Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

FOURTH SEMESTER B.TECH. (BIOMEDICAL ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL/MAY 2017
SUBJECT: ENGINEERING MATHEMATICS IV [MAT 2203]
REVISED CREDIT SYSTEM
(24-04-2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A.	Given $P(A) = {}^{3}/_{4}$ *and* $P(B) = {}^{3}/_{8}$. Show that i. $P(A \cup B) \geq {}^{3}/_{4}$ ii. ${}^{1}/_{8} \leq P(A \cap B) \leq {}^{3}/_{8}$ iii. ${}^{3}/_{8} \leq P(A \cap \bar{B}) \leq {}^{5}/_{8}$	**3M**
1B.	An electric assembly consists of two subsystems A and B. From the previous testing procedure, the following properties are assumed to be known. i. $P(A\ fails) = 0.2$ ii. $P(B\ fails\ alone) = P(A\ and\ B\ fails) = 0.15$ Compute the following probability 1. $P(A\ fails \mid B\ has\ failed)$ 2. $P(A\ fails\ alone)$	**3M**
1C.	Box 1 contains 4 black and 5 green balls. Box 2 has 5 black and 4 green balls. Three balls are drawn at random from Box 1 and transferred to Box 2. Then a ball is drawn from Box 2. What is the probability that it is green? If it is green then what is the probability that 2 green and one black ball is transferred from Box 1 to Box 2?	**4M**
2A.	Suppose f(x) is a continuous random variable with pdf, $f(x) = \begin{cases} ax, & 0 < x < 1 \\ a, & 1 < x < 2 \\ -ax + 3a, & 2 < x < 3 \\ 0, & elsewhere \end{cases}$ Determine the constant a and the cdf F(x).	**3M**
2B.	A coin is tossed 3 times. Let X denote 0 or 1 according as a tail or a head occurs on the first toss. Let Y denote the number of tails which occur. Determine 1. Joint Probability distribution of X and Y 2. Marginal probability distribution of X and Y	**3M**

Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

2C.	A random variable (X, Y) is uniformly distributed over the parallelogram with vertices at (1, 1) (3, 1) (0, 0) (2, 0). Find the marginal density of X.	**4M**
3A.	Find the two regression lines. x: 21, 23, 30, 54, 57, 58, 72, 78, 87, 90 y: 60, 71, 72, 83, 110, 84, 100, 92, 113, 135	**3M**
3B.	With usual notations prove that $\rho_{uw} = \pm\rho_{xy}$ where u=a+bx and w=c+dy.	**3M**
3C.	Prove that $\int J_3(x)dx = c - J_2(x) - \frac{2}{x}J_1(x)$	**4M**
4A.	Prove that $\int_{-1}^{1} P_m(x)P_n(x)dx = 0, \quad m \neq n$	**3M**
4B.	Show that $(n+1)P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x)$	**3M**
4C.	Use Big M method to solve $Minimize\ P = -3x + y + z$ $Subject\ to \quad x - 2y + z \leq 11$ $-4x + y + 2z \geq 3$ $2x - y = -1$ $x,\ y,\ z \geq 0$	**4M**
5A.	Use simplex method to solve $Maximize\ Z = 3x + 5y$ $Subject\ to\ 3x + 2y \leq 18$ $x \leq 4$ $y \leq 6$ $x,\ y \geq 0$	**3M**
5B.	An insurance company has discovered that only about 0.1% of the population is involved in a certain type of accident each year. If its 10,000 policy holders were randomly selected from the population, what is the probability that not more than 5 are involved in such an accident next year?	**3M**
5C.	Steel rods are manufactured to be 3 inches in diameter but they are acceptable if they are inside the limits 2.99 inches and 3.01 inches. It is observed that 5% are rejected as oversize and 5% are rejected as undersize. Assuming that the diameters are normally distributed, find mean and standard deviation of the distribution. Hence calculate the population of rejects if permissible limits were widened between 2.985 inches and 3.015 inches.	**4M**