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Reg. No. : .....

Name : .....

Fifth Semester B.Tech. Degree Examination, January 2018
(2013 Scheme)
13.501 : ENGINEERING MATHEMATICS – IV (BCHMPSU)

Common

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Given the pdf of a random variable X as $f(x) = cx^2(1 - x)$, $0 < x < 1$, find (i) the value of c and (ii) the mean.

2. During war, one ship out of nine was sunk on an average in making a certain voyage. Find the probability that exactly three out of a convoy of six ships would arrive safely.

3. A die is thrown 9000 times and a throw of 3 or 4 is observed 3240 times. Show that the die cannot be regarded as unbiased.

4. Reduce the following LPP to its standard form

   Minimize $z = 2x_1 + x_2 + 4x_3$

   Subject to the constraints

   $$-2x_1 + 4x_2 \leq 4$$
   $$x_1 + 2x_2 + x_3 \geq 5$$
   $$2x_1 + 3x_3 \leq 2$$
   $$x_1 \geq 0, x_2 \geq 0.$$

5. Write the dual of the LPP

   Maximize $z = 5x_1 + 3x_2$ subject to

   $$3x_1 + 5x_2 \leq 15$$
   $$5x_1 + 2x_2 \leq 10$$
   $$x_1 \geq 0, x_2 \geq 0$$

PART – B

Answer **one full** question from **each** Module. **Each** question carries **20** marks.

Module – 1

6. a) Derive the mean and variance of uniform distribution.

   b) In a test on 2000 bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for (i) more than 2150 hours (ii) less than 1950 hours.

   c) A screw making machine produces on an average of 2 defective screws out of every 100 and packs them in boxes of 500. Find the probability that a box contains 15 defective screws.

7. a) The length of time for a person to be served at a cafeteria is a random variable having exponential distribution with mean of 4 minutes. Find the probability that a person is served in less than 3 minutes on at least 4 of the next 6 days.

   b) In a distribution exactly normal, 7% items are under 35 and 89% items are under 63. Find the mean and variance of the distribution.

   c) In 256 sets of 12 tosses of an unbiased coin, in how many cases can we expect 8 heads and 4 tails ?

Module – 2

8. a) Fit a parabola $y = a + bx + cx^2$ to the data

x :	0	1	2	3	4
y :	1	1.8	1.3	2.5	6.3

   b) The mean height of 50 students was 68.2 inches with a standard deviation of 2.5 inches while that of another 50 students was 67.5 inches with standard deviation of 2.8 inches.

      i) Test the hypothesis that students of first group are taller than the students of the second group.

      ii) By how much should the sample size of each of the groups be increased in order that the observed difference of 0.5 inches in the mean heights be significant at 5% level of significance ?

9. a) Find the lines of regression of X and Y if

X :	52	63	45	36	72	65	47	25
Y :	62	53	51	25	79	43	60	33

b) A man detects 2, 3, 6, 0, 4 and 9 defectives in six cartons, each containing 144 tiles. Assuming that the data can be looked upon as a random variable from a normal population, construct 95% confidence interval for the true average number of defectives per carton.

Module – 3

10. a) A company produces two types of hats. Each hat of the first type requires twice as much labour time as the second type. If all hats are of second type only, the company can produce a total of 500 hats a day. The market limits daily sales of the first and second type to 150 and 250 hats. Assuming that the profits per hat are Rs. 8 for type A and Rs. 5 for type B, formulate a LPP in order to determine the number of hats to be produced of each type so as to maximize the profit.

b) Solve by simplex method

Maximize $z = 3x_1 + 2x_2 + 5x_3$

Subject to the constraints

$$x_1 + 2x_2 + x_3 \leq 430$$
$$3x_1 + 2x_3 \leq 460$$
$$x_1 + 4x_2 \leq 420$$
$$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0.$$

11. a) Use Big M method, to maximize $z = 3x_1 - x_2$

Subject to the constraints $2x_1 + x_2 \geq 2$

$$x_1 + 3x_2 \leq 3$$
$$x_2 \leq 4$$
$$x_1 \geq 0, x_2 \geq 0.$$

b) Use simplex algorithm to solve the LPP

Minimize $z = x_1 - 3x_2 + 2x_3$

Subject to $3x_1 - x_2 + 3x_3 \leq 7,$

$$-2x_1 + 4x_2 \leq 12$$
$$-4x_1 + 3x_2 + 8x_3 \leq 10$$
$$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0.$$

Module – 4

12. a) Apply the principle of duality to solve the LPP

Maximize $z = 4x_1 + 2x_2$

Subject to the constraints

$$-x_1 - x_2 \leq -3$$
$$-x_1 + x_2 \leq -2$$
$$x_1 \geq 0, x_2 \geq 0.$$

b) Determine the optimum basic feasible solution to the following transportation problem where O*i* and D*j* denote the *i*th origin and *j*th destination respectively.

	D_1	D_2	D_3	D_4	Capacity
O_1	1	2	3	4	6
O_2	4	3	2	0	8
O_3	0	2	2	1	10
Demand	4	6	8	6	24 (total)

13. a) Solve by the principle of duality

Minimize $z = 3x_1 + x_2$

Subject to $x_1 + x_2 \geq 1$

$2x_1 + 3x_2 \geq 2$

$x_1 \geq 0, x_2 \geq 0.$

b) Solve the following minimal assignment problem

man →	1	2	3	4
I	12	30	21	15
Job II	18	33	9	31
↓ III	44	25	24	21
IV	23	30	28	14