Code No: NR311801 **NR**

III B.Tech I Semester Supplementary Examinations, May 2005
PROBABILITY AND STATISTICS
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) A card is drawn from a well shuffled pack of cards. What is the probability that it is either a spade or an ace?
   (b) A can hit a target 3 times in 5 shots, B, 2 times in 5 shots, and C, 3 times in 4 shots. Find the probability of the target being hit, when all of them try.

2. In a certain assembly plant, three machines B_1, B_2 and B_3 make 30%, 45% and 25% respectively, of the products. It is known from the past experience that 2%, 3% and 2% of the products made by each machine, respectively, are defective. Now, suppose that a finished product is randomly selected and found to be defective; what is probability that it was made by machine B_3.

3. (a) The diameter of an electric cable is assumed to be a continuous random variable X with pdf f(x) = 6x(1-x); $0 \leq X \leq 1$,
      i. Check whether f(x) is really a pdf
      ii. Determine b such that P($X < b$) = P($X > b$).
   (b) X is a normal variable with mean 30 and S.D 5. Find the probability that
      i. $26 \leq X \leq 40$
      ii. $X \geq 45$ and
      iii. $|X - 30| > 5$.

4. (a) A process for making certain bearings is under control if the diameters of the bearings have the mean of 0.5000 cm. what can we say about this process if a sample of 10 of these bearings has a mean diameter of 0.5060 cm and a standard deviation of 0.0040 cm?
   (b) Prove that the variance of a sample of n numbers a, a + d, a + 2d ..... a + (n-1) d is given by $\frac{1}{12}(n^2 - 1)d^2$.

5. (a) The S.D of the height of all students in Madras University is 4". Two samples are taken. The S.D of the height of 100 B.Sc. students is 3.5" and the height of 100 B.A. Students is 4.5". Test the significance of the difference of S.D of the samples.
   (b) In a survey of incomes of two classes of workers of two random samples gave the following details. Examine whether the difference between (i) means and (ii) the s.d are significant.

6. (a) It is desired to test the hypothesis $\mu_0 = 40$ against the alternative hypothesis $\mu_1 = 42$ on the basis of a random sample from a normal population with the

Sample	Size	Mean Annual income in r.s.	Standard deviation in Rs.
I	**100**	**582**	**24**
II	**100**	**546**	**28**

standard deviation $\sigma = 4$. If the probability of a Type 1 error is to be 0.05 and the probability of a Type II error is to be 0.24, find the required size of the sample.

(b) The diameter of rotor shafts in a lot has a mean of 0.249 inch and a standard deviation of 0.003 inch. The inner diameters of bearings in another lot have a mean of 0.255 inch and a standard deviation of 0.002 inch. (i) What are the mean and the standard deviation of the clearances between shafts and bearings selected from these lots? (ii) If a shaft and a bearing are selected at random, what is the probability that the shaft will not fit inside the bearing? (Assume that both dimensions are normally distributed)

7. Estimate r by fitting the ideal gas law $PV^r = c$ to the following data

Pressure P (lb/in^2)	16.6	39.7	78.5	115.5	195.3	546.1
Volume V (IN^3)	50	30	20	15	10	5

8. Use $r = \frac{\sigma_x^2 + \sigma_y^2 + \sigma_{x-y}^2}{2\sigma_x \sigma_y}$ to find r for the following data

x :	21	23	30	54	57	58	72	78	87	90
y :	60	71	72	83	110	84	100	92	113	135

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