

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

PAPER ID : 2762

Roll No.

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B.Tech.

(SEM. VII) THEORY EXAMINATION 2011-12

MECHANICAL SYSTEM DESIGN

Time : 3 Hours

Total Marks : 100

Note :—Attempt all questions.

1. Answer any **four** of the following : **(5×4=20)**
- (a) Describe the systems approach to engineering problem solving. Discuss its advantages.
 - (b) How would you develop need statement for a given situation ? Explain. Give an example to support your answer.
 - (c) How an analysis of system hierarchy permits the analysis of system at various levels ? Give an example.
 - (d) Discuss how concurrent engineering concepts would help in achieving :
 - (i) Life cycle design and
 - (ii) Shorten time to market the products.

(e) Explain what methods can be employed for developing the product design specifications and constraints for inclusion in needs statement.

(f) What is meant by boundary and viscous fluid lubrication? How viscous fluid lubrication can be achieved in wire drawing operations? What are its limitations?

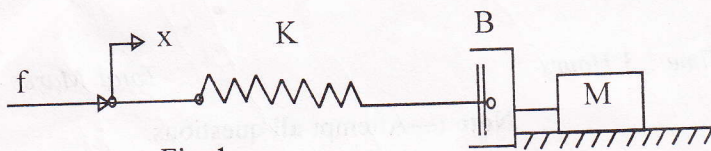


Fig. 1

2. Answer any **four** of the following : **(5×4=20)**

(a) Describe the framework for carrying out the system analysis.

(b) Explain the basic concepts of (i) black box and state theory approach for system analysis.

(c) Discuss in brief the important characteristics, and applications of iconic, analog and symbolic models. Give examples of each.

- (d) What are the reasons for developing system models ? How models can be employed for decision making ? Give an example.
- (e) Differentiate between series and parallel mechanical systems. For the system shown in Fig. 1 develop a relationship between 'f' and 'x'.
- (f) Enumerate the principles used in system modelling. What is meant by descriptive model and symbolic definition of a problem ? Explain.

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

(a) Write short notes on the following :

- (i) Combinational optimization
- (ii) Subjective optimization and
- (iii) Analytical optimization methods.

Indicate the scope of applications for each of the above.

(b) A small maintenance project consists of the following 10 jobs. The precedence relationships of the jobs is identified by their node numbers. Determine the shortest and longest

path connecting the start node to finish node.

Job	Initial Node, Final node	Duration (days)
a	1, 2	2
b	2, 3	3
c	2, 4	5
d	3, 5	4
e	3, 6	1
f	4, 6	6
g	4, 7	2
h	5, 8	8
i	6, 8	7
j	7, 8	4

(c) With reference to optimization problems explain the following by means of suitable examples :

- (i) Defining the system goals, objectives and criteria
- (ii) Motivation and freedom of choice.

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

(a) Explain the meaning and scope of :

(i) Technical feasibility,

(ii) Economic feasibility,

(iii) Commercial feasibility, and

(iv) Financial feasibility.

(b) Suppose 2 alternative robot designs are being considered for certain industrial application. The following cost data are available, which robot be selected on the basis of PW values ? Assume $i = 20\%$

	Robot 1	Robot 2
Investment	15000.00	25000.00
Life	3 yrs	3 yrs
Salvage value	0	6000.00
Annual disbursement	8000.00	5000.00

(c) Determine the maximum and minimum values of the function :

$$f(x) = 12x^5 - 45x^4 + 40x^3 + 5.$$

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

(a) Write short notes on the following :

(i) Utility based decision

(ii) Elements of a decision problem

(iii) Monte Carlo simulation and

(iv) Probability density function.

(b) State the Bayes theorem. A manufacturing firm produces steel pipes in 3 different plants with daily production volume of 500, 1000 and 2000 units respectively. Experience has revealed that fraction defectives from the three plants are respectively 0.005, 0.008 and 0.010. If a pipe is selected at random from day's total production and found to be defective find out (i) From which plant the defective came ? (ii) What is the probability that it came from the 1st plant ?

(c) The manager of a small post office is concerned that growing township is overloading the one window service being offered. Sample data are collected on 100 individuals who arrive for service.

Time between arrivals (min)	Frequency	Service Time (min)	Frequency
1	8	1.0	12
2	35	1.5	21
3	34	2.0	36
4	17	2.5	19
5	6	3.0	7
	<u>100</u>	3.5	5
			<u>100</u>

Using the following random nos, simulate 6 arrivals :
estimate the average customer waiting time and average
idle time of for the clerks.

RN : 08, 74, 24, 34, 45, 86, 31, 32, 45, 21, 10, 67, 60,
17, 60, 87, 74, 96