CBCS SCHEME

USN

18MDE/MEM/MPD/MPE/MPM/MPT/ MPY/MSE/MEA/MMD11

# First Semester M.Tech. Degree Examination, June/July 2019
# Mathematical Methods in Engineering

Time: 3 hrs. Max. Marks: 100

***Note: Answer any FIVE full questions, choosing ONE full question from each module.***



## Module-1

1 a. Explain about : i) Inherent errors ii) Rounding errors iii) Truncation errors iv) Absolute errors v) Relative and percentage errors. **(10 Marks)**

b. Round off the number 865250 and 37.46235 to four significant figures and compute: i) Absolute error ii) Relative error and iii) Percentage errors in each case. **(10 Marks)**

**OR**

2 a. If $u = 4x^2y^3/z^4$ and errors in x, y, z be 0.001, compute the relative maximum error in u where $x = y = z = 1$. **(10 Marks)**

b. Explain about conservation of laws of engineering. **(10 Marks)**

## Module-2

3 a. A set of five similar coins is tossed 320 times and the results is below given:

| Number of heads: | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Frequency: | 6 | 27 | 72 | 112 | 71 | 32 |

Test the hypothesis that the data follow a binomial distribution [5d.f of $\psi^2_{0.05} = 11.07$]. **(10 Marks)**

b. Set up analysis of variance table for the following per acre production data for three varieties of wheat, each grown on 4 plots and state if the variety differences and significant. [$F_{0.05} = 4.26$ for d.f. $v_1 = 2$, $v_2 = 9$]. **(10 Marks)**

| Plot of Land | Per acre production data Variety of Wheat | | |
|---|---|---|---|
| | A | B | C |
| 1 | 6 | 5 | 5 |
| 2 | 7 | 5 | 4 |
| 3 | 3 | 3 | 3 |
| 4 | 8 | 7 | 4 |

**OR**

4 a. Explain and illustrate the Randomized block design [RBD]. **(10 Marks)**

b. The time taken by workers in performing a job by method-I and method-II is given by

| Method – I | 20 | 16 | 26 | 27 | 23 | 22 | - |
|---|---|---|---|---|---|---|---|
| Method – II | 27 | 33 | 42 | 35 | 32 | 34 | 38 |

Do the data show that the variances of time distribution from population from which these samples are drawn do not differ significantly [F for (6, 5) d.f. at 5% LOS is 4.95]. **(10 Marks)**

## Module-3

5 a. Apply Gauss-Jordan method to solve the system of equation
$2x + 5y + 7z = 52$, $2x + y - z = 0$, $x + y + z = 9$. **(10 Marks)**

b. Using the Householder's transformation reduce the matrix into a tridiagonal matrix.

$$A = \begin{bmatrix} 1 & 3 & 4 \\ 3 & 2 & -1 \\ 4 & -1 & 1 \end{bmatrix}$$ **(10 Marks)**

**OR**

6 a. Determine the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$ using the partition method. Hence solve the system of equations Ax = b where $b = [1, 6, 4]^T$. **(10 Marks)**

b. Transform the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$ to tridiagonal form by Givens method. **(10 Marks)**

## Module-4

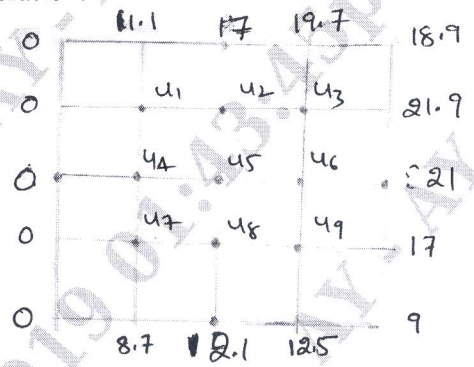
7 a. Find the real root of the equation $3x = \cos x + 1$ correct to four decimal using Newton's Raphson method. **(10 Marks)**

b. Solve the boundary value problem $u_t = u_{xx}$ under the condition $u_{(0,\ t)} = u_{(1,\ t)} = 0$ and $u(x, 0) = \sin \pi x$, $0 \le x \le 1$. Using Schmidt method [Take h = 0.2 and $\alpha = \frac{1}{2}$]. **(10 Marks)**

**OR**

8 a. Find by Horner's method the positive root of the equation $x^3 + x^2 + x - 100 = 0$ correct to three decimal places. **(10 Marks)**

b. Solve the Laplace equation $u_{tt} + u_{xx} = 0$ for the following square mesh with boundary values as shown. Carry out first iteration. **(10 Marks)**




## Module-5

9 a. A parachutist of mass 68.1 kg jumps out of a stationary hot air balloon. Use analytic solution to compute velocity prior to opening the chute. The drag coefficient is equal to 12.5 kg/s. **(10 Marks)**

b. Find solution of the vibrating string (wave equation) by method of separation of variables. **(10 Marks)**

**OR**

10 a. Obtain the solution of the wave equation $u_{tt} = c^2 u_{xx}$ under the following conditions:

i) $u(0, t) = u(2, t) = 0$

ii) $u(x, 0) = \text{Sin}^3 \pi/2$

iii) $u_t(x, 0) = 0$. **(10 Marks)**

b. A parachutist of mass 68.1 kg jumps out of a stationary hot air balloon. Use numerical solution to compute the velocity. The drag coefficient is equal to 12.5kg/s. Employ a step size of 2 for the calculation. **(10 Marks)**

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