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06ME71

# Seventh Semester B.E. Degree Examination, December 2010
## Control Engineering

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions, selecting at least TWO questions from each part.***



### PART – A

1 a. Explain the concepts of open loop and closed loop systems, with examples and block diagrams. **(08 Marks)**

b. Derive the transfer function for an armature controlled D.C. motor, which relates output angular displacement (θ) with input voltage (e). **(12 Marks)**

2 a. What is control action? **(02 Marks)**

b. Draw the block diagram with brief explanation of an industrial automatic controller with measuring element. **(06 Marks)**

c. Briefly explain proportional and integral control action, with necessary block diagrams and mathematical expressions. **(12 Marks)**

3 a. A dynamic vibration absorber is shown in Fig.Q3(a). Obtain the differential equations describing the behaviour of the system. Draw also the analogous electrical circuit, based on the force-voltage analogy. List all the analogous elements. **(10 Marks)**

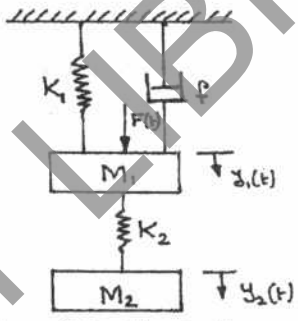


Fig.Q3(a)

b. Determine the transfer function of the block diagram shown in Fig.Q3(b). **(10 Marks)**

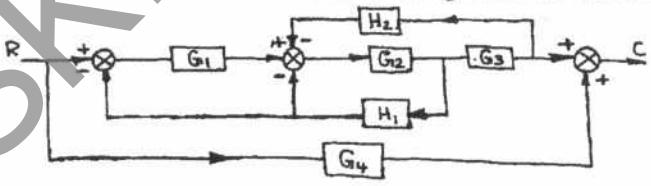


Fig.Q3(b)

4 a. Derive expressions for the responses of a first order system, subjected to :
i) Step input ii) Ramp input **(08 Marks)**

b. A system oscillates with a frequency ω, has poles at S = ± JW and no poles in the right half of S-plane. Determine the values of constants K and a, so that the system shown in Fig.Q4(b) oscillates at a frequency of 2 rad/sec. **(12 Marks)**

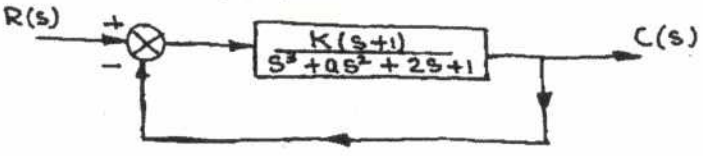


Fig.Q4(b)

## PART – B

5 a. Briefly explain the concept of gain margin and phase margin by drawing neat polar plots, for both stable and unstable systems. **(06 Marks)**

b. Sketch the complete Nyquist plot for $G(S)H(S) = \frac{K(4S+1)}{S^2(1+S)(1+2S)}$. Also determine the range values of K for stability, using the Nyquist stability criterion. **(14 Marks)**

6 Draw Bode magnitude and phase angle plots for the transfer function given as :

$$G(S)H(S) = \frac{4(1+0.5S)}{S^2(1+2S)(1+0.5S+0.125^2S^2)}.$$

Use asymptotic straight line approximation method. Also determine the gain margin and the phase margin from the plot. Hence comment on the system stability. **(20 Marks)**

7 a. Define root locus. **(03 Marks)**

b. The closed loop transfer function of a unity feedback system is given by :

$$\frac{C(S)}{R(S)} = \frac{K(S+4)(S+6)}{S(S+2)+K(S+4)(S+6)}.$$

Sketch the root locus diagram of the system. Show all relevant details on the plot. **(17 Marks)**

8 a. Explain the need for system compensation. **(06 Marks)**

b. Write a note on:

i) Lead compensator

ii) Lag compensator. **(14 Marks)**

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06ME72

# Seventh Semester B.E. Degree Examination, December 2010
# Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions, selecting at least TWO questions from each part.***



## PART – A

1 a. Define and explain automation. Describe three basic types of automated manufacturing systems. **(10 Marks)**

b. Explain the mathematical model of product life cycle. **(10 Marks)**

2 a. Classify and explain work part transport mechanisms, with examples. **(10 Marks)**

b. Explain different types of control functions used in an automated flow line. **(10 Marks)**

3 a. Explain and differentiate between the upper bound and lower bound approach, with reference to the automated flow line. **(10 Marks)**

b. A 20 station transfer line is divided into two stages of 10 stations each. The ideal cycle time of each stage is $T_C$ = 1.2 min. All the stations in the line have the same probability of stopping, p = 0.005. Assume that the down time, $T_d$ = 8.0 min is constant when a breakdown occurs. Using the upper bound approach, compute the line efficiency for the following buffer capacities : i) b = 0 ii) b = ∞ iii) b = 10 iv) b = 100 **(10 Marks)**

4 a. Explain the following with reference to line balancing: **(10 Marks)**
i) Minimum rational work element ii) Precedence diagram iii) Balance delay

b. In a plant, a product is to be assembled as per the following data:

| Element | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Time '$T_e$' min | 5 | 3 | 8 | 2 | 1 | 6 | 4 | 5 | 3 | 6 |
| Immediate predecessor | – | 1 | 1 | 2 | 2 | 3 | 4, 5 | 3, 5 | 7, 8 | 6, 9 |

i) Construct the precedence diagram.
ii) If the cycle time is 10 min, find the number of stations required.
iii) Compute the balance delay of the line, using the largest candidate method. **(10 Marks)**

## PART – B

5 a. Explain with neat sketches, the following part feeding devices of automated assembly systems: i) Vibratory bowl feeder ii) Selector and orienter
iii) Escapement and placement devices **(10 Marks)**

b. Explain vehicle guidance methods used in AGV, for automated manufacturing systems. **(10 Marks)**

6 a. With a block diagram, explain the general procedure in a retrieval computer aided process planning system. **(10 Marks)**

b. Discuss the fundamental concepts and input to the MRP system. **(10 Marks)**

7 a. Describe salient features of CNC systems. **(10 Marks)**

b. Discuss the advantages and disadvantages of NC systems. **(10 Marks)**

8 a. With neat sketches, discuss the common robot configurations. **(12 Marks)**

b. Explain resolution, accuracy and repeatability, as applied to robots. **(08 Marks)**

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06ME73

# Seventh Semester B.E. Degree Examination, December 2010
# Manufacturing Processes - III

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions, selecting atleast TWO questions from Part – A and Part - B.***





## PART - A

1 a. With neat sketches, explain the classification of metal working processes on the basis of force applied. **(10 Marks)**

b. Explain : i) Tresca's yield criterion and ii) Von – Mises yield criterion. **(10 Marks)**

2 a. Explain with a neat sketch, the hydrostatic pressure in metal working. **(05 Marks)**

b. Discuss the concept of deformation zone geometry, in metal working. **(05 Marks)**

c. Explain the effect of the following on metal working processes :
i) Strain rate ii) Temperature. **(10 Marks)**

3 a. Deduce the expression for forging pressure and load in open – die forging by slab analysis making suitable assumptions. **(10 Marks)**

b. A circular disc of 150mm radius and thickness 50mm is forged to half its original thickness by open – die forging. Determine the maximum forging force, if the coefficient of friction between the job and the die is 0.25. The average shear yield stress is 4 $N/mm^2$. **(05 Marks)**

c. Explain typical forging defects. **(05 Marks)**

4 a. With neat sketches, explain the different types of rolling mills. **(08 Marks)**

b. Describe the effect of front and back tension on the rolling load. **(06 Marks)**

c. Calculate the rolling load if a steel sheet is hot rolled 40% from a 40mm thick slab using 900mm diameter rolls. The slab is 760mm wide. Assume $\mu = 0.3$. The plane strain flow stress is 140 MPa at the entrance and 200 MPa at the exit from the roll gap due to increasing velocity. What would be the rolling load, if sticking friction occurs? **(06 Marks)**

## PART - B

5 a. With a neat sketch, explain tube drawing process. **(06 Marks)**

b. Explain optimal cone angle and dead zone formation in drawing. **(06 Marks)**

c. What is meant by redundant work in drawing process? Explain. **(08 Marks)**

6 a. Explain backward extrusion process with a neat sketch. **(06 Marks)**

b. Write a note on extrusion equipment, die design and lubrication. **(06 Marks)**

c. Explain the manufacture of seamless tubes with a neat sketch. **(08 Marks)**

7 a. With neat sketches, explain the working of progressive and compound die arrangement in sheet metal working. **(10 Marks)**

b. Explain the following operations with neat sketches : i) Rubber forming ii) Stretch forming. **(10 Marks)**

8 a. With a neat sketch, explain the explosive forming process. **(06 Marks)**

b. What is powder metallurgy? Explain any 2 methods of metal powder production. **(08 Marks)**

c. List the applications of powder metallurgy components. **(06 Marks)**

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06ME74

# Seventh Semester B.E. Degree Examination, December 2010
# Operations Research

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions, selecting at least TWO questions from each part.***





## PART – A

1 a. Explain the limitations of OR models. **(05 Marks)**

b. A plant manufactures washers and dryers. The major manufacturing departments are stamping department, motor and transmission department and final assembly department. Stamping department fabricates a large number of metal parts for both washers and dryers. Monthly dept. capacities ate as follows:

Stamping dept. : 10000 washers or 10000 dryers
Motor and transmission dept. : 16000 washers or 7000 dryers.
Dryer assembly dept. : Only 5000 dryers.
Washer assembly dept. : Only 9000 washers.

Stamping dept. can produce parts for 10000 washers or 10000 dryers per month as well as for some suitable combinations. It is assumed that there is no changeover cost from washers to dryers. A similar situation exists in motor and transmission dept. but assembly lines are separate. The contribution to monthly profit is Rs.900/- per washer and Rs.1200/- per dryer. Determine the number of washers and dryers to be produced. **(15 Marks)**

2 Write the dual for the following LPP. Solve the primal and read the solution of both primal and dual problems.

Maximize $Z = 2x_1 + x_2$

Subjected to constraints $x_1 + 2x_2 \le 10$ ; $x_1 + x_2 \le 6$ ; $x_1 - x_2 \le 2$ ; $x_1 - 2x_2 \le 1$ and $x_1, x_2 \ge 0$ **(20 Marks)**

3 a. The following information is available concerning the operation of a manufacturing company:

| Period | Units in order | Production capacity | | Excess over cost per unit OT (Rs.) | Storage cost per unit (Rs.) |
|---|---|---|---|---|---|
| | | Regular time | Over time | | |
| Month 1 | 800 | 920 | 920 | 1.25 | 0.5 |
| Month 2 | 1400 | 250 | 250 | 1.25 | 0.5 |

Formulate the problem as a transportation problem and determine the optimal solution. **(15 Marks)**

b. "Solution to the assignment problem is inherently degenerate". Explain. **(05 Marks)**

4 a. State the assumptions of Johnson's algorithm. **(05 Marks)**

b. Find the sequence of the following eight jobs. Each job has to be processed in the order CAB. Following entries give the time in hours on the machine:

| Jobs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| M/c A | 4 | 6 | 7 | 4 | 5 | 3 | 6 | 2 |
| M/c B | 8 | 10 | 7 | 8 | 11 | 8 | 9 | 13 |
| M/c C | 5 | 6 | 2 | 3 | 4 | 9 | 15 | 11 |

Calculate the elapsed time and idle time. **(15 Marks)**

## PART – B

5 a. Define: i) Balking ii) Collision iii) Reneging **(06 Marks)**

b. Write a note on Kendall's notations. **(04 Marks)**

c. In a machine shop, the inter arrival times at the tool rib are exponential, with an average time of 10 minutes. The length of the service time is assumed to be exponential with a mean of 6 minutes. Find

i) The probability that a person arriving at the booth will have to wait.

ii) Average length of the queue

iii) The probability that an arrival will have to wait for mote than 12 minutes for service and to obtain his tools. **(10 Marks)**

6 a. Define: i) Critical path ii) Total slack iii) Free slack. **(06 Marks)**

b. Draw the network for the following project. Identify the critical path and calculate the total slack and free slack. **(14 Marks)**

| Activity | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| Predecessor | - | - | A | A | B,C | B,C | E | E | D,G | F,H,I |
| Time (weeks) | 15 | 15 | 3 | 5 | 8 | 12 | 1 | 14 | 3 | 14 |

7 a. Define: i) Saddle point ii) Fair game. **(04 Marks)**

b. If the following payoff matrix has a saddle point, determine the value of game and ranges of 'P' and 'Q'. **(06 Marks)**

| | | B | | |
|---|---|---|---|---|
| | | 1 | Q | 6 |
| A | | P | 5 | 10 |
| | | 6 | 2 | 3 |

c. Solve the following game graphically. **(10 Marks)**

| | | B | | |
|---|---|---|---|---|
| | | I | II | III |
| A | I | 1 | 3 | 11 |
| | II | 8 | 5 | 2 |

8 Solve the following integer programming problem using the Gomory's technique.

Maximize $Z = 7x_1 + 9x_2$

Subject to constraints $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_1, x_2 \geq 0$ and integers. **(20 Marks)**

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06ME754

# Seventh Semester B.E. Degree Examination, December 2010

## Solar Energy

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions, selecting at least TWO questions from each part.***





### PART – A

1 a. Define energy. Explain the different types of renewable energy sources, with examples. **(10 Marks)**

b. Explain the renewable energy potential and achievements in India. **(10 Marks)**

2 a. Define the following with relevant sketches:
i) Latitude ii) Declination iii) Hour angle
iv) Zenith angle v) Local apparent time **(12 Marks)**

b. Calculate the angle made by beam radiation with the normal to a flat-plate collector on May 1st at 1200 h (local apparent time). The collector is located in New Delhi (28°35′N, 77°12′E). It is tilted at an angle of 36° with the horizontal and is pointing due south. **(08 Marks)**

3 a. Explain the working principle of pyranometer, with schematic diagram. **(08 Marks)**

b. Explain the following : **(12 Marks)**
i) Solar constant ii) Beam and diffuse radiation iii) Solar radiation data of India.

4 a. Explain, with a neat sketch, liquid flat plate collector. **(08 Marks)**

b. Name the different types of solar thermal power cycles and explain any one type with a neat sketch. **(12 Marks)**

### PART – B

5 a. Explain the description and principles of working of solar cell. **(12 Marks)**

b. Draw a current voltage characteristic curve of a solar cell. **(08 Marks)**

6 a. Explain the basic energy balance equation. **(06 Marks)**

b. Explain the transmissivity of the cover system based on reflection-refraction, and absorption, with a sketch. **(14 Marks)**

7 a. Define the following :
i) Collector heat removal factor ii) Collector efficiency factor
iii) Collector flow factor iv) Mean plate temperature
v) Instantaneous efficiency. **(10 Marks)**

b. Name the different types of concentrating collectors, with sketches. **(10 Marks)**

8 a. Define : i) Aperture are ii) Concentration ratio
iii) Intercept factor iv) Acceptance factor. **(08 Marks)**

b. What is tracking? Explain the different types of tracking modes. **(12 Marks)**

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06ME762

# Seventh Semester B.E. Degree Examination, December 2010
# Engineering Systems Design

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions, selecting at least TWO questions from each part.***





## PART – A

1 a. What is designing? Explain design by evolution. **(06 Marks)**

b. Differentiate between scientists and engineers. **(04 Marks)**

c. Explain the structure of design process. **(10 Marks)**

2 a. Considering hand drier as an example, state the following :
   i) Preliminary need statement.
   ii) Specifications.
   iii) Standards of performance.
   iv) Environmental factors. **(12 Marks)**

b. Explain design decision making and iteration, with an example. **(08 Marks)**

3 a. What are checklists? Give a checklist for the problem of quick cleaning of a large auditorium. **(08 Marks)**

b. Explain the steps involved in morphological analysis. **(06 Marks)**

c. Explain AIDA and brain storming. **(06 Marks)**

4 a. How do you measure the physical realisability of a design concept? Explain with an example. **(10 Marks)**

b. State the law of diminishing returns. **(04 Marks)**

c. Explain the concept of economic and financial feasibility. **(06 Marks)**

## PART – B

5 a. What is reliability? Explain bath tub curve by assigning the causes for each portion of the curve. **(08 Marks)**

b. Prove that for a series system, the failure rates are additive. **(04 Marks)**

c. Determine the reliability of the system for 20 hours of operating period. The configuration is given below. The failure rate/hour are :
$\lambda_A = 0.01$ , $\lambda_B = 0.015$ , $\lambda_C = 0.02$ , $\lambda_D = 0.02$ , $\lambda_E = 0.025$. **(08 Marks)**

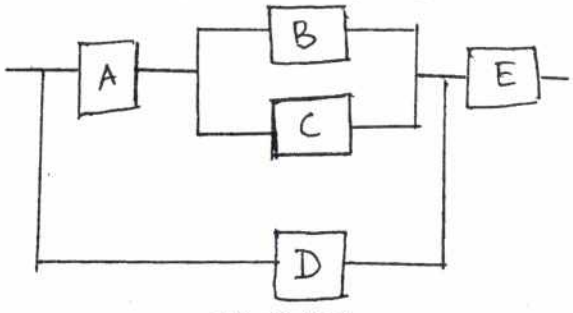


Fig.Q.5(c).

6 a. What are fixed costs and variable costs? **(04 Marks)**

b. Mention the uses and limitations of break – even – analysis. **(08 Marks)**

c. A publisher sells a text book priced at Rs.200 each. The production costs for a volume of 10000 books are as follows :

| | |
|---|---|
| Labour cost | = Rs.2,40,000 |
| Material cost | = Rs.4,80,000 |
| Total overheads | = Rs.3,60,000 |
| Selling and administrative overheads | = Rs.2,00,000 |
| Interest on capital | = Rs.3,20,000 |

Use the data to draw break – even – chart and determine BEP. **(08 Marks)**

7 a. The manager of an oil company has to decide the optimal mix of two possible blending processes of which the inputs and outputs per production run are as follows :

| | Input | | Output | |
|---|---|---|---|---|
| | Crude | Crude | Gasoline | Gasoline |
| Processes | A | B | X | Y |
| Process 1 | 5 | 3 | 5 | 8 |
| Process 2 | 4 | 5 | 4 | 4 |

Maximum availability of crude A and crude B are 200 and 150 units respectively. Also at least 100 units of gasoline X and 80 units of gasoline Y must be produced. Profits from processes 1 and 2 are 300 rupees and 400 rupees respectively. Determine the optimal strategy through a graph. **(12 Marks)**

b. Explain the concept of utility in design decisions. **(08 Marks)**

8 a. Explain man – machine interaction cycle, with a neat sketch. **(08 Marks)**

b. Discuss the role of displays in designing a machine. **(06 Marks)**

c. List the factors to be considered in designing controls **(06 Marks)**

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06ME767

# Seventh Semester B.E. Degree Examination, December 2010
# Computational Fluid Dynamics

Time: 3 hrs. Max. Marks:100

**Note:** *Answer any FIVE full questions, selecting at least TWO questions from each part.*



## PART – A

1 a. What is computational fluid dynamics? What are some of the advantages of using CFD? What is the future of CFD? **(10 Marks)**

b. Explain the applications of CFD. **(10 Marks)**

2 a. Explain the steps involved in preprocess. **(10 Marks)**

b. Explain the steps involved in CFD solver. **(10 Marks)**

3 a. Write a generic form of the governing equation for CFD. Indicate the terms in the equation. **(04 Marks)**

b. Explain the additional equations for turbulent flow. **(08 Marks)**

c. Explain the physical boundary conditions of the governing equations. **(08 Marks)**

4 a. Compare the finite difference and finite volume discretizations. **(10 Marks)**

b. Solve the following set of equations by Gaussian elimination:

$$\begin{bmatrix} 3000 & -1000 & 0 & 0 \\ -1000 & 2000 & -1000 & 0 \\ 0 & -1000 & 2000 & -1000 \\ 0 & 0 & -1000 & 3000 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \end{bmatrix} = \begin{bmatrix} 2000T_A + 2500 \\ 2500 \\ 2500 \\ 2000T_B + 2500 \end{bmatrix}$$

where $T_A = 100°C$ and $T_B = 400°C$ **(10 Marks)**

## PART – B

5 a. With examples, explain the consistency and convergence. **(10 Marks)**

b. Discuss some types of errors that can cause a solution to be inaccurate. **(10 Marks)**

6 a. Explain the methods of grid generation. **(10 Marks)**

b. Discuss the guidelines on inlet and outlet boundary conditions. **(10 Marks)**

7 a. With examples, explain the CFD as a design tool. **(10 Marks)**

b. Discuss the applications of CFD for heat transfer coupled with fluid flow. **(10 Marks)**

8 a. Write a short note on moving grids and parallel computing. **(10 Marks)**

b. Discuss the numerical methods for incompressible and compressible flows. **(10 Marks)**

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