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Printed Pages—4 **EME043**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2762 **Roll No.** 0 9 0 3 2 4 0 0 9 0

B.Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2012-13

MECHANICAL SYSTEM DESIGN

Time : 3 Hours *Total Marks : 100*

Note : *(1) Attempt **all** questions.*

(2) Any missing data may be assumed suitably.

1. Attempt any **two** parts of the following : **(10×2=20)**

   (a) What do you understand by system approach in engineering ? Explain it with the help of two examples. What are the advantages of its approach.

   (b) Explain with the help of flow diagram the implementation of computer based concurrent engineering in the cost based design for viscous lubrication system in wire drawing.

   (c) Formulate an optimum design problem of a high speed belt drive system.

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

   (a) With the help of an example explain the state theory approach in analysing a system.

   (b) Write a short note on the following :

      (i) Component integration approach

      (ii) System modelling.

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(c) Formulate the following cabinet design problem : A cabinet is assembled from components C_1, C_2 and C_3. Each cabinet requires $8C_1$, $5C_2$ and $15C_3$ components. The assembly of C_1 requires either 5 bolts or 5 rivets, whereas C_2 requires 6 bolts or 6 rivets, and C_3 requires 3 bolts or 3 rivets. The cost of installing a bolt, including the cost of bolt, is \$ 0·70 for C_1, \$ 1·00 for C_2 and \$ 0·60 for C_3. Similarly, riveting costs are \$ 0·60 for C_1, \$ 0·80 for C_2, and \$ 1·00 for C_3. Bolting and riveting capacities per day are 6000 and 8000 respectively. In order to minimize the cost for 100 cabinets that must be assembled each day, we wish to determine the number of components to be bolted or riveted.

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) How graph theory helps in solving network flow problem in a material handling system ?

(b) Differentiate between 'path' and 'trail' terms used in graph theory. What is the difference between directed graph and undirected graph ? What do you understand by isomorphism ?

(c) Define the following terms :

(i) Mathematical programming problem.

(ii) Behaviour constraint

(iii) Objective function

(iv) Design space

(v) Geometric programming problem.

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4. Attempt any **two** parts of the following : **(10×2=20)**

(a) What are the steps involved in mechanical system evaluation ? Explain them.

(b) Locate and classify the stationary points of the following functions :

$$f(x_1, x_2) = x_1^2 + 2x_2^2 - 4x_1 - 2x_1x_2.$$

(c) Using Kuhn-Tucker conditions maximize :

$$f(x_1, x_2) = 8x_1 + 4x_2 + x_1x_2 - x_1^2 - x_2^2$$

subject to

$$2x_1 + 3x_2 \leq 24$$

$$-5x_1 + 12x_2 \leq 24$$

$$x_2 \leq 5$$

5. Attempt any **two** parts of the following : **(10×2=20)**

(a) Define Bayes' theorem. For a new medical test, a medical screening of population is conducted. The probability that the test correctly identifies someone with illness as positive is 0·99, and the probability that the test correctly identifies someone without illness as negative is 0·95. The incidence of the illness in the general population is 0·0001. You take the test, and the result is positive. What is the probability that you have the illness ?

(b) According to the economic lot size formula, if the annual requirement for an item is 800 units, set up cost are Rs. 20, and cost of holding the item inventory is Rs. 0·20 per year what is the economic lot size to

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order ? Supposing the holding cost doubled to Rs. 0·40 per year what is the percentage effect on the order size ?

(c) Define the continuous random variable. Let X be the life length of a certain type of light bulb (in hours). Assuming X to be a continuous random variable, we suppose that the probability density function f of X is given by $f(x)=\frac{a}{x^3}$ for $1500 \leq x \leq 2500$ and is 0 elsewhere. What is the value of a ?