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# MANIPAL INSTITUTE OF TECHNOLOGY
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**IV SEMESTER B.TECH (INDUSTRIAL & PRODUCTION ENGINEERING)**

**END SEMESTER EXAMINATIONS, APRIL/MAY 2017**

**SUBJECT: ENGINEERING MATHEMATICS IV (MAT 2209)**

**REVISED CREDIT SYSTEM**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates**

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

**1A.** An incomplete frequency distribution for the weights of 120 boys is given below. Find the missing frequencies, given that the mode is 51.25 and $\sum f = 120$. **3**

| Weight(In kgs) | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
|---|---|---|---|---|---|
| No. of boys | 12 | - | 35 | - | 11 |

**1B.** A box contains 10 red, 5 white and 8 black balls. A person draws 4 balls from the box at random. Find the probability that among the balls drawn, there is at least one ball of each color. **3**

**1C.** Find the regression lines of y on x and x on y for the following data. **4**

| X | 153 | 157 | 168 | 160 | 170 | 163 |
|---|---|---|---|---|---|---|
| Y | 48 | 50 | 50 | 49 | 54 | 53 |

**2A.** If $X, Y, Z$ are uncorrelated random variables with standard deviation $5, 12$ and $19$ respectively and if $U = X + Y$ and $V = Y + Z$, Evaluate the correlation coefficient between U and V. **3**

**2B.** Find the mean and variance of the sum obtained in tossing a pair of fair dice. **3**

**2C.** A two dimensional random variable (X, Y) is uniformly distributed inside a region bounded by the parallelogram with vertices at (0, 0), (2, 0) (1, 1) and (3, 1). Find the marginal distribution of X and Y. **4**

**3A.** There are two bags one of which contains 4 white and 3 black balls and the other has 4 black and 3 white balls. A fair die is rolled. If a 1 or a 3 turns up, a ball is drawn from the first bag. Otherwise a ball is drawn from the second bag. What is the probability that the ball is white? **3**

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| **3B.** | A manufacturer of metal pistons finds that on the average, 12% of his pistons are rejected because they are either oversize or undersize. What is the probability that a batch of 10 pistons will contain<br>i) no more than 2 rejects?<br>ii) at least 2 rejects? | **3** |
| **3C.** | Let $X$ be a continuous random variable with pdf $f(x) = \begin{cases} 1\,; 0 < x < 1 \\ 0;\ \text{elsewhere} \end{cases}$.<br>Let $X_1$ and $X_2$ be a sample from $X$. Let $Y_1 = X_1 + X_2, Y_2 = X_1 - X_2$. Find the pdf of $Y_1$. | **4** |
| **4A.** | Find the mean and variance of Gamma Distribution. | **3** |
| **4B.** | If $\bar{X}$ is the mean of the random sample of size n from a normal distribution with $u$ a mean and variance 100. Find the value of n so that $P(u-5 < \bar{X} < u+5) = 0.954$ | **3** |
| **4C.** | The time $X$ minutes, taken by a person to install a satellite dish may be assumed to be a normal random variable with $P(X < 170) = 0.14$ and $P(X > 200) = 0.03$. Find the mean and standard deviation of $X$. | **4** |
| **5A.** | Suppose that $X_j, j = 1,2, \ldots 50$ are independent random variables each having a poisson distribution with $m = 0.03$. Let $S = X_1 + X_2 + \cdots + X_{50}$. Find $P(S \geq 3)$. | **3** |
| **5B.** | If $X_1, X_2$ and $X_3$ are independent random variables and $Z = X_1 + X_2 + X_3$. Let the mgf of $X_1, X_2$ and $X_3$ be $(1-2t)^{-3}, (1-2t)^{-2}$ *and* $(1-2t)^{-\frac{1}{2}}$ respectively. Then find the mean and variance of $Z$. | **3** |
| **5C.** | Compute mean deviation from the median and also find coefficient of mean deviation from the median. | **4** |

| Marks | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 |
|---|---|---|---|---|---|---|
| Students | 2 | 10 | 20 | 15 | 10 | 3 |