INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

B.Tech II Semester End Examinations (Regular) - May, 2017

Regulation: IA-R16

COMPUTATIONAL MATHEMATICS AND INTEGRAL CALCULUS
(Common for AE/CE/ME)

Time: 3 Hours   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Evaluate a real root of $4\sin x = e^x$ by using bisection method. **[7M]**

   (b) Construct difference table and then express y as function of x .The corresponding values of x and y are given as **[7M]**

X	0	1	2	3	4
Y	3	6	11	18	27

2. (a) Find the root of $x^4 - x - 9 = 0$ by using Newton Raphson's method **[7M]**

   (b) Using Gauss's forward interpolation formula find f(30) from the following table **[7M]**

X	21	25	29	33	37
Y	18.4708	17.8144	17.1070	116.3422	15.5154

UNIT – II

3. (a) Fit an exponential curve of the form $y = ae^{bx}$ by the method of least squares for the following data. **[7M]**

x	5	6	7	8	9	10
y	133	55	23	7	2	2

   (b) Given $y' = 3x + \frac{y}{2}, y(0) = 1$. Compute ,$y(0.2)$ by taking h=0.2 using Runge–Kutta methods of fourth order. **[7M]**

4. (a) Use Modified Euler's method to solve $y' = x + \sqrt{y}$ in the range $0 \le x \le 0.4$ by taking h=0.2 given that y =1 at x=0. **[7M]**

   (b) Fit a Parabola $y = a + bx + cx^2$ by the method of least squares for the following data: **[7M]**

x	2	4	6	8	10
y	3.07	12.85	31.47	57.38	91.29

UNIT – III

5. (a) Evaluate $\iint\limits_{R} xy\,dxdy$ where R is the region bounded by $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ and $\frac{x}{a} + \frac{y}{b} = 1$ **[7M]**

(b) Evaluate $\int\limits_{1}^{e} \int\limits_{1}^{\log\log y} \int\limits_{1}^{e^x} \log z\,dxdydz$. **[7M]**

6. (a) Change the order of integration evaluate **[7M]**

$$\int\limits_{0}^{4a} \int\limits_{x^2/4a}^{2\sqrt{ax}} dydx$$

(b) Find the area enclosed by the parabolas $x^2 = y$ and $y^2 = x$ **[7M]**

UNIT – IV

7. (a) Prove that force field given by $\vec{F} = 2xyz^3\vec{i} + x^2z^3\vec{j} + 3x^2yz^2\vec{k}$ is conservative .Find the scalar potential function. **[7M]**

(b) Evaluate $\iint\limits_{S} \vec{F}.\vec{n}\,ds$ if $\vec{F} = yz\vec{i} + 2y^2\vec{j} + xz^2\vec{k}$ and S is the surface of the cylinder $x^2 + y^2 = 9$, contained in the first octant between the planes z=0 and z=2. **[7M]**

8. (a) Find the angle between the normals to the surface $xy = z^2$ at (1, 4, 2) and (-3, -3, 3). **[7M]**

(b) Using Gauss – divergence theorem evaluate $\iint\limits_{s} \overline{f}.\overline{n}\,ds$ over the entire surface of the region above xy plane bounded by the cone $z^2 = x^2 + y^2$ and the plane z=4 where $\vec{f} = 4 + zi + xyz^2j + 3zk$ **[7M]**

UNIT – V

9. (a) Prove that $\int\limits_{0}^{\pi/2} Sin^2\theta\, Cos^4\theta d\theta = \frac{\pi}{32}$ **[7M]**

(b) Obtain the series solution of $\frac{d^2y}{dx^2} + xy = 0$ **[7M]**

10. (a) Show that **[7M]**
    i. $\cos x = J_0 - 2J_2 + \ldots\ldots\ldots$
    ii. $\sin x = 2J_1 - 2J_3 + \ldots\ldots$

(b) State and Prove generating function of Bessel's. **[7M]**