Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. (CHEMICAL/BIOTECH ENGG.)

END SEMESTER EXAMINATIONS, APRIL- 2018

SUBJECT: ENGINEERING MATHEMATICS-IV [MAT 2204]

REVISED CREDIT SYSTEM

Time: 3 Hours (23/04/2018) MAX. MARKS: 50

Instructions to Candidates:
- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A.	Suppose that the joint pdf of the two dimensional random variable (X,Y) is given by $f(x,y)=\dfrac{2x+y}{210},\ 2<x<6,\ 0<y<5$. Find $E(X)$ and $P[(X+Y)\le 4]$.	**4 Marks**
1B.	Solve $y''+xy=1,\ y(0)=0,\ y'(1)=1,\ h=0.5$ by finite difference scheme.	**3 Marks**
1C.	Only 1 in 1000 adults is afflicted with a rare disease for which a diagnostic test has been developed. The test is such that when an individual actually has the disease, a positive result will occur 99% of the time, whereas an individual without the disease will show a positive test result only 2% of the time. If a randomly selected individual is tested and the result is positive, what is the probability that the individual has the disease?	**3 Marks**
2A.	Solve $u_{xx}+u_{yy}=0,\ 0<x,y<1$ with $h=\dfrac{1}{3}$. Given $u(0,y)=u(x,0)=0$ and $u(1,y)=u(x,1)=100$.	**4 Marks**
2B.	The marks obtained by students in the mathematics test is normally distributed with mean 10 and variance 4. In a section having 70 students, find the approximate number of students who obtained (i) above 13 marks, (ii) not more than 5 marks.	**3 Marks**
2C.	A box contains 12 items of which four are defective. A sample of 3 items is selected from the box. Let X denote the number of defective items in the sample. Find the probability distribution of X. Determine the mean and standard deviation of the distribution.	**3 Marks**
3A.	Solve the following LPP using simplex method: Minimize $z=x_1-3x_2+3x_3$; subject to $3x_1-x_2+2x_3\le 7,\ \ 2x_1+4x_2\ge -12,\ \ -4x_1+3x_2+8x_3\le 10,\ x_1,x_2,x_3\ge 0.$	**4 Marks**

3B. Find the Z-transform of $f_n = \frac{1}{n+1}, \quad n \geq 0.$ **3 Marks**

3C. With $h = 0.25$, solve $u_t = u_{xx}$, $0 \leq x \leq 1,\ t > 0$. Given that $u(x, 0) = 100\,(x - x^2),\ \ u(0, t) = u(1, t) = 0$. Compute u for 4 time steps. Assume $\lambda = \frac{1}{2}$ and use Schmidt explicit finite difference scheme. **3 Marks**

4A. Fit a parabola $y = a + bx + cx^2$ by the method of least squares to the following data. **4 Marks**

x	0	1	2	3	4	5
y	2.1	7.7	13.6	27.2	40.9	61.1

4B. A and B throw alternatively a pair of dice. A wins if he throws 6 before B throws 7 and B wins if he throws 7 before A throws 6. If A begins, find his chances of winning the game. **3 Marks**

4C. A company making cold drinks has 2 plants located at towns T_1 and T_2. Each plant produces 3 drinks A, B, C and their production capacity/day is shown below.

Cold drinks	Plants at	
	T_1	T_2
A	6000	2000
B	1000	2500
C	3000	3000

The marketing department of the company forecasts a demand of 80000 bottles of A, 22000 bottles of B and 40000 bottles of C during the month of May. The operating cost/day of plants at T_1 and T_2 are Rs.6000 and Rs.4000 respectively. Formulate the LPP. **3 Marks**

5A. Two independent random variables X_1 and X_2 have means 5 and 10, and variances 4 and 9. Find the covariance between $U = 3X_1 + 4X_2$, $V = 3X_1 - X_2$. **4 Marks**

5B. Using graphical method, solve the following LPP.
Maximize $z = 3x_1 + 2x_2$ subject to $-2x_1 + x_2 \leq 1,\ x_1 \leq 2,\ x_1 + x_2 \leq 3,\ x_1, x_2 \geq 0.$ **3 Marks**

5C. Derive the expression for mean and variance of Gamma distribution. **3 Marks**