Code No: 121AL **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech I Year Examinations, August/September - 2016
MATHEMATICAL METHODS
(Common to EEE, ECE, CSE, EIE, BME, IT, ETM, ECM, ICE, CST)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Write Newton-Gregory backward interpolation formula. [2]
b) Write Gauss central difference formulas. [3]
c) Write Milne's Predictor-Corrector formulae to solve the ODE
$\frac{dy}{dx} = f(x, y)$ $with$ $y(x_0) = y_0$. [2]
d) Explain Gauss Seidal iteration method for solving system of non-Homogeneous equations. [3]
e) Write Euler formulas for Fourier series. [2]
f) Define Finite Fourier sine and cosine transforms and their inversion formulae in $0 < x < L$. [3]
g) Define linear Lagrange first order PDE. [2]
h) Write suitable solution of one dimensional heat equation. [3]
i) Define solenoidal and irrotational vectors. [2]
j) Evaluate divergence of $\left(2x^2z\ i - xy^2z\ \ j + 3yz^2\ \ k\right)$ at the point $(1, 1,\ \ 1)$. [3]

PART-B

(50 Marks)

2. Using Lagrange's formula, express the function $\frac{x^2 + 6x - 1}{(x^2 - 1)(x - 4)(x - 6)}$ as a sum of partial fractions. [10]

OR

3. Fit a least squares quadratic curve $y = a_0 + a_1 x + a_2 x^2$ to the following data

x	1	2	3	4
y	1.7	1.8	2.3	3.2

Estimate $y(2.4)$. [10]

4.a) Find the real root of the equation $x^3 - 4x + 1 = 0$ using bisection method.
b) Evaluate $\int_0^{0.6} e^{-x^2} dx$ by using Simpson's $\frac{1}{3}$ rd rule taking seven ordinates. [5+5]

OR

5.a) Obtain Picard's second approximate solution of the initial value problem $\frac{dy}{dx} = \frac{x^2}{y^2+1}$, $y(0) = 0$. Find $y(1)$.

b) Given that $\frac{dy}{dx} = x + y,\ y(0) = 0$. Find $y(1)$ in steps of 0.2 using the Euler's method.

[5+5]

6. Find a Fourier series to represent $f(x) = x - x^2$ in $-\pi \le x \le \pi$. Hence show that $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots\cdots = \frac{\pi^2}{12}$ [10]

OR

7. Express $f(x) = \begin{cases} 1 & for\ 0 \le x \le \pi \\ 0 & for\ x > \pi \end{cases}$ as a Fourier sine integral and hence evaluate $\int_0^\infty \frac{1-\cos(\pi\lambda)}{\lambda} \sin(x\lambda)\, d\lambda$.

[10]

8.a) Form partial differential equation by eliminating the arbitrary functions from $z = f(x) + e^y g(x)$.

b) Find the general solution of the partial differential equation $\left(x^2 - y^2 - z^2\right) p + 2xyq = 2zx$. [5+5]

OR

9.a) Solve the partial differential equation $p^2 + q^2 = x^2 + y^2$.

b) Solve by the method of separation of variables $4u_x + u_y = 3u\ and\ u(0, y) = e^{-5y}$.

[5+5]

10. State Green's theorem and Verify Green's theorem for $\oint_C \left[\left(xy + y^2\right)dx + x^2 dy\right]$, where C is bounded by $y = x\ and\ y = x^2$. [10]

OR

11. Verify Gauss divergence theorem for the function $\overline{F} = y\,\overline{i} + x\,\overline{j} + z^2\,\overline{k}$ over the cylindrical region bounded by $x^2 + y^2 = 9,\ z = 0\ and\ z = 2$. [10]

---ooOoo---