M.Tech I Semester Degree Examination, April/May - 2024
MINERAL PROCESSING
Applied Mathematics and Experimental Design
(NEP)

Time : 3 Hours   Maximum Marks : 70

Note : (i) Answer **any five** of the following.

(ii) Question No. **1** is **compulsory**.

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1. (a) Solve : $x^4 - 6x^3 + 12x^2 - 10x + 3 = 0$ By Synthetic division **4**
   (b) Solve : $(D^3 - 2D^2 + 4D - 8)y = 0$ **5**
   (c) Solve graphically : $2x + 3y = 2,$ **5**
   $$x - 2y = 8$$

2. (a) Solve by the method of cross multiplication $5x - 4y + 2 = 0,\ 2x + 3y = 13$ **2**
   (b) Find **2**
   (i) Median
   (ii) Lower Quartile
   for the series 5, 23, 9, 16, 0, 14, 19, 8, 26, 13, 18, 2
   (c) Solve the following initial value problem using Laplace transform **5**
   $y'' + 3y' + 2y = 0;\ y(0) = 1$ and $y'(0) = 0$
   (d) Solve : $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$ **5**

3. (a) Find $L\{e^{2t}\sin^2 3t\}$ **7**
   (b) If $f(t) = t^2$ where $0 < t < 2a$ and $f(t + 2a) = f(t)$ then find $L\{f(t)\}$ **7**

4. (a) Use remainder theorem to find the remainder when $f(x) = 9x^2 - 6x + 2$ is
   divided by $(3x - 2)$ **4+5+5**
   (b) A Mathematical aptitude test of 50 students was recorded as follows

Marks	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
No. of students	4	8	14	19	5

   (c) Solve the following initial value problem using Laplace transform
   $$y''(t) + 5y'(t) + 6y(t) = 5C^{2t}$$
   $$y(0) = 0 \qquad y'(0) = 1$$

5. (a) Solve $x^2y''' + 3xy'' + y' = x^2\log x$ **4+5+5**

(b) Find the Variance and Standard Deviation for the following data.

x_i	6	10	14	18	24	28	30
f_i	2	4	7	12	8	4	3

(c) Calculate the mean; median and mode of the following distribution.

Number	5	10	15	20	25	30	35
Frequency	1	2	5	6	3	2	1

6. (a) Solve by using quadratic formula $12x^2 + 7x - 10 = 0$ **4+5+5**

(b) Solve : $y'' + 3y' + 2y = 12x^2$

(c) Draw histogram for the following.

Class interval	11 - 20	21 - 30	31 - 40	41 - 50	51 -60
Frequency	5	8	13	10	6

7. (a) Solve by Eliminating method. **4+5+5**

$8x - 3y = 12$
$5x = 2y + 7$

(b) Find the lower Quartile, upper Quartile and inter Quartile range for the below data.

9, 11, 15, 19, 17, 13, 7.

(c) Construct a frequency distribution table for the following data with class size 3 [Exclusive from]

18, 12, 7, 6, 11, 15, 21, 9, 8, 13, 15, 17, 22, 14, 21, 23, 8, 12, 17, 15, 6, 18, 23, 22, 16, 9, 11, 16.

8. (a) In the following table $\Sigma_f = 90$ and mean $= 7.5$ find the missing frequency f_1 and f_2. **5**

Variable	5	6	7	8	9	10	11	12
Frequency	20	17	f_1	10	8	f_2	7	6

(b) (i) Find the Auxiliary equation $(D^4 - 2D^3 + D^2)x = 0$ **4**

(ii) Find Standard Deviation for the data.

6, 8, 10, 12, 14, 16, 18, 20, 22, 24.

(c) Find the value of 'a' if the division of $ax^3 + 9x^2 + 4x - 10$ by $x + 3$ leaves a re-mainder of 5. **5**

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