Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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IV SEMESTER B.E DEGREE END SEMESTER EXAMINATION – APRIL 2017

SUB: ENGG.MATHEMATICS – IV (Mechatronics) -MAT-2211

(REVISED CREDIT SYSTEM)

Time : 3 Hrs. **Max. Marks: 50**

Note : a) Answer FIVE full questions. b) All questions carry equal marks (3+3+4)

1A. Suppose that the joint pdf of a two dimensional random variable (X, Y) is

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

Find i) $P(X \ge Y)$ ii) $P(X + Y \le 1)$

1B. A certain screw making machine has a chance of producing 2 defective out of 1000. The screws are packed in boxes of 100. Find the approximate number of boxes containing
(i) no defective screws (ii) One defective screw
In a consignment of 5000 boxes.

1C. Solve the difference equation $y_{n+2} - 4y_n = n^2 + n - 1$.

2A. Obtain the power series solution of the equation $y'' + xy = 0$.

2B. Obtain the expression for $J_{\frac{1}{2}}$ and $J_{\frac{-1}{2}}$ in terms of sine and cosine terms.

2C. If X, Y, Z are uncorrelated random variables and the standard deviations are 5, 12, 9 respectively and if $U = X + Y$; $V = Y + Z$. Evaluate correlation coefficient between U and V.

3A. Derive the mean and variance of Poisson distribution.

3B. Solve the difference equation $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$, using Z - Transform.

3C. Companies A, B, C produce 30%, 45%, 25% of cars respectively. It is known that 2%, 5%, 2% of the cars produced by A, B, C are defective. If a car is purchased and found to be defective. What is the Probability that this car is produced by company A?

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4A. State and Prove the Orthogonality of Bessel's function.

4B. The daily consumption of electric power is a random variable having Probability distribution function given by

$$f(x) = \begin{cases} \frac{1}{9} e^{\frac{-x}{3}}; x > 0 \\ 0; \ x \leq 0 \end{cases}$$

If the total production is 12 million KWH. Determine the probability that there is a power shortage on a given day.

4C. Fit a straight line to the following data:

x	0	1	3	6	8
y	1	3	2	5	4

5A. A two dimensional random variable (X, Y) is uniformly distributed on a circle $x^2 + y^2 = a^2$. Find the correlation coefficient between X and Y.

5B. Let X be random variable with probability distribution $f(x) = \frac{1}{\pi(1+x^2)}$ for $-\infty < x < \infty$. Then find the PDF of $Y = \frac{1}{X}$.

5C. The probability that a person A solves the problem is $\frac{1}{3}$ that of B is $\frac{1}{2}$ and that of C is $\frac{3}{5}$. If the problem is simultaneously assigned to all of them. What is the probability that problem is solved.?

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