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ET-101(B)

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

Term-End Examination

December, 2013

ET-101(B) : MATHEMATICS-II

Time : 3 hours *Maximum Marks : **70***

Note : *Attempt **any seven** questions. All questions carry **equal** marks. Use of calculator is **permitted.***

1. (a) Define random experiment, sample space event, simple event, mutually exclusive events. Give one example of each term.

(b) If the joint probability distribution of x and y is given by :

$f(x, y) = kxye^{-(x^2 + y^2)}$ $x \geq 0,\ y \geq 0$, find k. Test whether x and y are independent.

2. (a) State and prove Bayes Theorem.

(b) A bag contains 4 red and 3 blue balls. Two draws of 2 balls each are made. Find the probability that the first draw gives 2 red balls and the second draw gives 2 blue balls, if :

(i) The balls are returned to the bag after the first draw.

(ii) The balls are not returned after the first draw.

3. (a) Define cumulative distribution function. A fair coin is tossed two times. Let x be the number of heads that appear. Obtain and sketch the c.d.f. of the random variable x.

(b) Define binomial variate. Find its mean and variance.

4. (a) Calculate the first four moments about the mean for the following f.d. and comment upon the nature of the f.d.

x :	–4	–3	–2	–1	0	1	2	3	4
f :	3	4	5	7	12	7	5	4	3

(b) What are the properties of a good measure of dispersion ? Explain these in context with S.D. Show that it is the least among the root mean square deviations.

5. (a) A machine automatically packs a chemical fertilizer in polythene packets. It is observed that 10% of the packets weigh less than 2.42 kg while 15% of the packets weigh more than 2.50 kg. Assuming that the packet is normally distributed, find the mean and variance of the packet.

(b) Show that in case of a normal distribution

$$\mu_{2r+1} = 0, \text{ and } \mu_{2r} = \frac{(2r)!\,\sigma^{r}}{2^{r}\,r!}, \quad r = 0, 1, 2, \_\_\_\_\_\_.$$

6. (a) Define exponential variate. Give one example. Describe its 'no memory property' ?

(b) The joint pdf of (x, y) is :

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

$0 \le y \le 2$. Find the correlation coefficient 'ρ' between the varialbes (x, y).

7. (a) Define an unbiased estimator. Show that the sample mean $\bar{x}$ is an unbiased estimator for μ, the population mean. Is $\bar{x}^2$ unbiased estimator for μ^2 ? If not find its bias.

(b) For the population with p.d.f.

$$f(x;\ \alpha, \beta) = \frac{1}{T\alpha\ \beta^{\alpha}}\ e^{-x/\beta}\ x^{\alpha-1},\ x > 0$$ find

moment estimators for the parameters α and β based on a random sample of size n.

8. (a) Construct a $100(1-\alpha)\%$ confidence interval for parameter θ of exponential distribution having pdf $f(x;\ \theta) = \theta e^{-\theta x}$, $x > 0$ based on one observation from the distribution

(b) Explain the following :

(i) Type I and Type II errors

(ii) Level of significance and power of a test.

9. (a) Following are the scores of two players in 10 successive games played by each of the player :

Player I :	13	15	7	15	5	12	9	3	20	11
Player I :	12,	7	2	8	6	9	5	7	6	8

Is Player II more consistent in scoring than I ? Use $\alpha = 0.05$.

(b) The following table gives the sample data on the number of defective casting 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 this data can we say that the proportion of defectives is same for different moulds ? Use $\alpha = 0.05$
