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06ME71

Seventh Semester B.E. Degree Examination, Dec.09/Jan.10
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 open loop and closed loop control systems, with block diagrams. What are the advantages and disadvantages of a closed loop system over an open loop system? **(10 Marks)**

b. What are the requirements of a control system? Briefly explain. **(05 Marks)**

c. Draw the block diagram of proportional integral controller and explain. **(05 Marks)**

2 a. Obtain the differential equations for the mechanical system shown in Fig.2(a). **(10 Marks)**

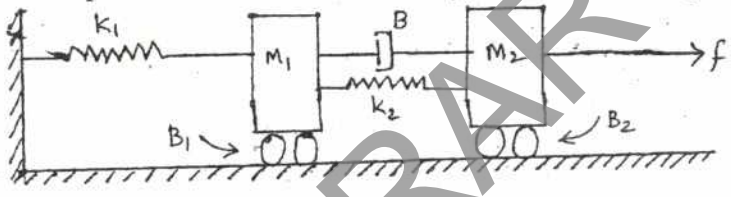

Fig.2(a)

b. A thermometer is dipped in a vessel containing liquid at a constant temperature of $\theta_i(t)$. The thermometer has a thermal capacitance for storing heat as C and thermal resistance to limit heat flow as R. If the temperature indicated by the thermometer is $\theta_o(t)$, obtain the transfer function of the system. **(10 Marks)**

3 a. Reduce the block diagram shown in Fig.3(a) to its simplest possible form and find its closed loop transfer function. **(10 Marks)**

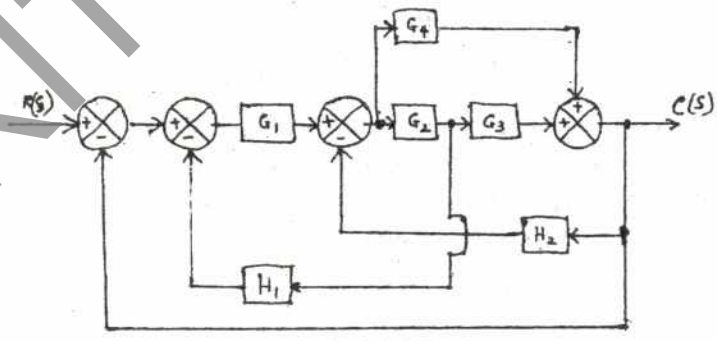

Fig.3(a)

b. For the system shown in Fig.3(b) determine $\frac{C(s)}{R(s)}$ using Mason's gain formula. **(10 Marks)**

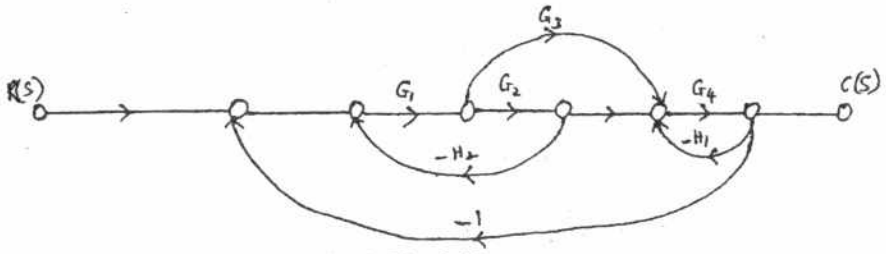

Fig.3(b).

4 a. Aunity feedback system is characterized by an open loop transfer function $G(S) = \frac{10}{S^2 + 5S + 6}$

Determine the following, when the system is subjected to a unit step input.

i) Undamped natural frequency
ii) Dampimg ratio
iii) Peak overshoot
iv) Peak time
v) Setting time. **(12 Marks)**

b. Ascertain the stability of the system given by the characteristic equation, $S^6 + 3S^5 + 5S^4 + 9S^3 + 8S^2 + 6S + 4 = 0$, by Routh Hurwitz criterion. **(08 Marks)**

PART – B

5 a. Sketch the polar plot for the transfer function $G(S) = \frac{10}{S(S+1)(S+2)}$. **(08 Marks)**

b. Apply Nyquist stability criterion to the system with transfer function $G(s)H(s) = \frac{4S+1}{S^2(1+S)(1+2S)}$ and ascertain its stability. **(12 Marks)**

6 Sketch the Bode plot for $G(s)H(s) = \frac{2}{S(S+1)(1+0.2S)}$. Also obtain gain margin and phase margin and crossover frequencies. **(20 Marks)**

7 Sketch the root locus plot for the system, whose open loop transfer function is given by $G(s)H(s) = \frac{K}{S(S+2)(S^2+8S+20)}$. **(20 Marks)**

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

b. Explain the following systems, with block diagrams.

i) Series compensated system
ii) Feedback compensated system. **(10 Marks)**

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06ME72

Seventh Semester B.E. Degree Examination, Dec.09/Jan.10
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 neat sketches wherever necessary.

PART – A

1 a. Define automation. Explain different types of automation systems. **(10 Marks)**

b. The average part produced in a certain batch manufacturing plant must be processed through an average of six machines. There are 20 new batches of parts launched each week. Other pertinent data are as follows.

Average	operation time	= 6 mins
Average	set up time	= 5 hrs
Average	batch size	= 25 parts
Average	non-operation time/batch	= 10 hrs.

There are 18 machines in the plant. The plant operates an average of 70 production hrs/week.

i) Determine the manufacturing lead time for an average part.
ii) Determine the plant capacity
iii) Determine the plant utilization. **(10 Marks)**

2 a. What do you understand by an automated flow line? Explain it with the help of a neat sketch and also list the objectives of automated flow line. **(10 Marks)**

b. Explain the following transfer mechanisms in automated flow the system.
i) Walking beam transfer bar system
ii) Geneva mechanism. **(10 Marks)**

3 a. With examples, explain upper bound and lower bound approaches to analyze automated flow line without storage buffer. **(08 Marks)**

b. The following data applies to a 12 station in-line transfer machine.
P = 0.01 (all stations have an equal probability of failure)
T_c = 0.3 min
T_d = 3 min.
Using upper bound and lower bound approaches, compute the following:
i) Frequency of line stops/cycle
ii) Average production rate
iii) Line efficiency. **(08 Marks)**

c. Explain briefly, partial automation in a flow line. **(04 Marks)**

4 a. Explain the following terms in line balancing:
i) Minimum rational work element
ii) Total work content
iii) Cycle time
iv) Balance delay. **(08 Marks)**

b. The following data gives the precedence relationship and element times for a new product.

Element	te (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 largest candidate rule method,

i) Construct the precedence diagram for this job

ii) If the ideal cycle time is to be 1.5 min, what is the minimum number of workstations required?

iii) Calculate the balance delay. **(12 Marks)**

PART – B

5 a. Explain with neat sketches, the in-line and dial (rotary) type of automated assembly systems. **(10 Marks)**

b. What is an automated guided vehicle system? Explain the principle of working of an AGVS. Also list the applications of AGVS. **(10 Marks)**

6 a. With a neat sketch, explain retrieval type of CAPP system. **(10 Marks)**

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

7 a. Explain the salient features of horizontal and vertical axis machining centre and list their applications. **(10 Marks)**

b. Prepare the manual part program for CNC machining of a slot and holes in a mild steel plate, a shown in Fig.7(b). Assume suitable data for machining parameters and toolings. Indicate the datum and meanings of G and M codes used in the program. **(10 Marks)**

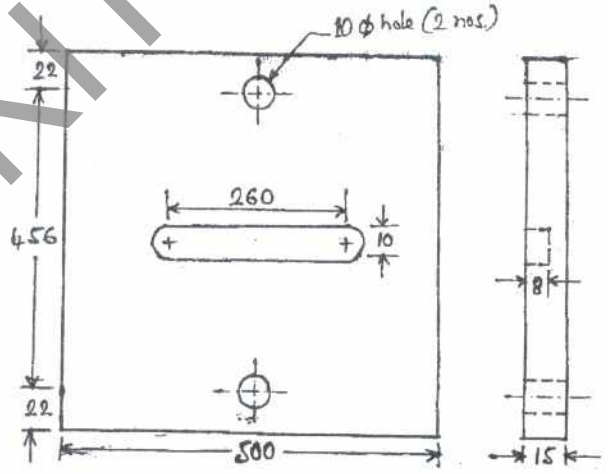

Fig.7(b) All dimensions in mm.

8 a. With neat sketches, explain the four basic configurations of industrial robots. **(12 Marks)**

b. Describe 'end effectors' and 'sensors' with respect to robots. **(08 Marks)**

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06ME73

Seventh Semester B.E. Degree Examination, Dec.09-Jan.10
Manufacturing Process - III

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. Explain the salient features of metal forming processes along with the advantages and limitations. **(10 Marks)**

b. Explain the concept of true stress and true strain. **(05 Marks)**

c. Write a note on determination of flow stress. **(05 Marks)**

2 a. Explain the effect of the following on metal working processes : i) Temperature ii) Friction and lubrication. **(10 Marks)**

b. Comment on i) Deformation zone geometry ii) Residual stresses in wrought products. **(10 Marks)**

3 a. A circular disc of diameter 120mm and height 64mm is forged between two flat dies to 36mm height. Find the die load at the end of compression using the slab method of analysis. The yield strength of the material is given by $\sigma = 15.00(0.01+ \varepsilon)^{0.41}$ kgf/mm^2, and the coefficient of friction is 0.05. Also find mean die pressure. **(08 Marks)**

b. Explain die design parameters in forging. **(06 Marks)**

c. What is the significance of slab analysis? Explain the steps involved in it. **(06 Marks)**

4 a. A 300mm wide aluminium alloy strip is hot rolled in thickness from 20 to 15mm. The rolls are 1m diameter and operate at 100 rpm. The rolling load is 2.36MN. Find the power required for this hot reduction. **(04 Marks)**

b. Calculate the rolling load if steel sheet is hot rolled 30% from a 40mm thick slab using a 900mm diameter roll. The slab is 760mm wide. Assume $\mu = 0.30$. The plane strain flow stress is 140 MPa at the entrance and 200MPa at the exit from the roll gap due to increasing velocity. Also find the rolling torque. **(10 Marks)**

c. Explain the following : i) Planetary rolling mill ii) Defects in rolling. **(06 Marks)**

PART - B

5 a. Derive an expression for drawing load. **(07 Marks)**

b. Write a note on 'Estimation of redundant work'. **(03 Marks)**

c. Briefly explain, optimal cone angle and dead zone formation in drawing. **(04 Marks)**

d. Find the drawing stress to produce 20% reduction in a 10mm diameter steel wire. The flow stress is given by $\sigma_0 = 1300\ \varepsilon^{0.30}$ MPa. The die angle is 12^0 and $\mu = 0.09$. **(06 Marks)**

6 a. Give the classification of extrusion processes and explain hydrostatic extrusion process with a neat sketch. **(08 Marks)**

b. Explain the following : i) Defects in extrusion ii) Lubrication in extrusion. **(12 Marks)**

7 a. Give the classification of dies in sheet metal forming and explain 'combination dies' with neat sketch. **(07 Marks)**

b. Explain with neat sketches the following : i) Rubber forming ii) Stretch forming. **(08 Marks)**

c. Write a note on forming limit criteria. **(05 Marks)**

8 a. Discuss the principle of 'High Energy Rate Forming' methods and with a sketch, explain explosive forming. **(10 Marks)**

b. With a flow chart, explain in detail the powder metallurgy process. **(10 Marks)**

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06ME74

Seventh Semester B.E. Degree Examination, Dec.09-Jan.10
Operations Research

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, choosing atleast TWO questions from each Part.***
2. ***Use of Normal distribution tables is permitted.***

PART - A

1 a. State the assumptions made in LPP and explain in brief any one of them. **(04 Marks)**

b. A softdrink bottling plant has two machines A and B. Though machines A and B are designed for bottling 8 – ounce and 16 – ounce respectively, each machine can be used on both types with some loss of efficiency. The following data is available :

Machine	8 – ounce bottles	16 – ounce bottles
A	100 / minute	40 / minute
B	60 / minute	75 / minute

Each machine can be run 8 – hour per day, 5 days per week. Profit on each 8 – ounce bottle is Rs 0.50 and that on 16 – ounce bottle is Rs 0.8. Weekly production of the drink cannot exceed 3,00,000 ounces and the market can absorb 25,000 eight – ounce bottles and 7,000 sixteen – ounce bottles per week. The production planner of the bottling plant wishes to plan the production for maximization of profit. Formulate the problem as LPP. **(10 Marks)**

c. Solution space identified by a set of constraints is shown in fig. Q1(c). If one more constraint $x_1 + x_2 \geq 3$ is to be included, then is there any change in the solution space? If so, show the new feasible zone. With respect to the new feasible zone, state the redundant constraint or constraints if there any any. **(06 Marks)**

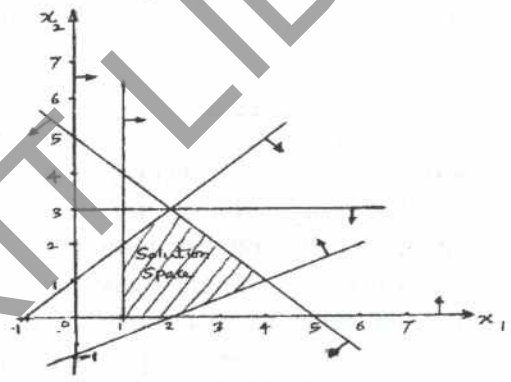

Fig.Q1(c)

2 a. Find the optimum value of Z for the following LPP by inspecting its dual only.
Min $Z = 4x_1 + 5x_2 + 3x_3 + 4x_4$.
Such that $2x_1 + 6x_2 + 3x_3 + 4x_4 \geq 50$ and $x_1, x_2, x_3, x_4 \geq 0$. **(05 Marks)**

b. With reference to the solution of LPP by simplex method / table when do you conclude as follows : i) LPP has no limit for the improvement of the objective function ii) LPP has no feasible solution. **(05 Marks)**

c. Solve the following LPP by Dual simplex method.
Min $Z = 3x_1 + 2x_2$.
Subject to $3x_1 + x_2 \geq 3$
$4x_1 + 3x_2 \geq 6$
$x_1 + x_2 \leq 3$.
$x_1, x_2 \geq 0$. **(10 Marks)**

3 A problem of scheduling the weekly production of certain items for the next four weeks is to be solved. The production cost of the item is Rs 10 for the first two weeks and Rs 15 for the last two weeks. The weekly demands are 500, 800, 1000 and 900, which must be met. The plant can produce a maximum of 700 units per week. In addition, the company can use overtime during second and third week. This increases the weekly production by an additional 200 units, but the production cost increases by Rs 5. Excess production can be stored at a unit cost of Rs 3 per week. How should the production be scheduled so as to minimize the total cost? **(20 Marks)**

4 a. A University examination panel has five examiners. The examiners are to be assigned to two practical examinations, two each for each practical exam. University desires to assign examiners such that the total distance traveled by all the examiners is minimum. The distance each examiner would have to travel to each practical examination centre are given below. Solve the problem. **(10 Marks)**

		Examiner				
		E1	E2	E3	E4	E5
Practicals	A	20	40	60	20	70
	B	45	90	70	60	15

b. It is required to process the following jobs (two jobs) on various machines shown below :

Job I	Sequence	A	B	C	D	E
	Time (in hrs)	7	9	5	13	5

(10 Marks)

Job II	Sequence	B	C	A	D	E
	Time (in hrs)	11	9	7	5	13

Find for each machine which job should be done first and calculate the total elapsed time.

PART - B

5 a. What is service discipline? State various disciplines with examples. **(06 Marks)**

b. Patrons arrive at a reception counter at an average inter arrival time of 2 minutes. The receptionist on duty takes an average of one minute per person. (Arrivals are as per Exponential and Services are as per Poisson distribution).

i) What is the chance that a patron will straight away meet the receptionist? ii) For what portion of time the receptionist is busy? iii) What is the average queue length? iv) What is the average number of patrons in the system? v) What is the average waiting time of a patron? vi) What average time a patron spends in the system? vii) Suppose management wants to keep a second receptionist when the average waiting time of an arrival exceeds 1.5 minutes. Find what should be the inter – arrival time to justify a second receptionist? **(14 Marks)**

6 a. Time estimates for a particular activity are provided by two engineers A and B as follows :

Engineer	Optimistic time	Most likely time	Pessimistic time
A	3	6	7
B	4	5	9

State who is more certain about his estimation. **(05 Marks)**

b. A project is expected to take 12 months with a standard deviation of 4 months. What is the probability of completing the project within i) 10 months ii) 16 months? **(05 Marks)**

c. The utility data for a network is given below :

Activity	Normal		Crash	
	Time (days)	Cost (Rs)	Time (days)	Cost (Rs)
1 - 2	8	100	6	200
1 – 3	4	150	2	350
2 – 4	2	50	1	90
3 – 4	5	100	1	200

Indirect cost : Rs 100 per day. Crash systematically and determine the optimum project duration and cost. **(10 Marks)**

7 a. In a game of matching coins, Player 'A' wins Rs 8, if both coins show heads and Rs 1 if both are tails. Player B wins Rs 3 when coins do not match. Given the choice of being Player A or Player B, which would you choose and what would be your strategy? **(10 Marks)**

b. Solve the following game : **(10 Marks)**

		B			
		I	II	III	IV
A	1	20	15	12	35
	2	25	14	8	10
	3	40	2	19	5
	4	5	4	11	0

8 a. Write a short note on 'Solution methods of integer programming'. **(08 Marks)**

b. Solve the following :

Max. $Z = 5x_1 + 4x_2$.

Subject to $x_1 + x_2 \leq 5$

$10x_1 + 6x_2 \leq 45$

$x_1, x_2 \geq 0$ and integer. **(12 Marks)**

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06ME754

Seventh Semester B.E. Degree Examination, Dec.09/Jan.10
Solar Energy

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least TWO questions from each part.*
2. Draw neat diagram.
3. Use of charts and heat transfer data book permitted.

PART – A

1 a. What is meant by renewable energy sources? Explain in brief these energy sources with special reference to Indian context. **(08 Marks)**

b. Explain the following:
i) The sun
ii) Solar spectrum
iii) Spectral solar impedance. **(12 Marks)**

2 a. Sketch and explain the working of pyrheliometer and sunshine recorder. **(14 Marks)**

b. Define beam, diffuse and global radiation. **(06 Marks)**

3 a. Define the following:
i) Declination angle
ii) Hour angle
iii) Local apparent time
iv) Surface azimuth angle
v) Average daily global radiation. **(10 Marks)**

b. Estimate the average daily global radiation on a horizontal surface at Baroda (22°N, 73°10′E) during the month of March, if the average sunshine is 9.5 hours per day. Assume a = 0.28 and b = 0.48 for Baroda city. **(10 Marks)**

4 a. Sketch and explain cylindrical concentrator. Also explain concentration ratio. **(08 Marks)**

b. Calculate the overall loss coefficient U_l for the receiver of a cylindrical parabolic concentrating collector system. The receiver consists of a selectively – coated absorber tube with one glass cover around it. The following data is given :
Absorber tube inner-diameter 7.5 cm and outer diameter 8.1 cm. Glass cover inner diameter 14.4 cm, outer diameter 15 cm.
Emmissivity of absorber tube surface = 0.15, Emissivity of glas = 0.88, Mean temperature of absorber tube = 170°C, Ambient temperature = 25°C, Wind velocity = 4m/s (attempt in two trials). **(12 Marks)**

PART – B

5 a. What are the major components of a photovoltaic system? Explain with a neat diagram the working of a solar cell. **(10 Marks)**

b. What are the advantages and disadvantages of photovoltaic solar energy conversion? **(10 Marks)**

6 a. Explain :
   i) Bottom loss coefficient and
   ii) Side loss coefficient. **(06 Marks)**

b. Derive an expression for the collector heat removal factor given by: $F_R = \frac{\dot{m}Cp}{U_l A_p}\left[1 - \exp\left\{\frac{-F'U_l A_p}{MCp}\right\}\right]$ with usual notations. **(08 Marks)**

c. Explain transmissivity – absorptivity product in relation to flat plate solar collector covers. **(06 Marks)**

7 a. Write notes on :
   i) Number of covers
   ii) Brightness concentration ratio
   iii) Selective surface
   iv) Intercept factor. **(12 Marks)**

b. Explain the effects of various parameters on the collector's performance. **(08 Marks)**

8 a. Explain the orientation of concentric collectors and various tracking modes in detail. **(08 Marks)**

b. A CPC is mounted on a horizontal east-west axis and oriented with its aperture plane sloping at an angle of 40°. The concentration ratio of the collector is 6.5, the width of its absorber plate is 6 cm and length is 2m. The collector is used for heating a fluid (c_p = 2.35kJ/kgK), which enters at a temperature of 130°C. Calculate the exit temperature of the fluid and the instantaneous collector efficiency for the following situation. Location of the collector – New Delhi (28.58 N); Date: Nov 5; time: 1100 h (LAT); I_g : 0735 kW/m^2; I_d : 0.162 kW/m^2; No of tubes: 02; tube outer diameter: 18mm; Tube inner diameter : 14 mm; Transmissivity of glass cover : 0.89; Reffectivity of concentrator : 0.87; Absorptivity of absorber surface: 0.94; Heat transfer coefficient on inside of absorber tube: 230 W/m^{2}K overall loss coefficient = 10.5 W/m^{2}K; Mass flow rate of fluid: 1.25 kg/min; Ambient temperature = 21°C. **(12 Marks)**

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06ME762

Seventh Semester B.E. Degree Examination, Dec.09/Jan.10
Engineering System Design

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 and clearly stated.

PART – A

1 a. What is designing? Explain design by evolution with an example. **(10 Marks)**
b. With the flow diagram, explain morphology of design. **(10 Marks)**

2 a. Explain the preliminary need statement. **(04 Marks)**
b. Write at least one need statement for
i) Satellite and
ii) Photocopying machine. **(04 Marks)**
c. Explain the four important factors to be considered during analysis of need. **(12 Marks)**

3 a. What is creativity? Explain the creative process by considering five step-by-step orderly process. **(10 Marks)**
b. What is morphological analysis? Conduct morphological analysis of a kerosene stove for kitchen. **(10 Marks)**

4 a. Describe the five different stages in preliminary design. **(10 Marks)**
b. Explain the concept if tolerance and standardization, with an example, in detailed design. **(10 Marks)**

PART – B

5 a. Explain the concept of utility, with an example. **(04 Marks)**
b. A company produces four different designs of pens. Their performance is summarized as follows:

Performance parameter→ Design ↓	Writing time between refills (in minutes)	Nib life (in months)	Cost in Rs.	Writing pressure
A	35	24	10	0.30
B	15	30	08	0.20
C	65	20	20	0.40
D	30	18	12	025
Minimum acceptable value	10	15	20	0.20

Assign proper weights to the quality dimensions and determine which design gives the maximum utility. **(16 Marks)**

6 a. Explain bath tub curve with the sketch. **(04 Marks)**

b. Determine the reliability of an equipment having an operating period of 40 hours and MTBF of 60 hours. If the reliability has to be improved by 25%, what percentage charge in MTBF is required? **(08 Marks)**

c. Calculate the reliability of the system shown in Fig.6(c).

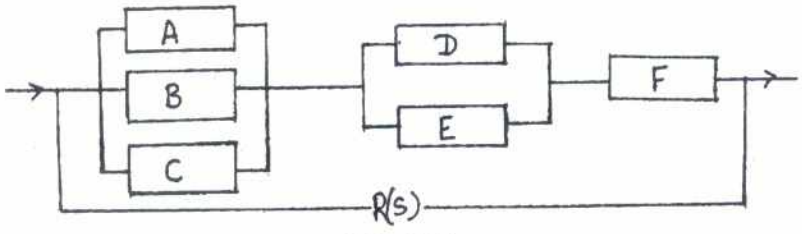

Fig.6(c).

R(A) = 0.75 R(B) = 0.68 R(C) = 0.82 R(D) = 0.91 R(E) = 0.87 R(F) = 0.89.

(08 Marks)

7 a. Describe with a sketch the components of break even analysis. **(04 Marks)**

b. Explain fixed costs and variable costs. **(06 Marks)**

c. Products P and Q which serve as food for cattle in different amounts of nutritive ingredients N_1 and N_2, are to be provided to cattle in certain specified quantity. The products also contain an ingredient N_3 which is harmful, if present in excessive quantity. The following table gives the data.

Ingredient	Amount present in product		Minimum or maximum amount needed in units
	P	Q	
N_1	9	3	45 minimum
N_2	1	4	16 minimum
N_3	2	2	20 maximum

If the prices of P and Q per unit are Rs.20/- and Rs.40/- respectively; find the optimum product mix of the food with prescribed ingredient contents using graphical method.

(10 Marks)

8 a. With the sketch, explain man – machine interaction cycle. **(08 Marks)**

b. Explain any three purposes of display in designing a machine. **(06 Marks)**

c. Explain three essential things for the proper design of controls. **(06 Marks)**

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