Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH (ENVIRONMENTAL ENGINEERING) MAKE UP EXAMINATIONS, JAN 2018

SUBJECT: COMPUTATIONAL METHODS & OPTIMIZATION TECHNIQUES

[MAT -5106]

REVISED CREDIT SYSTEM

(2/12/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** questions.
- All questions carry equal marks.

1A.	Solve x^2 y'' +x y' + (x^2 -3) y = 0, y(1) = 0, y(2) = 2 with h =0.25.	**4**
1B.	Compute approximately the probability that the mean of a random sample of size 15, from a distribution having the pdf $f(x) = \begin{cases} 3x^2 & 0 \le x \le 1 \\ 0 & elsewhere \end{cases}$ is between $\frac{3}{5}$ and $\frac{4}{5}$.	**3**
1C.	Let s^2 be the variance of a random sample of size 6 from the normal distribution N(μ,12). Find $P\{2.30 < s^2 < 22.2\}$.	**3**
2A.	Using Simplex method, solve the following LPP, maximize $f(x) = 3x_1 + 4x_2$ subject to $4x_1 + 2x_2 \le 80$, $2x_1 + 5x_2 \le 180$, $x_1 \ge 0$, $x_2 \ge 0$.	**4**
2B.	Minimize the function $f(x) = x^2 - 3x - 20$ in the interval [0, 5] using Golden section method.	**3**
2C.	Let X_1, X_2 and X_3 be uncorrelated random variables having the same standard deviation. Find the correlation coefficient between $X_1 + X_2$ and $X_2 + X_3$.	**3**

3A. A die is cast n = 120 independent times and the following resulted. **4**

Spots up	1	2	3	4	5	6
Frequency	b	20	20	20	20	40 – b

If we use chi-square test, for what values of b would the hypothesis that the die is unbiased be rejected at 0.025 significance level.

3B. The income of a group of 10,000 persons was found to be normally distributed with mean Rs.750 and standard deviation of Rs. 50. Find the number of persons out of 10,000 who have income exceeding Rs.668 and those who have income exceeding Rs. 832?. Also, find the lowest income among the richest 100? **3**

3C. Suppose that X is a random variable with pdf given by $f(x)=\begin{cases}2x & ; \ 0<x<1 \\ 0 & ; \ \text{elsewhere}\end{cases}$. Find the pdf of $Y=e^{-X}$. **3**

4A. Suppose that joint pdf of the two dimensional r. v. (X, Y) is given by

$$f(x,y)=\begin{cases}x^2+\frac{xy}{3}, & 0\le x\le 1,\ 0\le y\le 2 \\ 0, & \text{elsewhere}\end{cases}$$

Compute (i) $\Pr(Y<X)$

(ii) $\Pr\left(X>\frac{1}{2}\right)$ **4**

4B. Fit a parabola in the form $Y= AX^2 + BX + C$ for the following data: **3**

X:	0	1	2	3	4
Y:	1	1.8	1.3	2.5	6.3

4C. Perform 3 iterations to find the minimum value of the function $f(x) = x(x - 1.5)$ in the interval (0, 1) using Fibonacci search method. **3**

5A. Use M- method, Minimize $Z = 2x_1 + x_2$ subject to $3x_1 + x_2 = 3$, $4x_1 + 3x_2 \ge 6$, $x_1 + 3x_2 \le 3$. **4**

5B. Calculate the mean, median and mode of the following data relating to weight of 120 articles. **3**

Wt(in gm)	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
No. of articles	14	17	22	26	23	18

5C. Suppose that the continuous random variable X has pdf $f(x)=\frac{1}{2}e^{-|x|}, -\infty<x<\infty$. Find mgf of X and hence find E(X) and V(X). **3**