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06ME71

Seventh Semester B.E. Degree Examination, June/July 2011
Control Engineering

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. Missing data may be suitably assumed.

PART – A

1 a. With suitable example the explain regulator system and follow-up system. **(06 Marks)**

b. What are the requirements of an ideal control system? Explain them. **(04 Marks)**

c. Discuss, giving equations, the effect of the following controller on the system:
i) Proportional plus derivative controller, ii) Proportional plus Integral controller. **(10 Marks)**

2 a. Obtain the transfer function $\frac{Y_1(S)}{F(S)}$ of the mechanical system shown in Fig. Q2 (a) and draw a schematic diagram of an equivalent electrical circuit using force-voltage analogy. **(12 Marks)**

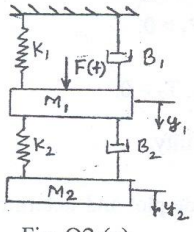

Fig. Q2 (a)

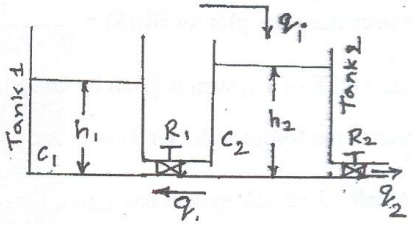

Fig. Q2 (b)

b. Fig. Q2 (b) shows the liquid level system in which q is flow rate, C is hydraulic capacitance, R is hydraulic resistance and h is head of liquid. Obtain the transfer function $\frac{Q_2(S)}{Q_i(S)}$. **(08 Marks)**

3 a. Obtain the closed loop transfer function of the block diagram shown in Fig. Q3 (a).

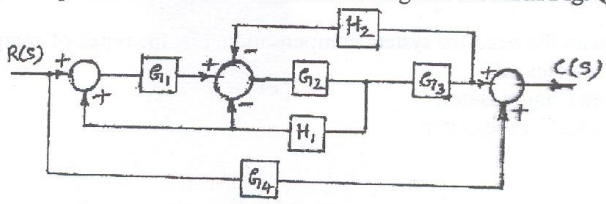

Fig. Q3 (a)

b. For the signal flow graph shown in Fig. Q3 (b), determine C/R using mason's gain formula. **(10 Marks)**

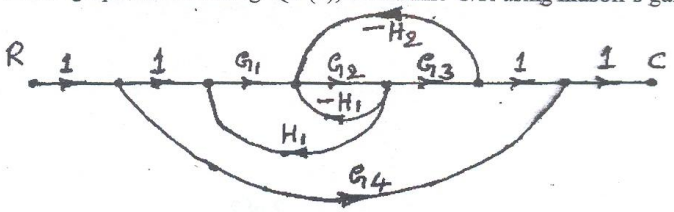

Fig. Q3 (b) **(10 Marks)**

4 a. A second order control system is represented by the differential equation; $\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} = 4 \times x(t)$; $y(o) = \dot{y}(o) = 0$. Obtain its total response for unit step input. **(08 Marks)**

b. When the system shown in Fig. Q4 (b) is subjected to a unit step input, it responds as shown. Determine the value of K and T from the response curve.

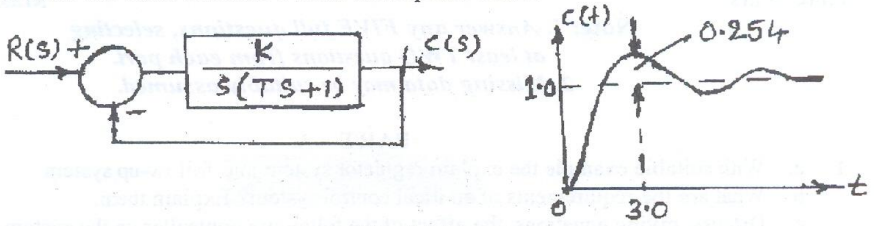

Fig. Q4 (b) **(06 Marks)**

c. The characteristic equation of a system is given by $S^2+6S^3+11S^2+K=0$. Determine the range of K for the system to be stable. Use Routh criterion **(06 Marks)**

PART – B

5 a. Sketch the polar plot for $GH(S) = \frac{1}{(S+P_1)(S+P_2)}$ where $P_1, P_2 > 0$. **(05 Marks)**

b. The OLTF of a system is given by $GH(S) = \frac{K(T_1S+1)}{S^2(T_2S+1)}$; $K, T_1, T_2 > 0$.

Sketch the Nyquist plot for $T_1 < T_2$ and ascertain system stability. **(15 Marks)**

6 A unity feedback system has $G(S) = \frac{K}{S(S+1)(S+10)}$. Draw Bode plot and determine the value of K so that the gain margin of the system is 20db. **(20 Marks)**

7 Draw the root locus plot using guidelines for the OLTF

$G(S)H(S) = \frac{K(S+2)}{S(S^2+2S+2)}$ Discuss stability of the system as a function of K. **(20 Marks)**

8 a. Explain the need for system compensation. List the types of compensators used. **(10 Marks)**

b. Write notes on:

i) Lag Compensator.

ii) Lead Compensator. **(10 Marks)**

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06ME72

Seventh Semester B.E. Degree Examination, June/July 2011
Computer Integrated Manufacturing

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Draw sketches wherever necessary.

PART – A

1 a. Define Automation? Briefly explain with one example each of different types of automation. **(08 Marks)**

b. Explain the following terms related to manufacturing: i) Utilization & Availability. ii) W/P & T/P ratio. iii) Production rate & MLT. **(06 Marks)**

c. The average part produced in a certain batch manufacturing plant must be processed through an average of the machines. There are 20 new batches parts launched each week. Data for the above problem are;
Average operation time : 6min
Average setup time : 5 hours
Average batch size : 25 parts
Average non-operation time per batch : 10 hours
There are 18 machines in the plant. The plant operates an average of 70 production hours per week. Scrap rate is neglizable
i) Determine the manufacturing lead time.
ii) Plant capacity.
iii) Plant utilization. **(06 Marks)**

2 a. Explain the various methods of work part transport in an automated flow line. **(08 Marks)**

b. Explain with sketches the following transfer machines used for the automated flow lines.
i) Linear transfer mechanism. ii) Rotary transfer mechanism. **(12 Marks)**

3 a. Using the lower bound approach analyze the transfer lines without storage and with storage buffers. **(10 Marks)**

b. With suitable assumptions, determine the line performance for the single stage, two stage & three stage cases.

Station	P_i	Station	P_i
1	0.01	9	0.03
2	0.02	10	0.01
3	0.01	11	0.02
4	0.03	12	0.02
5	0.02	13	0.02
6	0.04	14	0.01
7	0.01	15	0.03
8	0.01	16	0.01

(10 Marks)

4 a. With suitable terminology, explain following terms related to line balancing problems.
i) Minimum Rational work element ii) Workstation process time iii) Precedence constraint & diagram iv) Balance delay. **(12 Marks)**

b. Explain with an example, any one method of line balancing. **(08 Marks)**

PART – B

5 a. Explain with sketches, the various elements of a parts delivery system. **(10 Marks)**

b. Analyse the multi station assembly machine with suitable assumption and parameters. **(06 Marks)**

c. Explain briefly i) The vehicle guidance and routing system. ii) traffic control & safety related to automated guided vehicles(AVG's). **(04 Marks)**

6 a. Explain the following two approaches designed for the computer aided process planning system i) Retrieval CAPP system. ii) Generative CAPP system. **(12 Marks)**

b. What is a material requirement planning? Explain the various inputs to the MRP system. **(08 Marks)**

7 a. Explain with a block diagram, the general configuration of a computer numerical control system (CNC). **(10 Marks)**

b. Explain the fundamental steps involved in development of part programming for milling and turning. **(10 Marks)**

8 a. Explain with sketches, the common robot configurations. **(10 Marks)**

b. Explain the different methods of programming a robot. **(08 Marks)**

c. List the various types of sensors used for the robot? **(02 Marks)**

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06ME752

Seventh Semester B.E. Degree Examination, June/July 2011
Theory of Plasticity

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 terms with suitable sketches. i) Octahedral stresses. ii) Stress- transformation. **(08 Marks)**

b. The stress tensor at a point is given by the following array in x, y, z co-ordinate system,

$$\sigma_{ij}^{T} = \begin{bmatrix} 100 & 50 & -100 \\ 50 & 200 & -150 \\ -100 & -150 & 60 \end{bmatrix} \text{N/mm}^2$$

Determine i) Representative stress. ii) Spherical & Deviator stress tensors. iii) Cubic stress invariant. **(12 Marks)**

2 a. What is the mechanism of plastic deformation in metals? Explain your answer with special emphasis on slip and twinning. **(10 Marks)**

b. Discuss the following with neat sketches: i) Luder's lines. ii) Strain hardening. **(10 Marks)**

3 a. Explain representative strain and cubic dilation. **(04 Marks)**

b. Derive the expression for the true stress & strain. **(04 Marks)**

c. At a point in a body the components of strain tensor are $\epsilon_x = 0.01$, $\epsilon_y = -0.005$, $\epsilon_z = 0.005$, $\gamma_{xy} = 0.03$, $\gamma_{yz} = 0.01$, $\gamma_{xz} = -0.008$, Determine i) Octahedral normal strain. ii) Octahedral shear strain. iii) Hydrostatic & distortion strain tensor. **(12 Marks)**

4 a. Discuss any five empirical equations used to represent the stress-strain curves for materials. Give their limitations. **(10 Marks)**

b. Write a short note on the following: i) Concept of Plastic potential. ii) The maximum work Hypothesis. **(10 Marks)**

PART – B

5 a. Explain Taylor and Quinney's experiments in support of yield criteria. What are the important conclusions to be drawn from these experiments? **(08 Marks)**

b. A steel bolt is subjected to a bending moment of 200 N-m and a torque of 120 N-m. If the yield stress in tension for the bolt material is 250 MN/m^2, Determine the diameter of the bolt, according to i) Tresca yield criteria. ii) Von-mises yield criteria. **(12 Marks)**

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

b. State and prove Hencky's first theorem. **(08 Marks)**

c. Explain secant method for construction of slip-line nets. **(06 Marks)**

7 a. A rectangular beam 50mm wide and 80mm deep is 2000mm long. Determine the value of concentrated load applied at the mid span with simply supported ends for the following conditions: i) At the outer shell up to 22mm depth yields. ii) Fully yielded. Assume the yield strength for the beam as 270N/mm^2 and linear stress-strain curve. **(08 Marks)**

b. Derive the expression for the bending stresses in a beam having stress-strain curve of the form $\sigma = (E \epsilon)^{1/m}$. **(07 Marks)**

c. A cantilever beam 120mm wide, 150mm deep is 5m long and is subjected to an end load of 6250N. If the stress-strain curve for the beam material is given by $\sigma = 6820\ \epsilon^{0.25}$, Determine the maximum stress induced in the beam. **(05 Marks)**

8 a. Derive the expression for tension of a circular bar in a elastic-perfectly-plastic materials under incipient yielding, elastic-plastic and fully plastic cases. **(12 Marks)**

b. A hollow circular shaft of inner radius 50mm and outer radius 100mm is subjected to a twisting couple of 5000N-m. If the shear stress-strain diagram for the material is given by $\tau = 350\gamma^{0.3}$ determine the maximum shear stress induced in the shaft and the angle of twist per unit length. **(08 Marks)**

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06ME761

Seventh Semester B.E. Degree Examination, June/July 2011
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. Mention any three properties of an ideal strain gauge material and explain with neat diagram the working of 'Martens optical strain gauge'. **(10 Marks)**

b. Define 'gauge factor' and derive the equation to determine the same for an electrical resistance strain gauge. **(10 Marks)**

2 a. Using 'wheat stone' bridge with load resistance explain the error due to input impedance of the measuring instrument. **(10 Marks)**

b. What do you infer by 'multiple strain gauges'? Explain with neat sketch the method of switching active gauges individually. **(10 Marks)**

3 a. Explain the following with relevant sketches :
i) Rectangular rosette.
ii) Delta rosette
iii) Two element rosette. **(10 Marks)**

b. A rectangular rosette is mounted on a steel plate having modulus of elasticity E = 200 GPa, Poisson's ratio = 0.3. The strains measured are $\epsilon_1 = 500 \times 10^{-6}$, $\epsilon_2 = 400 \times 10^{-6}$ and $\epsilon_3 = -100 \times 10^{-6}$. Calculate the principal strains and stresses, max shear stress and the orientation angle for the principal axis of the stress. **(10 Marks)**

4 a. Define the 'polarization of light' and explain the method for production of 'plane polarized light'. **(10 Marks)**

b. Explain the effect caused, when light is passed through a crystalline medium. **(10 Marks)**

PART – B

5 a. Explain with neat diagram 'circular polariscope' for dark field arrangement with stressed photo elastic model. **(10 Marks)**

b. Establish the stress optic relation for a two dimensional photoelasticity. **(10 Marks)**

6 a. Explain the method of calibration of an ideal photoelastic material using a circular disc, under diametral compression. **(10 Marks)**

b. Describe with a neat sketch 'machining of a photoelastic casting'. **(10 Marks)**

7 a. With a neat diagram explain the 'reflection polariscope'. **(10 Marks)**

b. Explain 'moire phenomenon' with a neat diagram and the geometric approach of moiré fringe analysis for pure extension with no rotation. **(10 Marks)**

8 a. Explain with diagrams the steps involved in a typical brittle coating application. **(10 Marks)**

b. Draw schematic representation of holographic set up explain recording and reconstruction process of images in 'holography'. **(10 Marks)**

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