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ET-101(B)

B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering) /
B.Tech. (Aerospace Engineering) /
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Term-End Examination

00090

June, 2016

ET-101 (B) : MATHEMATICS – II
(PROBABILITY AND STATISTICS)

Time : 3 hours *Maximum Marks : 70*

Note : *All questions are **compulsory**. Attempt any **two** parts out of the three in each question. Each question carries equal marks. Use of scientific calculator is permitted.*

1. (a) For the two events A and B show that
$P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$.

(b) Suppose an assembly plant receives its voltage regulators from three different sources, 60% from B_1, 30% from B_2 and 10% from B_3. Let 95%, 80%, and 65% of the supply received respectively from the sources B_1, B_2 and B_3 perform as per specifications laid. If A is the event that a voltage regulator received at the plant performs as per specification, then find P(A).

(c) The joint density function of X and Y is given by $f(x, y) = 4xy\, e^{-(x^2+y^2)}$; $x, y \geq 0$.

Test whether X and Y are independent. Also find the conditional density function of X given Y = y. *2×7=14*

2. (a) Seven coins are tossed and the number of heads are noted. The experiment is repeated 128 times and the following distribution is obtained.

No. of Heads :	0	1	2	3	4	5	6	7
Frequency :	7	6	19	35	30	23	7	1

Fit a binomial distribution assuming the coin to be unbiased and test the goodness of fit.

(b) Define a Poisson variate. Find its mean and variance. Show that the sum of two independent Poisson variates is a Poisson variate.

(c) A multiple-choice quiz has 200 questions each with 4 possible answers of which only 1 is the correct answer. What is the probability that sheer guess-work yields 25 to 30 correct answers for 80 of the 200 problems about which the student has no knowledge ? *2×7=14*

3. (a) Find the correlation coefficient ρ between the variables (X, Y) defined by the p.d.f.

$f(x, y) = \frac{1}{8}(x + y),\ 0 \le x \le 2,\ 0 \le y \le 2.$

(b) If F has F-distribution with (v_1, v_2) d.f., then show that 1/F follows an F distribution with (v_2, v_1) d.f.

(c) Sixteen numbers are selected independently and at random from the interval [0, 1]. Find the probability that the mean of these sixteen numbers does not exceed 0·6. *2×7=14*

4. (a) State and prove central limit theorem.

(b) The number of items cleared by an assembly line during a week is a random variable with mean 50 and variance 25.

(i) What is the probability that items cleared this week will exceed 75 ?

(ii) What can be said about the probability that this week's clearance will be between 40 and 60 ?

(c) Is $\bar{X}^2$ an unbiased estimator for μ^2, μ being population mean ? If not find its bias. *2×7=14*

5. (a) A random sample of size n is taken from a geometric distribution with parameter p. Find the moment estimator and MLE for p. Are they same ?

(b) The test runs with six models of an experimental engine showed that they operated respectively for 24, 28, 21, 23, 32 and 22 minutes with a gallon of fuel. Obtain a 99% C.I. for the average run time of engine with a gallon of fuel.

(c) The following table gives the sample data on the number of defective castings produced by five different moulds.

Moulds :	I	II	III	IV	V
Defective Castings :	14	33	21	17	25
Sample size :	100	200	180	120	150

On the basis of the data can we say that the proportion of defectives is same for different moulds ? Use $\alpha = 0{\cdot}05$. *2×7=14*