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Name : .....

Reg. No: .....

FIRST SEMESTER M.TECH DEGREE EXAMINATION, JANUARY 2013

EPS / EPE / EPD 10 101 / EIC 11 101 – APPLIED MATHEMATICS
(Common to M.Tech in Power System and Power Electronics)

Time : Three Hours **Maximum : 100 Marks**

Answer any five questions choosing atleast one question from each module.
All question carry equal marks.

MODULE I

I (a) In a precision bombing attack there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. How many bombs must be dropped to give a 99% chance or better of completely destroying the target?

(b) A system has a component whose time to failure T is exponentially distributed with parameter $\beta = \frac{1}{6}$. If 6 such components are installed in different systems, what is the probability that atleast 2 are still working at the end of 9 years?

II (a) The mean muscular endurance score of a random sample of 60 subjects was found to be 145 with a standard deviation of 40. Construct a 95% confidence interval for the true mean. Also construct a 99% confidence interval for the mean.

(b) The mean yield of two sets of plots and their variability are as given below. Examine
(i) Whether the difference in the mean yields of two sets of plots is significant, and
(ii) whether the difference in the variability in yields is significant.

	Set of 40 plots	Set of 60 plots
Mean yield per plot	1258 lb	1243 lb
S.D. per plot	34 lb	28 lb

MODULE II

III (a) Calculate the two lines of regression and also the correlation coefficient for the following data:

x:	20	22	25	26	27	23
y:	31	29	32	37	35	34

What is expected value of y when x= 39.

(b) The table below gives the yields per hectare of a certain variety of paddy in a particular type of soil treated with manures A, B and C. Analyse the results for manure effects.

A	49	50	48	49
B	48	48	49	47
C	50	50	51	49

IV (a) Given $r_{12} = .4, r_{23} = .5, r_{13} = .6$. Find $R_{1.23}$ and $r_{23.1}$ under usual notation.

(b) By the method of least squares, fit $y = ax^2 + bx + c$ to the following data.

x	0.5	1.0	1.5	2.0	2.5	3.0
y	32	50	60	71	84	90

(c) Explain the method of least squares for fitting a straight line.

MODULE III

V (a) Define a stationary process. What are the different types of stationary processes.

(b) Show that the process $x(t)$ such that $P[x(t)=n]=\begin{cases}\dfrac{(at)^{n-1}}{(1+at)^{n+1}} & \text{if } n=1,2,\ldots\ldots\\ \dfrac{at}{1+at} & \text{if } n=0\end{cases}$

is evolutionary

VI (a) Define a Markov Process. What are its different classifications.

(b) Three children (denoted by 1, 2, 3) arranged in a circle play a game of throwing a balla to one another. At each stage the child having the ball in equally likely to throw it into any one of the other two children. Suppose that x_0 denotes the child who had the ball after n throws, show x_n forms a Markov chain.

Find the transition probability matrix P .

Also calculate

(a) $P\{x_2=1/x_0=1\}$

(b) $P\{x_3=2/x_0=3\}$

(c) $P\{x_3=3/x_0=2\}$

(d) The probability that the child who had originally the ball will have it after 2 throws.

(e) Find P if the number of children is $m\geq 3$.

MODULE IV

VII (a) Describe the different types of configurations in reliability models.

(b) A certain type of engine seal is found to have its life exponentially distributed with a constant failure rate = 0.03×10^{-4} failures per hour.

(i) What is the probability that a given seal will last beyond ten thousand hours?

(ii) What is the MTTF of the seal?

(iii) What is the reliability at MTTF?

(iv) If the reliability at design life has to be atleast 90%, what is the recommended design life?

VIII A system follows weibull distribution with a shape parameter (β) of 1.4 and a scale parameter (θ) of 550 days and also the system requires to have a design life reliability of 0.90.

Compute (i) mean time to failure

(ii) the standard deviation

(iii) reliability for 200 days

(iv) the design life, if there is nowear in period.

(v) the design life, if there is a wear – in period of one month in the beginning.

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