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06ME71

Seventh Semester B.E. Degree Examination, June 2012
Control Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define open-loop and closed loop control systems, mention their merits and demerits. **(06 Marks)**

b. What is feedback? Explain the effects of feedback. **(04 Marks)**

c. Explain proportional and integral controller and derive the closed-loop transfer function of PI controller for a second-order system. **(10 Marks)**

2 a. Derive the system equations in Laplace form for the system shown in Fig.Q.2(a) and obtain the transfer function $\frac{X_2(s)}{F(s)}$. **(10 Marks)**

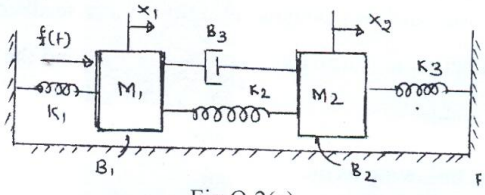

Fig.Q.2(a)

b. Obtain the force-voltage analogy for the mechanical system shown in Fig.Q.2(b). **(10 Marks)**

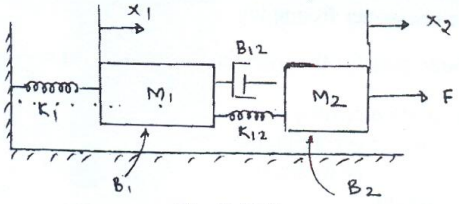

Fig.Q.2(b)

3 a. Reduce the given block diagram shown in Fig.Q.3(a) and determine the transfer function of the system. **(10 Marks)**

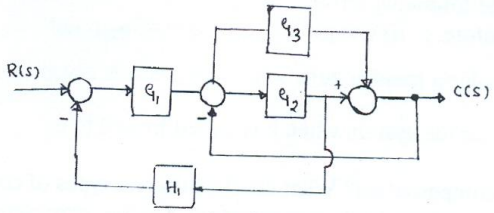

Fig.Q.3(a)

b. Find the transfer function of the system shown in Fig.Q.3(b) using Masons gain formula. **(10 Marks)**

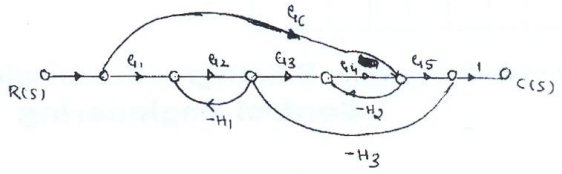

Fig.Q.3(b)

4 a. Define rise time, peak overshoot and settling time of a control system. **(06 Marks)**

b. The open-loop transfer function of a unity feedback control system is given by $G(s) = \frac{25}{s(s+5)}$. Obtain the maximum overshoot, peak time, rise time and settling time. **(07 Marks)**

c. The closed loop transfer function of a system is given by $\frac{C(s)}{R(s)} = \frac{k}{s(s^2+s+1)(s+2)+k}$. Determine the value of k for which the system is stable. **(07 Marks)**

PART – B

5 a. State the advantages and limitations of the Nyquist stability criterion. **(06 Marks)**

b. Construct the complete Nyquist plot for a unity feedback control system whose open-loop transfer function is $G(s)H(s) = \frac{k}{s(s^2+2s+2)}$. Find the maximum value of k for which the system is stable. **(14 Marks)**

6 a. Define the following terms :
i) Corner frequency
ii) Gain crossover frequency
iii) Phase crossover frequency. **(04 Marks)**

b. Draw the bode plot for the transfer function $G(s) = \frac{36(1+0.2s)}{s^2(1+0.05s)(1+0.01s)}$

From bode, plot determine
i) Phase cross over frequency
ii) Gain cross over frequency
iii) Gain margin
iv) Phase margin
Comment on the stability of the system. **(16 Marks)**

7 a. Define the following terms :
i) Asymptote ; ii) Centroid ; iii) Breakaway point. **(04 Marks)**

b. The open-loop transfer function of a system is given by $G(s)H(s) = \frac{k(s+12)}{s^2(s+20)}$. Sketch the root loci for the system when k is varied from 0 to ∞. **(16 Marks)**

8 a. What is compensation? What are the different types of compensation? **(05 Marks)**

b. What is a phase-lead compensator? Derive expression for the transfer function of a phase-lead compensator. **(15 Marks)**

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06ME72

Seventh Semester B.E. Degree Examination, June 2012
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is automation? Discuss the classification with features. **(10 Marks)**

b. Briefly explain the following terms:
i) Manufacturing lead time ii) Production rate
iii) Utilization and availability iv) Work in process. **(10 Marks)**

2 a. List the objectives of automated flow line. **(04 Marks)**

b. Sketch and explain the following transfer mechanisms:
i) Roller chain drive ii) Ratchet and Pawl mechanism **(10 Marks)**

c. Discuss the control functions used in an automated flow line. **(06 Marks)**

3 a. Differentiate between the upper bound and lower bound approach to analyse automated flow lines without storage buffers. **(08 Marks)**

b. Discuss the starving and blocking of stations with respect to an automated flow line. **(04 Marks)**

c. Compare on the basis of cost per unit and suggest whether the performance of ten station transfer line having six automated and four manual station with an automated station.
Cost data for the existing line:
i) C_m = Rs. 0.50/unit. ii) T_c = 30 seconds iii) C_o = Rs. 0.15/min
iv) C_{as} = Rs. 0.10/min v) C_{at} = Rs. 0.10/min vi) C_t = Rs. 0.08/min
The proposed automated station would allow the cycle time to be reduced to 24 seconds with added cost at Rs.0.25/min. Probability of breakdown for six stations P = 0.01 and estimated probability for new station P = 0.02 with downtime of 3 min. which is unaffected. **(08 Marks)**

4 a. Explain the following terms in line balancing:
i) Cycle time ii) Precedence constraints iii) Precedence diagram iv) Balance delay. **(08 Marks)**

b. For a new product the precedence relationship and element times are as per the following data:

Element	t_e (min)	Immediate predecessor
1	1.0	-
2	0.5	-
3	0.8	1, 2
4	0.3	2
5	1.2	3
6	0.2	3, 4
7	0.5	4
8	1.5	5, 6, 7

Using the largest candidate rule method,
i) Construct the precedence diagram for this product.
ii) Find the number of stations required if the cycle time is 1.5 min
iii) Compute the balance delay. **(12 Marks)**

PART – B

5 a. Illustrate elements of the parts delivery in automatic assembly system. **(10 Marks)**

b. Discuss the functions that are performed while operating automated guided vehicle system. **(10 Marks)**

6 a. Explain with figure the two approaches of CAPP system. **(10 Marks)**

b. What is material requirement planning? Explain the structure of MRP system. **(10 Marks)**

7 a. What are the elements of CNC system? List the salient features. **(10 Marks)**

b. Discuss the fundamental steps involved in development of parts programming for milling in CNC system. **(10 Marks)**

8 a. Sketch and explain the robot configurations. **(12 Marks)**

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

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06ME73

Seventh Semester B.E. Degree Examination, June 2012
Manufacturing Process – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the classification of metal forming process based on the working temperature. **(06 Marks)**

b. Mention the advantages of using true stress-strain diagram in plasticity **(07 Marks)**

c. With neat sketches, explain the Bi-axial and Tri-axial stress systems. **(07 Marks)**

2 a. Discuss the various theories regarding friction in metal working. **(08 Marks)**

b. Explain the deformation zone geometry. **(06 Marks)**

c. Explain the effect of strain rate on the metal working process. **(06 Marks)**

3 a. Mention the advantages and disadvantages of forging. **(08 Marks)**

b. Discuss the various forging design parameters. **(06 Marks)**

c. A flat circular disk of 25mm diameter and thickness 75mm is to be forged to half the height between flat faces. Calculate the maximum forging head. Take $\mu = 0.4$ and yield stress of material as 40 kN/mm^2. **(06 Marks)**

4 a. Discuss the effect of back and front tensions on rolling pressure. **(08 Marks)**

b. With neat sketches, explain the defects in rolled products. **(06 Marks)**

c. A strip is given 20% reduction in thickness by rolling operation. If its final thickness is 5mm and roll radius is 500mm, determine the position of the neutral plane. Take $\mu = 0.2$ and assume the plain strain condition for rolling. **(06 Marks)**

PART – B

5 a. Derive an expression for drawing load. **(08 Marks)**

b. Explain the steps in tube drawing process. **(06 Marks)**

c. With neat sketches, explain any three methods of tube drawing. **(06 Marks)**

6 a. Explain the various types of extrusion processes, with a neat sketch. **(08 Marks)**

b. Explain the extrusion tooling assembly. **(06 Marks)**

c. Briefly explain defects in the extrusion process. **(06 Marks)**

7 a. Explain the various types of dies. **(08 Marks)**

b. Write short notes on:
i) Stretch forming ii) Bulging iii) Coining iv) Rubber forming. **(12 Marks)**

8 a. Explain the electrohydraulic forming, with a neat sketch. **(06 Marks)**

b. Mention the advantages and disadvantages of powder metallurgy. **(08 Marks)**

c. Discuss the various methods of production of powder. **(06 Marks)**

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06ME74

Seventh Semester B.E. Degree Examination, June 2012

Operations Research

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of normal distribution tables is permitted.***

PART – A

1 a. Define operations research and briefly explain the phases of OR. **(05 Marks)**

b. ABC company owns a paint factory that produces both exterior and interior paints for wholesale distribution. The basic raw materials A and B are used to manufacture the paints. The maximum availability of A is 6 tonne/day and that of B is 8 tonne/day. The requirements of raw materials/tonne of interior and exterior paints are given below :

Raw material	Exterior paint	Interior paint
A	1	2
B	2	1

Market survey has established that the daily demand for interior paint cannot exceed that of exterior paint by more than 1 tonne. The survey also shows that max demand for interior paint is limited to 2 tonnes/day. The wholesale price/tonne is Rs.3000 for exterior and Rs.2000 for interior paint. How much interior and exterior paint the company should produce to maximize the gross income. Formulate the above data as a LPP and solve graphically. **(15 Marks)**

2 a. Explain the condition of inconsistency and redundancy in LPP. **(05 Marks)**

b. Show that both the Primal and the dual of the following LPP have the same optimal 'Z' and the solution can be read from the Primal solution :

Maximize $Z = 2x_1 + x_2$

Subject to constraint $x_1 + 5x_2 \le 10$; $x_1 + 3x_2 \le 6$; $2x_1 + 2x_2 \le 8$, $x_1, x_2 \ge 0$ **(15 Marks)**

3 a. Differentiate between transportation and assignment models. **(05 Marks)**

b. Goods are to be shipped from three warehouses W_1, W_2 and W_3 to six customers C_1, C_2, C_3.....C_6. The availabilities at the warehouses are 100, 120 and 150 units respectively while the demands of customers are 50, 40, 50, 90, 60 and 80 respectively. The unit costs of transportation are as given in the following table. Is it possible to have more than one optimal solution? **(15 Marks)**

		Customers					
		C_1	C_2	C_3	C_4	C_5	C_6
Warehouses	W_1	15	25	18	35	40	23
	W_2	22	36	40	60	50	38
	W_3	26	38	45	52	45	48

4 a. A bookbinder has one printing machine, one binding machine and one finishing machine. The time in minutes required for printing, binding and finishing operations for each book are known. Determine the order in which the books should be processed in order to minimize the total time required to process all the jobs. Also find the total elapsed time and idle time.

Book	1	2	3	4	5
Printing time	40	90	80	60	50
Binding time	50	60	20	30	40
Finishing time	80	100	60	70	110

(10 Marks)

4 b. Determine the minimum elapsed time for completing following two jobs. Details of processing times and the sequence of operations are given below :

Job 1 : A – 4 to C – 2 to D – 6 to E – 3 to B – 2

Job 2 : C – 8 to A – 3 to D – 4 to B – 2 to E – 3

Also determine the sequence of jobs on each machine. **(10 Marks)**

PART – B

5 a. List the basic characteristics of queue. **(05 Marks)**

b. A public telephone booth is in a post office. The arrivals are considered to be Poisson's with an average inter arrival time of 12 minutes. The length of the phone call is assumed to be exponentially distributed with an average of 4 minutes, calculate the following :

i) What is the probability that fresh arrival will not have to wait for the phone?

ii) What is the probability that an arrival will have to wait more than 10 minutes before the phone is free?

iii) What is the average length of the queue that forms time to time?

iv) What is the probability of finding more than 5 customers in the system? **(15 Marks)**

6 a. A project consists of the following activities with their precedence relationship and duration in days:

i) Draw the network of the project

ii) Identify the critical path and project duration

iii) Calculate EST, EFT, LST, LFT, TF, FF and IF for each activity.

Activity	A	B	C	D	E	F	G	H
Precedence	-	A	A	B	B	BC	BC	DF
Duration (in days)	10	8	7	9	6	10	4	12

(10 Marks)

b. A project is composed of 7 jobs whose time estimations are given below :

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Most likely time	7	16	7	9	20	14	2
Optimistic time	8	18	9	10	24	16	3
Pessimistic time	9	20	11	11	28	18	4

i) Draw the network and calculate the length and variance along the critical path

ii) Find the probability of completing the project one day earlier and 2 days later. **(10 Marks)**

7 a. Solve the following (2 × 4) game by graphical method, table Q7(a) **(08 Marks)**

		Player B			
		I	II	III	IV
Player A	I	2	1	0	-2
	II	1	0	3	2

Table.Q7(a)

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	3	2	4	0
	A_2	3	4	2	4
	A_3	4	2	4	0
	A_4	0	4	0	8

Table.Q7(b)

b. Solve the game by principle of dominance, table Q7(b). **(08 Marks)**

c. Define the following : **(04 Marks)**

i) Saddle point ii) Pure strategy iii) Mixed strategy iv) Two persons zero sum game

8 a. Explain the methods used in integer programming problems. **(04 Marks)**

b. Solve the following integer programming problem by Gomory technique :

Maximize $Z = x_1 + x_2$

Subject to constraints $3x_1 + 2x_2 \leq 12$, $x_2 \leq 2$, $x_1, x_2 \geq 0$ and integers. **(16 Marks)**

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06ME752

Seventh Semester B.E. Degree Examination, June 2012
Theory of Plasticity

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. The stress tensor at a point is given by,

$$\tau_{ij} = \begin{bmatrix} 50 & 50 & 150 \\ 50 & 100 & 100 \\ 150 & 100 & 150 \end{bmatrix} N/mm^2$$

Calculate for the plane having direction cosines $\alpha_{nx} = \frac{1}{\sqrt{6}}$, $\alpha_{ny} = \frac{1}{\sqrt{3}}$, $\alpha_{nz} = \frac{1}{\sqrt{2}}$

i) Total stresses,
ii) Normal stresses and
iii) Shear stress and its direction. **(10 Marks)**

b. Name the different types of theories of strength and explain any two in detail. **(10 Marks)**

2 a. What is the mechanism of plastic deformation in metals? Explain your answer with special emphasis on slip and twinning. **(12 Marks)**

b. Explain the following:
i) Recovery
ii) Recrystallisation and
iii) Grain growth **(08 Marks)**

3 a. Explain cubical dilation and obtain its expression in terms of linear strain. **(10 Marks)**

b. The strain tensor at a point is given by,

$$\epsilon_{ij} = \begin{bmatrix} 0.002 & -0.005 & 0.003 \\ -0.005 & 0.003 & 0.002 \\ 0.003 & 0.002 & 0.004 \end{bmatrix}$$

Determine the deviator and spherical strain tensors. **(05 Marks)**

c. The principal strains at a point in a body are given by:
$\epsilon_1 = 0.002$, $\epsilon_2 = 0.0002$ and $\epsilon_3 = -0.001$
Determine the octahedral normal and shearing strains. **(05 Marks)**

4 a. Enumerate the various types of materials encountered in practice from plastic flow point of view. Also sketch the corresponding mechanical models. **(10 Marks)**

b. Name different theories of plastic flow. Explain any three theories of plastic flow, in detail. **(10 Marks)**

PART – B

5 a. What do you understand by a yield criterion? Explain the two yield criteria which are commonly used. **(10 Marks)**

b. The state of stress at a point is given by, $\sigma_x = 70$ MPa, $\sigma_y = 120$ MPa, $\tau_{xy} = 35$ MPa
If the yield strength for the material is 125 MPa determined in a uniaxial tensile test, explain whether yielding will occur according to Tresca's and Von-Mises yield conditions or not. **(10 Marks)**

6 a. Write a short account of the purpose of slip-line field theory. What is its significance in practical metal working? What assumptions are necessary to slip-line field theory? **(08 Marks)**

b. Explain the various properties of the slip-lines. **(06 Marks)**

c. Name the different methods adopted to draw the slip-line field. Explain any one method. **(06 Marks)**

7 a. A beam of length L, simply supported at the ends carries a concentrated load W at midspan. If the stress-strain curve for the beam is given by $\sigma = H \in^n$, determine the deflection of the beam under the load. **(10 Marks)**

b. A rectangular beam 80 mm wide and 100 mm deep is 2000 mm long and is simply supported at the ends. The yield strength for the beam material is 250 MPa. Determine the value of the concentrated load applied at the beam midspan if,

i) The outermost fibres of the beam just start yielding,

ii) The outer shell upto 30 mm depth yields and

iii) Whole of the beam yields.

Assume linear stress-strain idealized curve for the beam material. **(10 Marks)**

8 a. Derive the expressions for twisting moment in a shaft for elastoplastic and full plastic yielding. The material of shaft follows a non-linear stress-strain curve. Assume hollow shaft. **(10 Marks)**

b. A solid circular shaft of radius 120 mm is subjected to transmit 600 kW at 540 rpm. The maximum torque is 30% greater than the mean torque. If the shear stress-strain curve for the shaft material is given by $\tau = 280\gamma^{0.25}$, determine the maximum stress induced in the shaft and the corresponding angle of twist. What would be these values if the stress strain curve is linear one? Take $G = 0.84 \times 10^5$ MPa. **(10 Marks)**

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06ME758

Seventh Semester B.E. Degree Examination, June 2012
Total Quality Management

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define quality. What is total quality management? Write its basic concepts. **(08 Marks)**
b. Write the obstacles of implementation of TQM. **(08 Marks)**
c. List the dimensions of quality, with example and how to measure. **(04 Marks)**

2 a. Explain the contributions of quality gurus to the modern management philosophy. **(08 Marks)**
b. What is Taguchi's loss function? Explain with a sketch of loss versus quality characteristics curve. **(08 Marks)**
c. With an example, explain the Ishikawa diagram. **(04 Marks)**

3 a. Define leadership and explain seven habits of effective people. **(08 Marks)**
b. What is strategic planning? Enumerate the steps to strategic planning. **(08 Marks)**
c. With an example, explain the vision and mission statements. **(04 Marks)**

4 a. What is quality cost? Write and explain its categories and elements. **(10 Marks)**
b. Explain reactive and proactive improvement with its standard steps and 7 tools of quality. **(10 Marks)**

PART – B

5 a. What is KAIZEN? Explain the usefulness of Kaizen in continuous improvement of an organization. **(08 Marks)**
b. Define benchmarking and write the process involved in benchmarking. **(08 Marks)**
c. Explain Poka – Yoke with an example. **(04 Marks)**

6 a. What is QFD? How it is useful when a new product is developed? **(08 Marks)**
b. What is meant by FMEA? Write the four main stages of FMEA. **(08 Marks)**
c. Explain in brief quality by design. **(04 Marks)**

7 a. Explain the steps that are necessary to implement a quality management system. **(10 Marks)**
b. What is documentation? Explain the system documentation containing 4 tiers with a pyramid. **(10 Marks)**

8 Write short notes on :
a. Six sigma quality standard
b. 5 S of Japanese management
c. Acceptance sampling
d. OC curve for an ideal situation. **(20 Marks)**

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06ME761

Seventh Semester B.E. Degree Examination, June 2012
Experimental Stress Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the working of Tuckerman optical gauge using a schematic diagram for the measurement of static strains. **(06 Marks)**

b. Derive an expression for gauge factor for an electrical resistance strain gauge. **(08 Marks)**

c. With neat sketches, explain any two types of metal resistance gauges. **(06 Marks)**

2 a. With circuit diagrams, explain the different methods of balancing of DC resistance bridge. **(10 Marks)**

b. Sketch and explain the method of calibration of strain measuring system. **(10 Marks)**

3 a. With a neat sketch, explain the production of plane polarized light by using Nicol's Prism. **(05 Marks)**

b. The following readings of strain were obtained on a three element delta rosette mounted on steel structure for which E = 200 GPa, Poisson's ratio $\gamma = 0.33$. In an experiment, it is found: $\hat{\epsilon}_A = 500$ μm/m , $\hat{\epsilon}_B = -250$ μm/m and $\hat{\epsilon}_C = 250$ μm/m and Gauge factor, Poisson's ratio and cross sensitivity are 2, 0.285 and 0.06 respectively for the gauge material. Determine : i) Actual strains ; ii) Principal strains and iii) Principal stresses and their directions. **(15 Marks)**

4 a. Derive an absolute and relative phase differences of two vibrating components coming out of photo elastic model in plane polariscope and also draw the optical arrangements. **(10 Marks)**

b. Briefly explain the methods of production of dark and light fields with suitable optical arrangements in circular polariscope. **(08 Marks)**

c. Define Quarter wave plate and half wave plate. **(02 Marks)**

PART – B

5 a. Derive stress-optic law relations in two-dimensional photoelasticity. **(05 Marks)**

b. Explain with a neat sketch, the procedure for measurement of fractional fringe order by Babinet – Soleil compensator method of compensation. **(10 Marks)**

c. Give a physical interpretation of formation of an isoclinic and isochromatics in a plane polariscope interposed with a two-dimensional model under condition of plane stress. **(05 Marks)**

6 a. What are the properties of an ideal photo elastic material? Explain briefly. **(06 Marks)**

b. Explain with a neat sketch any one method for calibration of photoelastic model material. **(08 Marks)**

c. Explain the casting techniques of photo elastic models. **(06 Marks)**

7 a. Explain with sketches geometric approach for uniform strain field under combined normal and shear strain. **(10 Marks)**

b. Derive an equation to prove that the difference in principal stresses in coating is linearly related to the difference in the principal stresses acting on the surface of machine part in birefringent coating method. **(10 Marks)**

8 a. With a neat sketch, explain the process of construction of hologram. **(10 Marks)**

b. Explain with sketches the principles of measurement of strain at a point on the surface of a loaded machine element form the brittle coating technique. **(10 Marks)**

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