{1}{r}\right)$ from $r = 1$ to $r = 2$

d) Obtain the arclength of parabola $y^2 = 4ax$ from vertex to one extremity of latus rectum

Q.6. Attempt any **FOUR** from the following (20)

a) Evaluate $\iint y\, dx\, dy$ over the area bounded by $x = 0$, $y = x^2$ and $x + y = 2$ in the first quadrant.

b) Change the order of $\int_0^{\pi/2} \int_x^{\pi/2} \frac{\cos y\, dy\, dx}{y}$ and hence evaluate

c) Evaluate $\int_0^a \int_y^a \frac{x\, dx\, dy}{\sqrt{x^2 + y^2}}$ by changing to polar co-ordinates.

d) Obtain the area of cardioide $r = a(1 + \cos\theta)$ by double integration.

e) Calculate the mass of lamina bounded by the curves $y^2 = x$ and $x^2 = y$ if the density of lamina at any point varies as the square of its distance from origin.