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ISMAT301

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M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – January 2013

Course & Branch	:	**B.E.- (Information Science and Engineering)**	**Semester**	:	**III**
Subject	:	Engineering Mathematics-III	**Max. Marks**	:	**100**
Subject Code	:	**ISMAT301**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT – I

1. a) From the following table, estimate the number of students who obtained marks between 40 and 45. (06)

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

b) Determine f(x) as the polynomial in x for the following data, using the Lagrange's interpolation formula and hence find f(3). (07)

x	0	1	2	5
y	2	3	12	147

c) Use Simpson's 1/3 rule and 3/8 rule to evaluate $\int_0^1 \frac{dx}{1+x^2}$ considering seven equidistant ordinates. Hence find the approximate value of π in each case. (07)

2. a) Given $y_0=-4, y_1=-2, y_4=220, y_5=546, y_6=1148$ then find y_2 and y_3 corresponding to the equidistant values of x. (06)

b) Find the equation of the cubic curve for the following data using Newton's divided difference formula and hence find f(10). (07)

x	4	7	9	12
y	-43	83	327	1053

c) Compute $y'(2)$ and $y'(4.5)$ for the data given below using Newton's backward interpolation formula. (07)

x	-2	-1	0	1	2	3
y	0	0	6	24	60	120

UNIT – II

3. a) Discuss the nature of the series $\frac{x}{1.2}+\frac{x^2}{2.3}+\frac{x^3}{3.4}+\dots\dots$ (06)

b) Obtain the Fourier series for the function $f(x) = |x|$, over the interval $-\pi < x < \pi$ and hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$. (07)

c) Obtain the Fourier series for the function y up to the second harmonic given by the following table (07)

x:	0	1	2	3	4	5
y:	4	8	15	7	6	2

4\. a) Find the half range Sine series for the function $f(x) = \begin{cases} \frac{1}{4} - x, & 0 < x < 1/2 \\ x - \frac{3}{4}, & 1/2 < x < 1 \end{cases}$. (06)

b) Obtain the Fourier series for the function $f(x)=2x - x^2$ in $0 \le x \le 2$ and hence deduce that $\frac{\pi^2}{12} = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}$ (07)

c) Obtain the Fourier series for the function y up to the first harmonic from the following table (07)

x^0:	0	45	90	135	180	225	270	315
y:	2	3/2	1	1/2	0	1/2	1	3/2

UNIT - III

5\. a) Find the Fourier Sine transform of $e^{-|x|}$ and hence evaluate $\int_0^{\infty} \frac{x \sin ax}{1+x^2} dx$, a > 0. (06)

b) Find the complex Fourier transform of $f(x) = e^{-a^2 x^2}$ where 'a' is a positive constant. Hence deduce that $e^{-x^2/2}$ is self reciprocal in respect of complex Fourier transform (07)

c) Solve the difference equation $y_{n+2} - 4y_n = 0$ with $y_0 = 0$, $y_1 = 2$ by using Z - transforms. (07)

6\. a) Find the inverse Z – transforms of the following. (06)

(i) $z\left(e^{\frac{1}{z}} - 1\right)$ (ii) $\frac{3z^2 + z}{(5z-1)(5z+2)}$

b) Prove that $Z_T(n^p) = -z\frac{d}{dz}[Z_T(n^{p-1})]$ and hence obtain the Z - transform of n and n^2. (07)

c) Employing Parseval's identity to the function $f(x) = \begin{cases} 1, & |x| < 1 \\ 0 & |x| > 1 \end{cases}$, Show that $\int_0^{\infty} \frac{\sin^2 x}{x^2} dx = \frac{\pi}{2}$ (07)

UNIT – IV

7. a) Form a partial differential equation by eliminating the arbitrary functions from: (06)

   i) $\varphi\left(x+y+z, x^2+y^2-z^2\right)=0$ *ii)* $z=f(x+iy)+\varphi(x-iy)$

   b) Find the general solution of the equation (07)

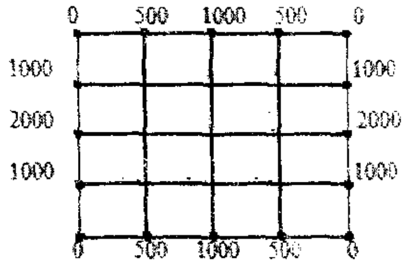
   $x^2(y-z)p+y^2(z-x)q=z^2(x-y)$

   c) Solve the equation $u_t=u_{xx}$ subject to the conditions $u(x,0)=\sin\pi x,\ 0\le x\le 1$; $u(0,t)=u(1,t)=0$, using Schmidt method. Carryout computations for two levels taking h=1/3 and k=1/36. (07)

8. a) Solve $\left(y^2+z^2-x^2\right)p-2xyq+2xz=0$ (06)

   b) Solve $\dfrac{\partial u}{\partial x}=2\dfrac{\partial u}{\partial t}+u$, given that $u(x,0)=6e^{-3x}$ by method of separation of variables. (07)

   c) Solve the Laplace equation $u_{xx}+u_{yy}=0$ in the square region shown in the following figure, with the boundary values as indicated in the figure carry out three iterations. (07)



UNIT – V

9. a) Determine whether the set $\{x^2+3x-1, x+3, 2x^2-x+1\}$ is linearly independent over the vector space P_2 of polynomials of degree less than or equal to 2. (06)

   b) Prove that the set $\{(1,0,-1),(1,1,1),(1,2,4)\}$ of vectors is a basis for the vector space R^3. (07)

   c) Determine the kernel and range of the transformation defined by the following matrix. (07)

   $$A=\begin{bmatrix}1 & 2 & 3\\ 0 & -1 & 1\\ 1 & 1 & 4\end{bmatrix}$$

10. a) Prove that the following transformation T: $R^2 \rightarrow R^2$ is Linear. (06)

    T(x,y) = (2x, x+y).

    b) Define coordinate vector. Also determine whether the vector (-3,3,7) is a linear combination of the vectors (1,-1,2),(2,1,0) and (-1,2,1). (07)

    c) Define dilation and contraction of a linear transformation. Find the matrix A of a linear operator T(X)=AX from $R^2 \rightarrow R^2$ that rotates a vector X through an angle θ about the origin. (07)

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