B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering) B.Tech. (Aerospace Engineering)

Term-End Examination 03949

June, 2012

ET-101(B) : MATHEMATICS-II (Probability and Statistics)

Time : 3 hours *Maximum Marks : 70*

Note : *All questions are **compulsory**. Use of calculator is allowed. Use statistical tables wherever necessary.*

1. Answer *any six* of the following : **6x5=30**

(a) A part-time student is taking two courses namely, statistics and finance. The probability that the student will pass the statistics course is 0.60 and the probability of passing the finance course is 0.70. Find the probability that the student.

(i) will pass atleast one course.

(ii) will fail both courses.

(b) An anti - aircraft gun can take a maximum of four shots on enemy's plane moving away from it. The probabilities of hitting the plane at first, second, third and fourth shots are 0.4, 0.3, 0.2 and 0.1 respectively. Find the probability that the gun hits the plane.

(c) A lot contains 20 articles. The probability that the lot contains exactly 2 defective articles is 0.4 and that it contains exactly 3 defective articles is 0.6. Articles are drawn from the lot at random one by one without replacement and tested till all the defective articles are found. What is the probability that this procedure ends at the twelfth testing ?

(d) A box contains 2 black, 4 white, and 3 red balls. One ball is drawn at a time randomly from the box till all the balls are drawn from it. Find the probability that the balls drawn are in the sequence of 2 black, 4 white and 3 red.

(e) A factory manufacturing televisions has four units A, B, C, D. The units A, B, C, D manufacture 15%, 20%, 30%, and 35% of the total output respectively. It was found that out of their output 1%, 2%, 2%, and 3% are defective. A television is chosen at random from the total output, and found to be defective. What is the probability that it came from unit D ?

(f) Find the errors in each of the following statements :

(i) A and B are two events with

$P(A) = 0.9, P(B) = 0.8, P(A \cap B) = 0.6$

(ii) A and B are two independent events

with $P(A) = \frac{1}{2}, P(B) = \frac{1}{3},$

and $P(A \cup B) = \frac{3}{4}.$

(g) There is a group of men and women in which 75% are men and 25% are women. If 10% of men and 45% of women in this group are unemployed, find the probability that a person selected at random from this group is employed.

(h) An urn contains four tickets numbered 1, 2, 3, 4 and the urn B also contains four tickets numbered 2, 4, 6, 7. One of the urn is chosen at random and a ticket is drawn. If X denotes the number on the ticket drawn, obtain the probability distribution of X.

2. Answer *any two* of the following : **2x10=20**

(a) The probability that a man aged 60 will live to be 70 is 0.65. What is the probability that out of 10 men, now, 60, at least 7 will live to be 70 ?

(b) The probability density function of a variable x is :

Values of x	0	1	2	3	4	5	6
$P(x)$	K	3 K	5 K	7 K	9 K	11 K	13 K

(i) Find the value of K

(ii) Find $P(x<4)$; $P(x \geq 5)$; $P(3<x \leq 6)$

(iii) What will be the minimum value of K so that $P(x \leq 2) \geq 3$?

(c) A Certain number of articles manufactured in one batch were classified into three categories according to a particular characteristics, being less than 50, between 50 and 60 and greater than 60. If this characteristics is known to be normally distributed, determine the mean and standard deviation for this batch if 60%, 35%, and 5% were found in these categories,

3. Answer *any two* of the following : **2x10=20**

(a) The breaking strengths of metal rods, produced by a certain company, have mean as 820 kg and standard deviation as 50 kg. When a new manufacturing process is adopted, it is claimed that the breaking strength can be improved. A sample of 100 rods is tested and the results indicates that the breaking strength as 840 kg. Can we support this claim at a 1% level of significance ?

(b) A sample of 100 electric bulbs produced by manufacturer A showed a mean life of 1190 hours and a standard deviation of 90 hours. A sample of 75 bulbs produced by manufacturer B showed a mean life time of 1230 hours, with a standard deviation of 120 hours. Is there a difference between the mean life time of two brands at a significance level of

(i) 0.05 and (ii) 0.01

(c) A random sample of 10 boys had the following IQ :

70, 120, 110, 101, 88, 83, 95, 98, 107, 100

Do these data support the assumption of a population mean IQ of 100. (at 5% level of significance) ?
