Hall Ticket No | | | | | | | | | | | Question Paper Code: AHS003

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

MODEL QUESTION PAPER – II

Four Year B.Tech I Semester End Examinations, December – 2016

Regulation: R16

COMPUTATIONAL MATHEMATICS AND INTEGRAL CALCULUS

(Common to CSE, IT, ECE and EEE)

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

Answer any 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) Find the real root of the equation $e^x = 3x$ by Bisection method up to 3 decimal places. [7M]
   (b) Fit the polynomial to the data given below using Newton Forward Interpolation formula. [7M]

x	1	3	5	7	9
y	3	14	1921	23	28

2. (a) Find by Newton-Raphson method correct to 4 places of decimals of the equation $x^4 - 11x + 8 = 0$. [7M]
   (b) Find $f(1.30)$ by Lagrange's interpolation formulae to the following data. [7M]

x	0	1.2	2.4	3.7
y	3.41	2.68	1.37	-1.18

Unit – II

3. (a) Derive the Normal Equations of the straight line $y = ax + b$ by the method of least squares. [7M]
   (b) Solve $y' = xy$, given $y(1) = 0$ to find $y(0.4)$ by Euler's method. [7M]

4. (a) Using the principle of least squares fit an equation of the form $y = ab^x$ to the following data. [7M]

x	2	3	4	5	6
y	144	172.8	207.4	248.8	298.5

   (b) Find $y(0.2)$, given that $\frac{dy}{dx} = x + y$, $y(0) = 1$ by Runge - Kutta method. [7M]

Unit – III

5. (a) Evaluate $\int\int_R xy\, dx\, dy$, where R is the region bounded by the line $x+2y = 2$, lying in first quadrant [7M]
   (b) Find the area of the loop of the curve $r = a(1 + \cos\theta)$ and outside the circle $r = a$. [7M]

6. (a) By changing the order of integration, evaluate $\int_0^a \int_{x^2/a}^{2a-x} xy^2 \, dy \, dx$. [7M]

   (b) Find the volume bounded by the cylinders $x^2 + y^2 = 4$, $y + z = 4$ and $z = 0$. [7M]

Unit – IV

7. (a) Prove that $curl \; grad \; \phi = 0$. [7M]

   (b) Evaluate $\int \overline{F} \cdot \overline{n} \, ds$ where $\overline{F} = yz\bar{i} + 2y^2\bar{j} + xz^2\bar{k}$ and S is the surface of the cylinder $x^2 + y^2 = 9$ contained in the first octant between $z = 0$ and $z = 2$. [7M]

8. (a) Show that the vector $\overline{F} = \left(x^2 - yz\right)\bar{i} + \left(y^2 - zx\right)\bar{j} + \left(z^2 - xy\right)\bar{k}$ is irrational. Also find the scalar potential ϕ. [7M]

   (b) Verify Stokes theorem for $\overline{F} = (y - z + 2)\,\bar{i} + (yz + 4)\,\bar{j} - xz\bar{k}$ where S is the surface of the cube $x = 0,\ y = 0,\ z = 0,\ x = 2,\ y = 2,\ z = 2$ above the xy-plane. [7M]

Unit – V

9. (a) Evaluate [7M]

   i. $\int_0^\infty x^6 e^{-4x^2} dx$

   ii. $\int_0^\infty x^8 e^{-2x} dx$

   (b) Prove the relation $x \, J_n'(x) = -n \, J_n(x) + x \, J_{n-1}(x)$. [7M]

10. (a) Solve in series the equation $\frac{d^2y}{dx^2} + xy = 0$ about $x = 0$. [7M]

    (b) State and Prove orthogonality of Bessel's functions. [7M]