Eighth Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Explain briefly the requirements of a control system. **(04 Marks)**
　　b. Explain the types of feedback control systems with examples. **(10 Marks)**
　　c. Identify and explain the salient features of a controller that corrects the error to zero.
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(06 Marks)

2　a. Derive the transfer function for the hydraulic system shown in Fig. Q2 (a). **(10 Marks)**
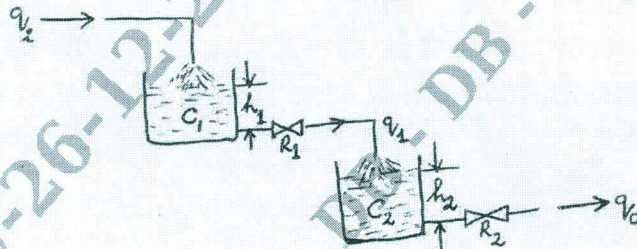

Fig. Q2 (a)

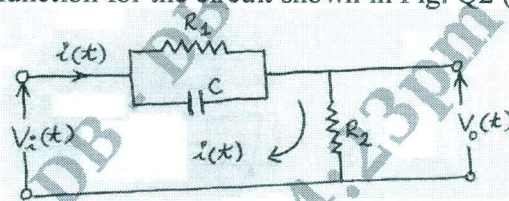　　b. Derive the transfer function for the circuit shown in Fig. Q2 (b). **(10 Marks)**

Fig. Q2 (b)

3　a. Determine $\dfrac{C(s)}{R(s)}$ for the block diagram, shown in Fig. Q3 (a) by using block diagram reduction rules? **(08 Marks)**
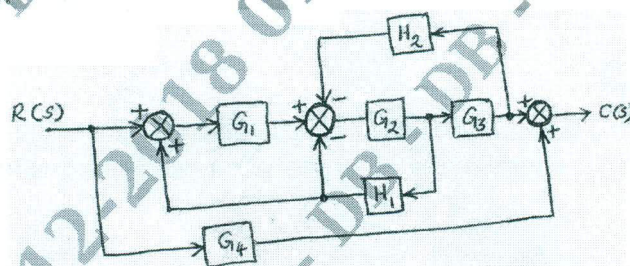

Fig. Q3 (a)

　　b. Determine $\dfrac{C(s)}{R(s)}$ for the signal flow graph shown in Fig. Q3 (b), using Mason's Gain formula. **(12 Marks)**
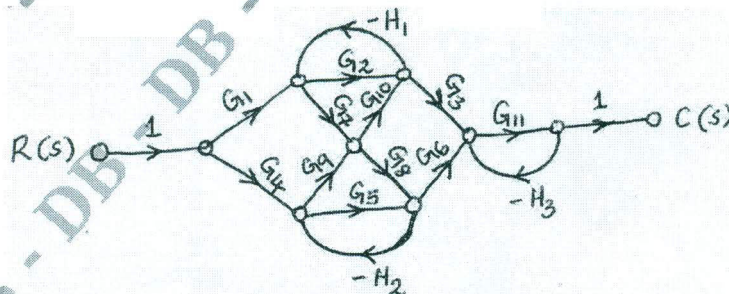

Fig. Q3 (b)

4   a. Determine the expression for the response of the system shown in Fig. Q4 (a) to a ramp input $\theta_i = Kt$. Assume a critically damped system initially at rest. Sketch input versus time and output versus time curves. **(10 Marks)**
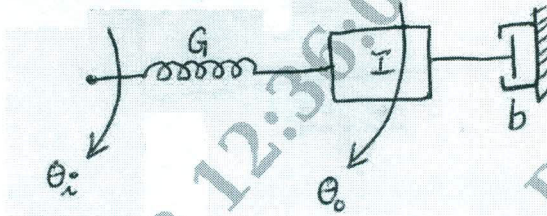

Fig. Q4 (a)

b. Determine the number of roots in left half plane, right half plane and on the imaginary axis for the characteristic equation $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$ by Routh-Hurwitz criterion. **(10 Marks)**

PART – B

5   a. Explain Gain margin and phase margin using a polar plot. **(05 Marks)**

b. Plot Nyquist diagram and ascertain the stability of the control system for the given open loop transfer function $G(s)H(s) = \dfrac{100}{s^3 + 8s^2 + 25s + 26}$. **(15 Marks)**

6   Draw Bode asymptotic attenuation and phase angle diagrams for a system with the open loop transfer function, $G(s)H(s) = \dfrac{25(s+2)}{s^2 + 10.5s + 5}$ and establish the nature of stability. **(20 Marks)**

7   For the control system shown in Fig. Q7, draw the Root Locus diagram and comment on the nature of stability of the system. **(20 Marks)**
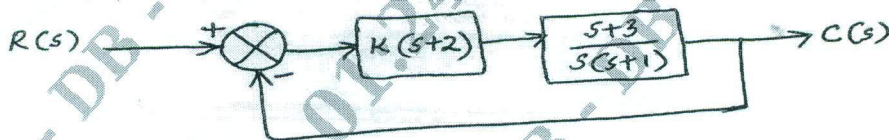
Fig. Q7

8   a. Explain the different types of feedback compensation with neat block diagrams. **(06 Marks)**

b. Determine the controllability property of control system with state equation,

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(t)$$

by (i) Kalman's test
   (ii) Gilbert's test. **(14 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐ **10ME833**

Eighth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Power Plant Engineering

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain with neat sketch working of spreader stroker. **(07 Marks)**
   b. Explain the working of unit system and bin system. **(08 Marks)**
   c. Sketch: i) Turbulent burner   ii) Tangential burner. **(05 Marks)**

2 a. Explain the working of Ball and Race mill. **(08 Marks)**
   b. Explain the working of Lamont boiler. **(06 Marks)**
   c. Explain working of electrostatic precipitator. **(06 Marks)**

3 a. Derive $h = 353H\left[\dfrac{1}{T_a} - \dfrac{m+1}{m} \times \dfrac{1}{T_g}\right]$ where h draught interms of water column in mm H is

   Chimney height in m is mass of air per kg of fuel T_a – Temp. of atmosphere T_g is flue gas temperature. **(10 Marks)**
   b. Explain direct dry cooling tower. **(05 Marks)**
   c. Explain cooling pond. **(05 Marks)**

4 a. Mention the applications of diesel engines in power field. **(05 Marks)**
   b. Draw the schematic of diesel engine power plant with clear labeling. **(08 Marks)**
   c. Explain Thermosiphon cooling. **(07 Marks)**

PART – B

5 a. Mention any five factors considered for site selection of hydroelectric plant. **(05 Marks)**
   b. Write the working of surge tanks. **(05 Marks)**
   c. Explain pondage and storage in hydro electric power plants. **(10 Marks)**

6 a. With neat sketch explain the working of Pressurized Water Reactor (PWR). **(10 Marks)**
   b. Explain the working of Boiling Water Reactor (BWR) of external circulation type. **(10 Marks)**

7 a. Explain load duration curves. **(06 Marks)**
   b. Mention the factors considered for construction of thermal power plants. **(04 Marks)**
   c. The peak load on a power plant is 60MW. The loads having maximum demands of 30MW, 20MW, 10MW and 14MW are connected to the power plant. The capacity of the power plant is 80MW and the annual load factor is 0.5. Estimate: i) the average load on power plant; ii) The energy supplied/year; iii) the demand factor; iv) the diversity factor.

   (10 Marks)

8 a. Briefly explain the performance and operating characteristics of power plants. **(08 Marks)**
   b. A generating unit of 10MW capacity supplies the following loads
      i)   Domestic consumers with a maximum demand of 6MW at a load factor of 20%;
      ii) Small industrial load with a max demand of 3.6MW at a load factor of 50%;
      iii) Street-light load with a maximum demand of 400kW at 30% load factor.
      Find the overall cost of energy per kWh for each type of consumer using the following data, capital cost of the plant Rs.1000/kW, total running cost is Rs.3600000/year. Annual rate of interest and depreciation on capital cost = 10%. **(12 Marks)**

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Eighth Semester B.E. Degree Examination, July/August 2021
Operations Research

Time: 3 hrs.　　　　　　　　　　　　　　　　　　　　　　　Max. Marks: 80

Note: Answer any FIVE full questions.

1　a. Define Operation Research. Discuss the scope of Operation Research. **(06 Marks)**
　　b. A firm manufactures 3 products A, B and C. Time to manufacture product A is twice for B and thrice for C and if the entire labour is engaged in making product A, 1600 units of this product can be produced. These products are to be produced in the ratio 3:4:5. There is demand for at least 300, 250 and 200 units of products A, B and C and the profit earned per unit if Rs.90, Rs.40 and Rs.30 respectively. Formulate the problem as a LPP. **(10 Marks)**

2　a. Discuss the assumptions made in LPP. **(06 Marks)**
　　b. Solve the following LPP graphically:
　　Maximize $Z = 2x_1 + 3x_2$
　　Subject to constraints $x_1 + x_2 \le 30$,
　　　　　　　　　　　$x_2 \ge 3$,
　　　　　　　　　　　$x_2 \le 12$,
　　　　　　　　　　　$x_1 - x_2 \ge 0$,
　　　　　　　　　　　$0 \le x_1 \le 20$ **(10 Marks)**

3　a. Explain the significance of following variables in LPP:
　　　i)　Slack variable
　　　ii)　Surplus variable
　　　iii)　Artificial variable. **(06 Marks)**
　　b. Solve by simplex method the following LPP:
　　Minimize $Z = x_1 - 3x_2 + 3x_3$
　　Subject to constraints $3x_1 - x_2 + 2x_3 \le 7$,
　　　　　　　　　　　$2x_1 + 4x_2 \ge -12$,
　　　　　　　　　　　$-4x_1 + 3x_2 + 8x_3 \le 10$,
　　　　　　　　　　　$x_1, x_2, x_3 \ge 0$ **(10 Marks)**

4　a. What is Pseudo-optimal solution? **(06 Marks)**
　　b. Solve the following LPP by Big-M method
　　Maximize $Z = 2x_1 + 3x_2 + 4x_3$
　　Subject to constraint $3x_1 + x_2 + 4x_3 \le 600$,
　　　　　　　　　　　$2x_1 + 4x_2 + 2x_3 \ge 480$,
　　　　　　　　　　　$2x_1 + 3x_2 + 3x_3 = 540$,
　　　　　　　　　　　$x_1, x_2, x_3 \ge 0$ **(10 Marks)**

5 a. Define the following with respect to transportation problem:
   i) Basic feasible solution
   ii) Optimal solution
   iii) Degenerate basic feasible solution. **(06 Marks)**

b. For the following Transportation Problem a solution is given check it for optimality. If not, modify it to obtain a better solution (next best).

	D_1	D_2	D_3	D_4	Available units
S_1	6	1	$9_{(50)}$	$3_{(20)}$	70
S_2	$11_{(55)}$	5	2	8	55
S_3	$10_{(30)}$	$12_{(35)}$	4	$7_{(25)}$	90
Demand units	85	35	50	45	

(10 Marks)

6   The captain of a cricket team has to allot five middle batting positions to 5 batsmen. The average runs scored by each batsman at these positions are as follows:

Batsman	Batting Position				
	I	II	III	IV	V
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

i) Find the assignment of batsman to positions which would give the maximum number of runs.

ii) If another batsman 'U' with the following average runs in batting position as given below:

Battery positions:	I	II	III	IV	V
Average runs scored:	45	52	38	50	49

is added to the team, should he be included to play in the team? If so, who will be replaced by him? **(16 Marks)**

7 a. Define:
   i) Preceding activity
   ii) Dummy activity
   iii) Network
   iv) Slack. **(06 Marks)**

b. Tasks A, B, C,....H, I constitute a project. The precedence relationships are A < D, A < E, B < F, D < F, C < G, C < H, F < I, G < I.

Task:	A	B	C	D	E	F	G	H	I
Time, days :	8	10	8	10	16	17	18	14	9

i) Draw the network
ii) Identify the critical path and duration. **(10 Marks)**

8 a. Discuss the operating characteristics of a queueing system. (06 Marks)

b. A typist at an office of a company receives on the average 20 letters/day for typing. The typist works 8 hours a day and it takes on the average 20 minutes to type a letter. The cost of a letter waiting to be mailed is 80 paise/hr and the cost of the equipment plus salary of the typist is Rs.45 per day.

   i) What is the typists utilization rate?

   ii) What is the average number of letters waiting to be typed?

   iii) What is the average waiting time needed to have a letter typed?

   iv) What is the total daily cost of waiting letters to be mailed. (10 Marks)

9 a. Define:

   i) Strategy

   ii) 2 person zero sum game

   iii) Pay off matrix. (06 Marks)

b. Solve the following game by using principle of dominance:

		Player B					
		I	II	III	IV	V	VI
	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
Player A	3	4	3	7	-5	1	2
	4	4	3	4	-1	2	2
	5	4	3	3	-2	2	2

(10 Marks)

10 a. Discuss any three priority rules of processing n jobs through one machine. (06 Marks)

b. Four jobs 1, 2, 3 and 4 are to be processed on each of the four machines. A, B, C and D in the order ABCD. The processing times in minutes are given in the table below. Find, for no passing the minimum elapsed time and idle time for each machine.

		Machines			
		A	B	C	D
	1	58	14	14	48
Jobs	2	30	10	18	32
	3	28	12	16	44
	4	64	16	12	42

(10 Marks)

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3 of 3

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Eighth Semester B.E. Degree Examination, July/August 2021
Additive Manufacturing

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions.*

1 a. Explain the need for Additive Manufacturing. **(06 Marks)**
   b. Explain with a neat sketch, the working principle , merits and demerits and applications of Discrete Particle Additive Manufacturing System. **(10 Marks)**

2 a. Distinguish between Additive Manufacturing and CNC Machining. **(06 Marks)**
   b. Explain with a neat sketch, the working principle , advantages , disadvantages and applications of Solid Sheet additive manufacturing system. **(10 Marks)**

3 a. Explain with neat sketches, the salient features of DC motors with field coil. **(10 Marks)**
   b. Explain with neat diagrams, the salient features and characteristics of Thyristor and Triac. **(06 Marks)**

4 a. Explain with neat sketches, the working principle of following hydraulic motors :
      i) Vane motor   ii) Gear motor. **(08 Marks)**
   b. Write a note on the following :
      i) Shape memory alloys   ii) Piezo electric actuators. **(08 Marks)**

5 a. Explain the main steps in powder metallurgy. **(08 Marks)**
   b. Explain with neat sketches the following :
      i) Tape casting   ii) Slip casting. **(08 Marks)**

6 a. Explain with a neat sketch, the working principle of polymer processing by wet spinning. What are its advantages and disadvantages? **(08 Marks)**
   b. Explain in detail Liquid Phase Sintering. **(08 Marks)**

7 a. Explain with neat sketches, Top-down and Bottom-up approaches pertaining to Nanotechnology. **(06 Marks)**
   b. Explain with a neat sketch, the working principle, uses and applications of Scanning Electron Microscopy (SEM). **(10 Marks)**

8 a. Explain with a neat sketch, production of Ultrafine powers by Mechanical grinding. **(06 Marks)**
   b. Explain with a neat sketch, the working principle, merits , demerits and application of Atomic Force Microscopy (AFM). **(10 Marks)**

9 a. Explain the various Automation principles and Strategies. **(10 Marks)**
   b. Distinguish between NC, CNC and DNC systems, with neat block diagrams. **(06 Marks)**

10 a. Explain with a block diagram the various levels of Automation.   **(08 Marks)**
    b. Write an NC part program for the part shown in Fig. Q10(b) depicting drilling operation.
        Use the following data :
        Spindle speed = 1000 rpm.
        Feed = 0.05mm/rev.
        Starting point of tool is at X = 0 , Y = -50mm , Z = 10mm.
        Diameter of drill = 7mm.
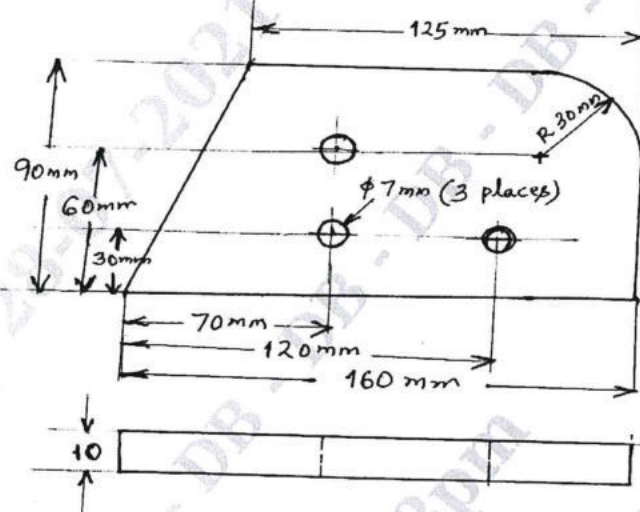   Consider absolute positioning system.   **(08 Marks)**

Fig. Q10(b) : A simple part depicting drilling operation

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Eighth Semester B.E. Degree Examination, July/August 2021
Product Life Cycle Management

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions.

1   a.   Define PLM? Explain the different stages of PLM.   (08 Marks)
    b.   Discuss and explain briefly the components of PLM.   (08 Marks)

2   a.   Discuss and explain the steps involved in product life cycle model with a neat sketch.   (06 Marks)
    b.   Summarize the five step process in implementing the PLM strategy.   (10 Marks)

3   a.   Define Engineering Design? Explain briefly the steps involved in Engineering Design.   (08 Marks)
    b.   Define Product Recycling? Discuss the various benefits of product recycling.   (08 Marks)

4   a.   Discuss and explain briefly the concepts involved in organization and decomposition in product design by considering a suitable example.   (08 Marks)
    b.   Discuss and explain briefly the different guidelines to be followed during design for manufacturing and assembly.   (08 Marks)

5   a.   Explain the benefits of New Product development.   (06 Marks)
    b.   Summarize the steps involved in estimating the market opportunities for a new product.   (10 Marks)

6   a.   Discuss the steps involved in launching of a New Product.   (10 Marks)
    b.   Explain briefly the need and benefits of product redesign.   (06 Marks)

7   a.   Explain briefly the elements of Technology forecasting.   (06 Marks)
    b.   Define Technology forecasting. Explain briefly the methods of technology forecasting.   (10 Marks)

8   a.   Discuss and explain briefly the importance of Relevance tree and mission flow diagram used in technology forecasting.   (08 Marks)
    b.   Explain briefly the methodologies and tools involved in product innovation process.   (08 Marks)

9   a.   Summarize the tools involved in virtual product development.   (08 Marks)
    b.   Illustrate with an example the Generic Product Structure.   (08 Marks)

10   a.   Define product data technology. Explain briefly the different categories of product data technology.   (06 Marks)
    b.   Define Data Model. Explain briefly the different types of data models used in product life cycle management.   (10 Marks)

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Eighth Semester B.E. Degree Examination, July/August 2021
Operations Research

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions.

1   a.   List and explain the phases of operations research.   **(08 Marks)**

    b.   A diet of a sick person must contain atleast 4,000 units of vitamins, 50 units of minerals and 1400 calories. Two foods are available at a cost of Rs.4 and Rs.3 per unit respectively for A and B types. If food A contains 200 units of vitamins, 1 unit of mineral and 40 calories and if food B contains 100 units of vitamins, 2 units of mineral and 40 calories, formulate this problem as LPP model and solve it by graphical method to find the least cost with minimum requirement of the ingredients.   **(12 Marks)**

2   a.   Discuss the scope of operations research.   **(06 Marks)**

    b.   Use graphical method to solve the following LPP.

Maximize $Z = 2x_1 + 3x_2$

Subjected to constraints (i) $x_1 + x_2 \le 30$ (ii) $x_2 \ge 3$ (iii) $0 \le x_2 \le 12$

                      (iv) $0 \le x_1 \le 20$ (v) $x_1 - x_2 \ge 0$; $x_1, x_2 \ge 0$ **(14 Marks)**

3   a.   What is the significance of introducing slack, surplus and artificial variables in LPP?   **(04 Marks)**

    b.   Solve the following LPP by simplex method:

Maximize $Z = 4x_1 + 3x_2$

Subject to constraints (i) $2x_1 + x_2 \le 1000$ (ii) $x_1 + x_2 \le 800$ (iii) $x_1 \le 400$ (iv) $x_2 \le 700$ **(16 Marks)**

4   Solve the given problem using Big M method.

Maximize $Z = -2x_1 - x_2$

Subject to $3x_1 + x_2 = 3$, $4x_1 + 3x_2 \ge 6$, $x_1 + 2x_2 \le 4$, $x_1, x_2 \ge 0$ **(20 Marks)**

5   a.   What is degeneracy in transportation problem? Discuss how it can be overcome.   **(04 Marks)**

    b.   L & T Company needs 3, 3, 4 and 5 million cubic feet of fill at 4 earthen dam sites I, II, III and IV in Karnataka. It can transfer the fill from 3 mounds A, B and C where 2, 6 and 7 million cubic feet of fill is available respectively. Costs of transportation for one million cubic feet of fill from 3 mounds to the 4 sites in lakhs of rupees are given in the table below (Table.Q5(b)). Determine the optimal transportation plan which minimizes cost to company.

		Sites			
		I	II	III	IV
	A	15	10	17	18
Mounds	B	16	13	12	13
	C	12	17	20	11

Table.Q5(b)   **(16 Marks)**

6   a.   What do you understand by a balanced and unbalanced transportation problem? How an unbalanced problem is tackled?   **(06 Marks)**

b. A product is produced by four factories A, B, C and D and their unit production costs in them are Rs.2, 3, 1 and 5 respectively. Their production capacities are factory A – 50 units, B – 70 units, C – 30, D – 50 units. These supply the products to four stores with their demands of 25, 35, 105 and 20 units respectively. Unit transportation cost from each factory to each store is given in Table.Q6(b). Determine the extent of deliveries from each factory to each store, so that total cost of production cum transportation is minimum.

		Stores			
		1	2	3	4
	A	2	4	6	11
Factories	B	10	8	7	5
	C	13	3	9	12
	D	4	6	8	3

Table.Q6(b)

(14 Marks)

7 A small project is composed of activities with their time estimates listed in Table.Q7.
a. Draw project network
b. Find expected duration and variance of each activity and its expected project length
c. What is the probability of completing project:
  (i) Atleast 4 weeks earlier than expected.
  (ii) If project is due in 19 weeks, what is the probability of meeting the due date?

Activity	t_o	t_m	t_p
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8
2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

Table.Q7

(20 Marks)

8 a. State and explain in brief Kendall's notation for representing queing models. (06 Marks)
b. A self service store employs one cashier at its counter. An average of 9 customers arrive every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution of arrival rate and exponential distribution of service rate find:
  (i) Average number of customers in system
  (ii) Average number of customers in queue
  (iii) Average time a customer spends in system
  (iv) Average time a customer waits before being served. (14 Marks)

9 a. Explain the following terms: (i) Pay off matrix   (ii) Saddle point   (iii) Fair game (06 Marks)
b. Use dominance rule to find the optimum strategies for both players.

$$
\begin{array}{c}
\quad\quad B_1 \;\; B_2 \;\; B_3 \;\; B_4 \;\; B_5 \;\; B_6 \\
\begin{array}{c} A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \end{array}
\begin{bmatrix}
4 & 2 & 0 & 2 & 1 & 1 \\
4 & 3 & 1 & 3 & 2 & 2 \\
4 & 3 & 7 & -5 & 1 & 2 \\
4 & 3 & 4 & -1 & 2 & 2 \\
4 & 3 & 3 & -2 & 2 & 2
\end{bmatrix}
\end{array}
$$

(14 Marks)

10 a. State assumptions made while applying Johnson's rule to n jobs on 2 machines. (06 Marks)
b. Use graphical method to minimize the time required to process the jobs. Details of processing time (hrs) and sequence given below:

Job 1:	A – 4, C – 2, D – 6, E – 3, B – 2
Job 2:	C – 8, A – 3, D – 4, B – 2, E – 3

Find sequence of jobs on each machine and total elapsed time for both jobs. (14 Marks)

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Eighth Semester B.E. Degree Examination, July/August 2021
Additive Manufacturing

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions.*

1   a.   Define additive manufacturing. Justify why additive manufacturing is so important in modern days. **(07 Marks)**
    b.   Explain the additive manufacturing process chain. **(06 Marks)**
    c.   Give the detailed classification of AM processes. **(07 Marks)**

2   a.   With a neat sketch, explain the working principle of Stereolithography process. **(08 Marks)**
    b.   Discuss the post processing of AM parts. **(07 Marks)**
    c.   Write the applications of AM parts. **(05 Marks)**

3   a.   Explain the importance of system drives and devices in AM machines. **(06 Marks)**
    b.   With a neat sketch, explain the working of DC electric motor. **(07 Marks)**
    c.   Give the detailed classification of hydraulic and pneumatic motors. **(07 Marks)**

4   Write short notes on :
      i)   Solenoids
      ii)   Diodes and Thyristors
      iii)   Triacs
      iv)   Piezoelectric actuators
      v)   Application of shape memory. **(20 Marks)**

5   a.   Give the detailed classification of polymers. **(04 Marks)**
    b.   Explain the concept of
      i)   Functionality
      ii)   Polydispersity and molecular weight
      iii)   Molecular weight distribution **(06 Marks)**
    c.   Explain with neat sketch :
      i)   Wet Spinning
      ii)   Dry Spinning. **(10 Marks)**

6   a.   Define Powder Metallurgy. Explain the different powder production techniques. **(07 Marks)**
    b.   Explain the importance particle size, and shape distribution, interparticle friction and compression ability on the quality of PM parts. **(08 Marks)**
    c.   Give the detailed applications of powder metallurgy. **(05 Marks)**

7   a.   Explain with relevant sketches
      i) Bottom – up   ii) Top down Approaches of nanotechnology. **(06 Marks)**
    b.   Explain the synthesis of nanomaterials
      i)   Solgel process
      ii)   Chemical Vapour Condensation (CVC) **(08 Marks)**
    c.   Give the applications of Nanotechnology. **(06 Marks)**

8   a.   With a neat sketch, explain Transmission Electron Microscopy (TEM). List the application.

                     (10 Marks)

      b.   With a neat sketch, explain Atomic Force Microscopy (AFM) – List the application.

                     (10 Marks)

9   a.   Give the detailed classification of CNC machine tools.   **(10 Marks)**

      b.   Explain the NC words used in manual part programming.   **(10 Marks)**

10   a.   Define Automation. Explain the basic elements of an automated system.   **(10 Marks)**

      b.   Explain the need of Automation in productivity.   **(04 Marks)**

      c.   Write short notes on :

           i)   Continuous and Discrete control

           ii) Control System components.   **(06 Marks)**

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Eighth Semester B.E. Degree Examination, July/August 2021
Product Life Cycle Management

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions.*

1   a.   List the benefits of PLM.   **(10 Marks)**
    b.   With neat sketch, explain PLM model.   **(10 Marks)**

2   a.   Explain the reasons for implementation of PDM system.   **(10 Marks)**
    b.   Explain the phases of PLM.   **(10 Marks)**

3   a.   With neat sketch, explain the Design for X and Design centered development model.
                                                                        (10 Marks)
    b.   With neat sketch, explain Methodical Evolution in Product design.   **(10 Marks)**

4   a.   Explain with a graph strategies for recovery at end of life. **(10 Marks)**
    b.   Briefly explain Engineering Design.   **(10 Marks)**

5   a.   With neat sketch, explain various stages of New product development.   **(10 Marks)**
    b.   Define Building decision support system. Explain components of DSS architecture.
                                                                        (10 Marks)

6   a.   With flow chart, explain launching and tracking new product program.   **(10 Marks)**
    b.   Explain Top – down and Bottom – up approach in new product financial control.   **(10 Marks)**

7   a.   Explain technology change with various stages.   **(10 Marks)**
    b.   Explain the various Technology forecasting methods.   **(10 Marks)**

8   a.   Write short notes on Morphology methods.   **(10 Marks)**
    b.   What is necessity of Technology forecasting?   **(10 Marks)**

9   a.   Write short notes on Digital mock up.   **(10 Marks)**
    b.   What is 3D – CAD system and model building?   **(10 Marks)**

10 a.   Explain Variant Management.   **(10 Marks)**
    b.   Explain Product data description and Data models.   **(10 Marks)**

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