Code No: 123AA **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, November/December - 2016

MATHEMATICS-II

(Common to CE, MMT, AE, PTE, CEE)

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) What is the greatest rate of increase of $\phi = xy^2z^2$ at the point (-1,1,2)? [2]

b) If $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$ then show that $\nabla^2(r^n) = n(n+1)r^{n-2}$ where $r = |\bar{r}|$. [3]

c) Write the Euler's formula in the interval $(c, c+2\pi)$, for finding Fourier series. [2]

d) Find the value of a_0 for the function $f(x)=e^{-x}$ in the interval $0 < x < 2\pi$. [3]

e) Evaluate $\frac{\Delta^2}{E} e^x$. [2]

f) Express the function $f(x)=2x^4-6x^3+5x^2-20x+10$ in factorial notation. [3]

g) Show that the rate of convergence of Bisection method is linear. [2]

h) Establish Newton Raphson's method for determining the approximate value of the root of the equation $f(x)=0$. [3]

i) Write Simpson's $\frac{1}{3}$ rule. [2]

j) Evaluate K_3 for the equation $\frac{dy}{dx} = y - x,\ y(0) = 1.5$ by using Runge-Kutta 4th order method. [3]

PART-B

(50 Marks)

2.a) Find the directional derivative of $f = xy + yz + zx$ in the direction of vector $i + 2j + 2k$ at the point(1,2,0).

b) Find the scalar potential of $\bar{F} = (z + \sin y)i + (-z + x\cos y)j + (x - y)\bar{k}$. [5+5]

OR

3.a) Prove that $(y^2 - z^2 + 3yz - 2x)\bar{i} + (3xz + 2xy)j(3xy - 2xz + 2z)k$ is both solenoidal and irrotational.

b) Find the flux of the vector field $\bar{A} = (X - 2Z)\bar{i} + (x + 3y + z)\bar{j} + (5x + y)\bar{k}$ through the upper side of the triangular ABC with vertices at the points A(1,0,0), B(0,1,0), C(0,0,1) [5+5]

4.a) Obtain a Fourier expansion for $\sqrt{1-\cos x}$ in $-\pi < x < \pi$.

b) Find the Fourier transform of $f(x) = \begin{cases} 1 & if\ |x| < a \\ 0 & if\ |x| \geq a \end{cases}$ where 'a' is a positive real number. Hence deduce that: i) $\int_0^{\infty} \frac{\sin t}{t} dt = \frac{\pi}{2}$ and ii) $\int_0^{\infty} \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$. [5+5]

OR

5.a) Express cosh x in Fourier series in $0 < x < 2\pi$.

b) Find the Fourier transform of f(x) given by $f(x) = \begin{cases} x^2 & if\ |x| \leq a \\ 0 & if\ |x| > a \end{cases}$. [5+5]

6.a) Find the cubic polynomial interpolation which takes on the values:
$f_0=5$, $f_1=1$, $f_2=9$, $f_3=25$, $f_4=55$.

b) The mode of a certain frequency curve y = f(x) is very near x = 9 and the value of the frequency density f(x) for x=8.9, 9.0 and 9.3 are respectively equal to 0.30, 0.35 and 0.25. Calculate the approximate value of the mode. [5+5]

OR

7.a) From the following table, find the number of students who obtained less than 45 marks:

Marks	30-40	40-50	50-60	60-70	70-80
No of Students	31	42	51	35	31

b) Fit a second degree parabola to the following data, taking x as the independent variable. [5+5]

x:	1	2	3	4	5	6	7	8	9
y:	2	6	7	8	10	11	11	10	9

8.a) Evaluate $\sqrt{29}$ by Newton-Raphson formula. Correct to four places of decimals.

b) Apply Gauss-Seidal iteration method to solve equations.
$10x_1+x_2+x_3=12$, $2x_1+10x_2+x_3=13$ and $2x_1+2x_2+10x_3=14$. [5+5]

OR

9.a) By iteration method, find the root of $\tan x = x$ up to four decimal places.

b) Apply Jacobi iteration method to solve equations.
$27x + 6y - z = 85$, $6x + 15y + 2z = 72$ and $x + y + 54z = 110$. [5+5]

10.a) Calculate the approximate value of $\int_0^{\frac{1}{2}\pi} \sin x\, dx$.

i) By Trapezoidal rule
ii) By Simpson's rule, Using 11 ordinates.

b) Given the differential equation $\frac{dy}{dx} = \frac{x^2}{y^2+1}$ with the initial condition y=0 when x=0, use Picard's method to obtain y for x=0.25, 0.5 and 1.0 correct to three decimal places. [5+5]

OR

11.a) Use Simpson's three-eights rule to obtain the value of $\int_0^{0.3} (1-8x^3)^{\frac{1}{2}} dx$.

b) Solve the boundary-value problem $y''=y(x)$, $y(0)=y(1)=0$ by the shooting method. [5+5]

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