

**B.Tech. SEM -IV Mechanical 2014 Course (CBCS) : WINTER - 2018**  
**SUBJECT: NUMERICAL METHODS AND OPTIMIZATION TECHNIQUES**

**W-2018-2361**

Day: Saturday  
Date: 17/11/2018

Time: 02.30 PM TO 05.30 PM  
Max. Marks: 60

**N.B:**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data if necessary.
- 4) Use of non- programmable **CALCULATOR** is allowed.

- Q.1** You buy a \$25000 piece of equipment for no down payment and \$5500 per year for six years. What is the rate of interest you are paying? The formula relating present worth P, annual payments A, number of years n and interest rate i is given by **(10)**

$$A = P \frac{i(1+i)^n}{(1+i)^n - 1}$$

**OR**

- Q1.** Determine the real root of the equation **(10)**  
$$f(x) = 0.95x^3 - 5.9x^2 + 10.9x - 6$$
  
By false position method

- Q.2** Solve the following system of equations by Gauss Elimination Method **(10)**
- $$\begin{aligned}x + 3y - 2z &= -3 \\2x + 6y + z &= 14 \\-5x - 2y + 4z &= -4\end{aligned}$$

**OR**

- Q.2** Solve the following set of equations by Gauss Siedel method **(10)**
- $$\begin{aligned}5x + 2y + z &= 12 \\x + 4y + 2z &= 15 \\x + 2y + 5z &= 20\end{aligned}$$

- Q.3** It is known that the tensile strength of a plastic increases as a function of time it is heat treated. The following data is collected **(10)**

Time	10	15	20	25	40	50	55	60	75
Strength	5	20	18	40	33	54	70	60	78

Fit a straight line in this data and use the equation to find the tensile strength at time 32 minutes.

**OR**

- Q.3** Use Divided Difference Formula to find  $f(7)$  if  $f(3)=24$ ,  $f(5)=120$ ,  $f(8)=504$ ,  $f(9)=720$  and  $f(12)=716$ . **(10)**

**P.T.O.**

- Q.4** The following data was collected for the distance travelled versus time for a rocket (10)

<b>Time(sec)</b>	0	25	50	75	100	125
<b>Dist (Km)</b>	0	32	58	78	92	100

Estimate the rocket's velocity and acceleration at time 25, 50 and 100.

**OR**

- Q.4** Solve  $\frac{dy}{dx} = x^3 + y^3, y(0) = 1$  and step size of  $h=0.1$  up to 3 iterations using RK method of fourth order. (10)

- Q.5** What are the sufficient and necessary conditions for optimization of a single variable optimization? (10)

**OR**

- Q.5** Find the maxima and minima for  $y = 5x^3 + 2x^2 - 3x$  by classical optimization technique. (10)

- Q.6** Describe the Newton's Method of optimization for multivariable optimization. (10)

**OR**

- Q.6** Explain the grid search method for multivariable optimization. (10)

\* \* \* \* \*