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ET-101(B)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering) / B.Tech. (Aerospace Engineering) / BTCLEVI / BTMEVI / BTELVI / BTECVI / BTCSVI

Term-End Examination

01801 **June, 2015**

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

Time : 3 hours *Maximum Marks : 70*

Note : *All questions are* ***compulsory****. Use of scientific calculator and statistical tables is allowed.*

1. Answer any ***six*** of the following : *6×5=30*

(a) A problem in mechanics is given to three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved ?

(b) An urn contains 10 white and 3 black balls, while another urn contains 3 white and 5 black balls. Two balls are drawn from the first urn and put into the second urn and then a ball is drawn from the latter. What is the probability that it is a white ball ?

(c) A large industrial firm uses 3 local motels to provide overnight accommodation for its clients. From past experience it is known that 20% of the clients are assigned rooms at the Ramananda Inn, 50% at the Saradananda, and 30% at the Lakeview Guha Lodge. If the plumbing is faulty in 5% of the rooms at the Ramananda Inn, in 4% of the rooms at the Saradananda, and in 8% of the rooms at the Lakeview Guha Lodge, what is the probability that

(i) a client will be assigned a room with faulty plumbing ?

(ii) a person with a room having faulty plumbing was assigned accommodation at the Lakeview Guha Lodge ?

(d) The probability that a patient recovers from a delicate heart operation is 0·8. What is the probability that

(i) exactly 2 of the next 3 patients who have this operation survive ?

(ii) all of the next 3 patients who have this operation survive ?

(e) In a bolt factory, machines A, B, and C manufacture respectively 25%, 35% and 40% of the total. Of their output, 5%, 4%, and 2% are defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine B ?

(f) The probabilities that a service station will pump gas into 0, 1, 2, 3, 4 or 5 or more cars during a certain 30-minute period are 0·03, 0·18, 0·24, 0·28, 0·10, and 0·17 respectively. Find the probability that in this 30-minute period

(i) more than 2 cars receive gas,

(ii) at most 4 cars receive gas,

(iii) 4 or more cars receive gas.

(g) If the probability is 0·10 that a person will make a mistake on his or her state income tax return, find the probability that

(i) four totally unrelated persons each make a mistake,

(ii) Mr. A and Mr. B both make a mistake and Mr. C and Mr. D do not make a mistake.

(h) In a certain region of the country it is known from the past experience that the probability of selecting an adult over 40 years of age with cancer is 0·05. If the probability of a doctor correctly diagnosing a person with cancer as having the disease is 0·78 and the probability of incorrectly diagnosing a person without cancer as having the disease is 0·06, what is the probability that a person is diagnosed as having cancer ?

2. Answer any ***two*** of the following : *2×10=20*

(a) A random variable X has the following probability distribution :

x	0	1	2	3	4	5	6	7	8
p(x)	a	3a	5a	7a	9a	11a	13a	15a	17a

(i) Determine the value of a.

(ii) Find $P(X < 3)$, $P(X \geq 3)$, $P(2 \leq X < 5)$.

(iii) What is the smallest value of x for which $P(X \leq x) > 0{\cdot}5$?

(b) The probability that a bomb dropped from a plane will strike the target is $\frac{1}{5}$. If six bombs are dropped, find the probability that

(i) exactly two will strike the target,

(ii) at least two will strike the target.

(c) In an examination taken by 500 candidates, the average and the standard deviation of marks obtained (normally distributed) are 40% and 10%.

Find approximately :

(i) How many will pass, if 50% is fixed as a minimum ?

(ii) What should be the minimum, if 350 candidates are to pass ?

(iii) How many have scored marks above 60% ?

3. Answer any ***two*** of the following : *2×10=20*

(a) The mean weight obtained from a random sample of size 100 is 64 gms. The S.D. of the weight distribution of the population is 3 gms. Test the statement that the mean weight of the population is 67 gms at 5% level of significance. Also set up 99% confidence limits of the mean weight of the population.

(b) The heights of college students in a city are normally distributed with S.D. 6 cms. A sample of 1000 students has mean height 158 cms. Test the hypothesis that the mean height of college students in the city is 160 cms.

(c) Ten individuals are chosen at random from a normal population of students and their marks found to be

63, 63, 66, 67, 68, 69, 70, 70, 71, 71.

In the light of these data, discuss the suggestion that mean mark of the population of students is 66.