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INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

MODEL QUESTION PAPER – I

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 $x \log_{10} x = 1.2$ by Regula-Falsi method upto three decimal places. [7M]
- (b) Given that $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$ and $\sin 60^\circ = 0.8660$, find $\sin 52^\circ$ using Newton interpolation formula. Estimate the error. [7M]
2. (a) Find the root by Newton-Raphson method correct to 4 places of decimals of the equation $3x - \cos x - 1 = 0$. [7M]
- (b) Given $u_1 = 22$, $u_2 = 30$, $u_4 = 82$, $u_7 = 106$, $u_8 = 206$ then find u_6 by Lagrange's interpolation formula. [7M]

Unit – II

3. (a) Derive the Normal Equations of the second degree parabola $y = ax^2 + bx + c$ by the method of least squares. [7M]
- (b) Solve $y' = x + y$, given $y(1) = 0$ to find $y(1.1)$ and $y(1.2)$ by Taylor's series method. [7M]
4. (a) Using the principle of least squares fit an equation of the form $y = ae^{bx}$ ($a > 0$) to the following data [7M]

x	1	2	3	4
y	1.65	2.70	4.50	7.35

- (b) Given $y' = x + \sin y$, $y(0) = 1$. Compute $y(0.2)$ and $y(0.4)$ by Euler's modified method. [7M]

Unit – III

5. (a) Evaluate $\int_0^{\log 2} \int_0^x \int_0^{x+\log y} e^{x+y+z} dz dy dx$. [7M]
- (b) Find the area of the loop of the curve $r = a(1 + \cos \theta)$. [7M]
6. (a) By changing the order of integration, evaluate $\int_0^1 \int_1^{2-x} xy dx dy$. [7M]
- (b) Find the volume common to the cylinders $x^2 + y^2 = a^2$ and $x^2 + z^2 = a^2$. [7M]

Unit – IV

7. (a) Prove that $\text{div curl } \vec{f} = 0$. [7M]
(b) Evaluate $\int \vec{F} \cdot \vec{n} \, ds$ where $\vec{F} = z\vec{i} + x\vec{j} - 3y^2z\vec{k}$ and S is the surface $x^2 + y^2 = 16$ included in the first octant between $z = 0$ and $z = 5$. [7M]
8. (a) Find the constants a, b, c so that the vector $\vec{A} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$ is irrotational. Also find ϕ such that $\vec{A} = \nabla\phi$. [7M]
(b) Verify Green's theorem for $\int_c [(xy + y^2)dx + x^2dy]$ where c is bounded by $y = x$ and $y = x^2$. [7M]

Unit – V

9. (a) Show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. [7M]
(b) Prove the relation $xJ'_n(x) = nJ_n(x) - xJ_{n+1}(x)$. [7M]
10. (a) Solve in series the equation $\frac{d^2y}{dx^2} - xy = 0$ about $x = 0$. [7M]
(b) State and Prove Generating function of Bessel's. [7M]