Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

FIRST SEMESTER M.TECH (ENVIRONMENTAL ENGINEERING) MAKE UP SEMESTER EXAMINATIONS, JANAURY 2019

SUBJECT: COMPUTATIONAL METHODS & OPTIMIZATION TECHNIQUES

[MAT -5106]

REVISED CREDIT SYSTEM

(/ /2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	The chances of A, B, C becoming the general manager of a certain company are in the ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company if A, B, C become general manager are 0.3, 0.7, 0.8 respectively. If the bonus scheme has been introduced, what is the probability that A has been appointed as general manager?	**4**
1B.	Solve: $x^2y'' + y' + y = 0$, y (1) = 0, y(2) =2, h = 0.25.	**3**
1C.	A and B throw alternatively a pair of fair dice. A wins if he throws sum 6 before B throws a sum 7 and B wins if he throws a sum 7 before A throws a sum 6. If A begins, find his chances of winning.	**3**
2A.	Using Simplex method, solve the following LPP, Maximize $z = x_1 + x_2$ subject to $x_1 + x_2 \leq 8, 2x_1 + x_2 \leq 10, x_1, x_2 \geq 0$.	**4**
2B.	Perform 3 iterations to find the minimum value of the function $f(x) = x^2 - 5x + 2$ in the interval [2, 4] using Golden section method.	**3**
2C.	In a test on electric light bulbs, it was found that the life time of a particular electric bulb was distributed normally with an average life of 2000 hrs and standard deviation of 60 hrs. If a firm purchases 2500 bulbs find the number of bulbs that are likely to last for i) more than 2100 hrs (ii) less than 1950 hrs.	**3**

3A. The Mendelian theory states that the probabilities of classification A, B, C, D are respectively $\frac{9}{16}, \frac{3}{16}, \frac{3}{16}, \frac{1}{16}$. From a sample of 160 the actual numbers observed were 86, 35, 26 and 13. Is this data consistent with the theory at 0.01 significance level ?. **4**

3B. Minimize the function $f(x) = x^2 + \frac{54}{x}$ in the interval [0, 5] by the Fibonacci method. **3**

3C. Let $x_1, \ldots, x_n$ denote a random sample from a normal distribution with mean 0 and variance, θ .0 < $\theta < \infty$. Show that $\frac{\sum_{i=1}^{n} {x_i}^2}{n}$ is an unbiased estimator of θ and has variance $\frac{2\theta^2}{n}$. **3**

4A. Solve : $16\, u_t = u_{xx}$, 0 < x < 1, t > 0, $u(x, 0) = 0$, $u(0, t) = 0, u(1, t) = 100$ t. Taking h = 0.25, compute u for 4 time steps. **4.**

4B. Fit a second degree parabola $y = ax^2 + bx + c$ to the following data. **3.**

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

4C. If X and Y are two random variables having the joint density function $f(x, y) = \begin{cases} \frac{1}{8}(6 - x - y), & 0 \le x < 2,\ 2 \le y < 4 \\ 0, & \text{otherwise} \end{cases}$. Find i) $P(X + Y < 3)$ ii) $P(Y > X)$ **3**

5A. Using M- method, Maximize $z = x_1 - 2x_2$ subject to $x_1 + x_2 \ge 2,\ -x_1 + x_2 \ge 1,\ x_2 \le 3,\ x_1, x_2 \ge 0$. **4.**

5B. Perform 2 iterations to find the minimum value of the function $f(x) = 6x + 7.5x^2 + 3x^3 + x^4$ in the interval [-2, 1] using Golden section method. **3**

5C. Find the median and the quartiles for the following data **3.**

Classes	60-62	63-65	66-68	69 – 71	72-74
Frequency	5	18	42	27	8