M.Tech. Mechanical Engineering Design (CBCS) Semester - I

MED11 - Advanced Engineering Mathematics

P. Pages : 2 **GUG/S/23/14186**

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Time : Three Hours Max. Marks : 70

Notes : 1. All questions carry equal marks.
2. Use of non - programable calculator is permitted.

1. a) If x = 3.26426 find absolute, relative & percentage error. **7**
i) X is truncated to the 4th decimal places.
ii) X is rounded to the 4th decimal places

b) Explain. **7**
i) Precision & accuracy. ii) Absolute error.
iii) Relative error. iv) Truncation error.

OR

2. a) What is a conservation law? Write the internal & differential from of conservation law. **3**

b) A computer is on sale for Rs. 1192 If the original price was reduced to 20% what was the original price of the computer. **4**

c) Differentiate between Accuracy & precision. Two students measure the length of same piece of string four times. **7**
Student 1: 19.3 cm 20.1 cm 19.4 cm 19.2 cm
Student 2: 19.5 cm 19.0 cm 19.4 cm 19.3 cm
Actual length is 19.2 cm out of two who is more accurate find the percentage error.

3. a) Solve the series the equation **7**

$$\frac{d^2y}{dx^2} + xy = 0$$

b) Express $F(x) = x^4 + 3x^3 + 5x - 2$ in terms of legendre polynomials. **7**

OR

4. a) Solve the differential equation of mass spring system involving several masses & springs. **7**
$y_1'' = -5y, +2y_2$ & $y_2'' = 2y, -2y_2$

b) Show that **7**

i) $J_{5/2}(x) = \sqrt{\frac{2}{\pi x}}\left(\frac{3-x^2}{x^2}\sin x - \frac{3}{x}\cos x\right)$ ii) $J_4(x) = \left(\frac{48}{x^3} - \frac{8}{x}\right)J_1(x) + \left(1 - \frac{24}{x^2}\right)J_0 x$

5. a) Given that. **7**

x:	1	1.1	1.2	1.3	1.4	1.5	1.6
y:	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Find $\frac{dy}{dx}$ & $\frac{d^2y}{dx^2}$ at $x = 1.1$ & $x = 1.6$

b) Using Taylor series method. **7**

Solve $\frac{dy}{dx} = x^2 - y, y(0) = 1$ at $x = 0.1, 0.2, 0.3 \& 0.4$

OR

6. a) Using Euler's method find y(0.6) of $y' = 1 - 2xy$ given that y(0) = 0 by taking h = 0.2. **7**

b) Using Runge - Kutta method of fourth order solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with y(0) = 1 at x = 0.2. **7**

7. a) Define the concept of finite difference equivalence to partial derivatives. **7**

b) Solve $u_{tt} = 4u_{xx}$ with boundary conditions **7**

$u(0,t) = 0 = u(4,t),\ u_t(x,0) = 0 \ \&\ u(x,0) = x(4-x)$

OR

8. a) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the condition $u(x,0) = \sin \pi x,\ 0 \le x \le 1,$ **7**

$u(0,t) = u(1,t) = 0$ carry out computations for two levers taking $h = \frac{1}{3}, k = \frac{1}{36}$

b) Find the solution of $u_t = u_{xx}$ subject to $u(x,0) = \sin \pi x,\ 0 \le x \le 1\ u(0,t) = u(1,t) = 0$ **7**
using Schmidt method.

9. a) Fit a curve $y = ax + bx^2$ for the following data. **7**

x:	1	2	3	4	5	6
y:	2.51	5.82	9.93	14.84	20.55	27.06

b) By the method of least square, find the straight line that best fits the following data. **7**

x:	1	2	3	4	5
y:	14	27	40	55	68

OR

10. a) An experiment give the following values. **7**

v(lt/min):	350	400	500	600
t(min)	61	26	7	2.6

It is known that v & t are connected by relation $v = at^b$. Find the best possible values of a & b.

b) Fit a second degree parabola to the following data by least square method. **7**

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

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