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18ME71

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Control Engineering

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain closed loop system with an example. (06 Marks)
- b. What are the ideal requirements of a control system? Explain them briefly. (06 Marks)
- c. Explain proportional plus integral plus derivative control action with the characteristics. (08 Marks)

OR

- 2 a. Draw the equivalent mechanical system of the given system shown in Fig.Q2(a). Hence the set of equilibrium equations for it and obtain electrical analogous circuits using (i) F-V analogy (ii) F-I analogy.

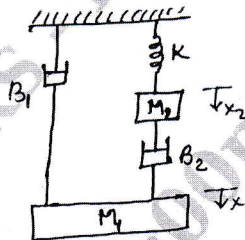


Fig.Q2(a)

(12 Marks)

- 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. (08 Marks)

Module-2

- 3 a. Obtain an expression for response of first order system for unit step input. (06 Marks)
- b. Explain different types of input signals. (06 Marks)
- c. Obtain an expression for response of first order system for parabolic input. (08 Marks)

OR

- 4 a. Derive the expression of steady state error for a simple closed loop system and state the factors on which it depends. (10 Marks)
- b. A second order system has natural frequency $\omega_n = 5$ rad/sec and damping ratio is 0.6. Calculate (i) Delay time (ii) Rise time (iii) Peak time (iv) Maximum overshoot. (10 Marks)

Module-3

- 5 a. Reduce the given block diagram shown in Fig.Q5(a) and obtain the transfer function $C(s)/R(s)$.

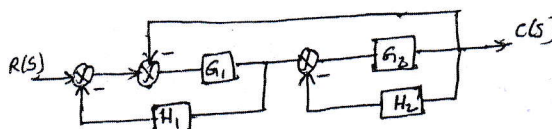


Fig.Q5(a)

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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- b. Find the overall transfer function by using Mason's gain formula for the signal flow graph shown in the Fig.Q5(b).

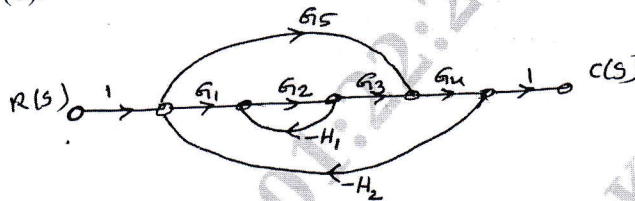


Fig.Q5(b)

(10 Marks)

OR

- 6 a. Draw the corresponding signal flow graph of a given block diagram in Fig.Q6(a) and obtain transfer function by using Mason's gain formula.

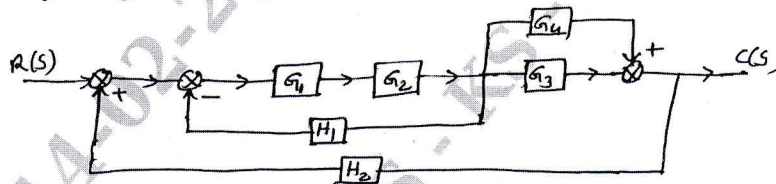


Fig.Q6(a)

(10 Marks)

- b. A system is governed by the differential equation $\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 10y = 8u(t)$ where y is the output and u is the input of the system. Obtain a state space representation of the system. (10 Marks)

Module-4

- 7 a. The characteristic equation of a system is given by $s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$. Determine the stability using RH criteria. (08 Marks)
- b. By applying Routh criterion, discuss the stability of the closed loop system as a function of K for the following open loop transfer function $G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}$ (12 Marks)

OR

- 8 Sketch the rough nature of root locus of a given transfer function $G(s)H(s) = \frac{K(s+1)}{s(s+2)(s^2+2s+5)}$ (20 Marks)

Module-5

- 9 a. Sketch the polar plot of given transfer function $G(s)H(s) = \frac{1}{s(1+5s)(1+10s)}$ (06 Marks)
- b. The transfer function $G(s)H(s) = \frac{10}{s(s+1)(s+2)}$. Sketch the rough nature of Nyquist plot and comment on stability. (14 Marks)

OR

- 10 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 : (20 Marks)
- (i) Phase crossover frequency (ii) Gain crossover frequency
 (iii) Gain margin (iv) Phase margin

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18ME72

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Computer Aided Design and Manufacturing

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define Automation. Explain different types of automation. (10 Marks)
 b. The average part produced in a certain batch manufacturing plant must be processed through an average 6 machines. 20 new batches are launched each week. Average operation time is 6 mins average set-up time is 5 hrs, average batch size is 25 parts, average non-operation time per batch is 10 hrs/machine. There are 18 machines in the plant. The plant operates an average of 70 production hours per week. Scrap rate is negligible, determine:
 (i) Manufacturing Load Time (MLT) for an average part (ii) Production rate
 (iii) Plant capacity (iv) Plant utilization (v) WIP (10 Marks)

OR

- 2 a. What is buffer storage? Explain types of buffer storage with neat sketch. (08 Marks)
 b. Define Upper bound approach and lower bound approach. (04 Marks)
 c. For a 10 station transfer line, refer following data:
 $P = 0.01$ (all stations have an equal probability of failure)
 $T_c = 0.5$ min, $T_d = 5.0$ min
 Using upper bound approach, determine: (i) The frequency of line stop
 (ii) The average production rate (iii) The line efficiency (08 Marks)

Module-2

- 3 a. Explain with block diagram, the design process using Computer Aided Design (CAD). (10 Marks)
 b. Explain the different functions of graphics packages. (10 Marks)

OR

- 4 a. Explain in detail the Retrieval type of CAPP. (10 Marks)
 b. What is MRP? Explain the different inputs of MRP with block diagram. (10 Marks)

Module-3

- 5 a. Briefly explain different types of manufacturing cells. (10 Marks)
 b. What is AS/RS? Explain different types of AS/RS. (10 Marks)

OR

- 6 a. By using the given information:
 The product demand is 1800 units/week; The industry works 48 hrs/week ;
 Number of operators 8 ; Uptime of assembly is 94% ; There is no repositioning required
 Determine: (i) Line efficiency, (ii) Balance delay (iii) Smoothness index, by using largest candidate rule method. The work elements and their times involved in the assembly operation is as below;

Element	1	2	3	4	5	6	7	8
Tek (min)	1.0	0.5	0.8	0.3	1.2	0.2	0.5	1.5
Predecessor by	-	-	1, 2	2	3	3, 4	4	5, 6, 7

(14 Marks)

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b. Define and write the mathematical model of:

(i) Total work content time (T_{wc})

(ii) Cycle Time (T_c)

(iii) Smoothness Index (SI)

(06 Marks)

Module-4

7 a. Explain briefly the steps involved in the development of a part program. (10 Marks)

b. List out the advantages, limitations and applications of CNC's. (10 Marks)

OR

8 a. Explain with neat sketches the different joints used in industrial robots. (10 Marks)

b. Write a short note on robot programming methods. (10 Marks)

Module-5

9 a. Define additive manufacturing systems and list out its advantages, disadvantages and application. (10 Marks)

b. With neat sketch, explain sheet lamination type AM process. (10 Marks)

OR

10 Write short notes on:

a. Evolution of industry 4.0

b. Big data and cloud computing for IoT

c. Supply chain optimization

d. Cyber physical manufacturing systems

(20 Marks)

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18ME734

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Total Quality Management

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. List out benefits of Implementing TQM. (04 Marks)
b. With a neat diagram, explain Framework of TQM. (06 Marks)
c. Explain contribution made by the any two quality Guru's. (10 Marks)

OR

- 2 a. Explain briefly all eight. ISO-9001 requirements. (10 Marks)
b. Explain briefly various series of ISO. (06 Marks)
c. Briefly describe the various benefits of ISO registration. (04 Marks)

Module-2

- 3 a. Explain briefly seven characteristics of effective people. (06 Marks)
b. List out Deming's 14 points of TQM philosophy and explain any three. (10 Marks)
c. Explain role of TQM leader. (04 Marks)

OR

- 4 a. Enumerate the seven steps to strategic planning. (10 Marks)
b. Explain different ways of communication. (06 Marks)
c. Explain briefly decision making process. (04 Marks)

Module-3

- 5 a. With a neat sketch enumerate how a KANO MODEL help in translating needs into requirements. (08 Marks)
b. Describe briefly the customer retention. (06 Marks)
c. Explain briefly customer perception towards quality. (06 Marks)

OR

- 6 a. State and explain elements of customer service. (08 Marks)
b. Define, motivation, performance, reward, recognition, empowerment, gain sharing, teams and union. (08 Marks)
c. List out advantages of employee involvement. (04 Marks)

Module-4

- 7 a. Sketch and explain Juran's Triology. (10 Marks)
b. Explain with neat diagram P-D-S-A cycle for continuous improvement. (06 Marks)
c. Write note on six sigma. (04 Marks)

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OR

- 8 a. Explain with neat diagram, cause and effect diagram, Pareto diagram. (08 Marks)
b. Explain various measures of central Tendency and Measure of Dispersion. (08 Marks)
c. Write note on control charts. (04 Marks)

Module-5

- 9 a. Define total productive maintenance and explain briefly its 8 pillars. (08 Marks)
b. Explain briefly 5 "s" foundation applied to total productive maintenance. (08 Marks)
c. Write notes on types of maintenance. (04 Marks)

OR

- 10 a. Define QbD and explain key component of quality by design. (08 Marks)
b. Define EMS and explain its benefits. (04 Marks)
c. Explain the concept of environment management system under ISO14001. (08 Marks)

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18ME735

Seventh Semester B.E. Degree Examination, Feb./Mar.2022

Operations Research

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of statistical table permitted.*

Module-1

- 1 a. Operation Research models help to solve several problems facing the industry today. Elaborate. (04 Marks)
b. Discuss various phases in solving OR problems. (06 Marks)
c. The following table Q1(c) summarizes the key facts above two products A and B and the resources Q and R required to produce them. Formulate the linear programming model for this problem and solve it graphically.

Resource	Resource usage per unit produced		Amount of resource available
	Product A	Product B	
Q	1	1	5
R	3	2	12
Profit per unit	6	5	

Table Q1(c)

(10 Marks)

OR

- 2 a. Write down the general structure of linear programming problem. What are its three basic elements? (04 Marks)
b. Solve the following LPP by graphical method:
Minimize $z = 20x_1 + 10x_2$
Subject to, $x_1 + 2x_2 \leq 40$
 $3x_1 + x_2 \geq 30$
 $4x_1 + 3x_2 \geq 60$
 $x_1, x_2 \geq 0$ (06 Marks)
c. A confectionery company mixes three types of toffees to form one kg toffee packs. The pack is sold at Rs.170. The three types of toffees cost Rs.200, Rs.100 and Rs.50 per kg respectively. The mixture must contain atleast 0.30 kg of the first type of toffees and the weight of the first two types of toffees must atleast be equal to the weight of the third type. Formulate the problem as LPP. (10 Marks)

Module-2

- 3 a. Solve the following LPP using simplex method,
Maximize $z = x_1 + x_2 + 3x_3$
Subject to $3x_1 + 2x_2 + x_3 \leq 3$
 $2x_1 + x_2 + 2x_3 \leq 2$
 $x_1, x_2, x_3 \geq 0$ (08 Marks)
b. Use Big M method to solve the following LPP:
Minimize $z = 5x_1 + 3x_2$
Subject to $2x_1 + 4x_2 \leq 12$
 $2x_1 + 2x_2 = 12$
 $5x_1 + 2x_2 \geq 10$
 $x_1, x_2 \geq 0$ (12 Marks)

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OR

- 4 a. Obtain the dual of the following primal problem,

Minimize $z = 3x_1 - 2x_2 + x_3$

Subject to $2x_1 - 3x_2 + x_3 \leq 5$

$4x_1 - 2x_2 \geq 9$

$-8x_1 + 4x_2 + 3x_3 = 8$

$x_1, x_2 \geq 0, x_3$ is unrestricted.

(08 Marks)

- b. Use two phase method to solve

Maximize $z = 5x_1 - 4x_2 + 3x_3$

Subject to $2x_1 + x_2 - 6x_3 = 20$

$6x_1 + 5x_2 + 10x_3 \leq 76$

$8x_1 - 3x_2 + 6x_3 \leq 50$

$x_1, x_2, x_3 \geq 0$

(12 Marks)

Module-3

- 5 a. With the aid of simple examples, describe the procedure to be adopted to balance,

(i) Transportation problem.

(ii) Assignment problem

(08 Mark

- b. Solve the transportation problem, the numbers in the cells represent unit transportation cost from warehouse i to store j .

(12 Marks)

		Stores						
		A	B	C	D	E	F	Supply
Warehouse	1	9	12	9	6	9	10	5
	2	7	3	7	7	5	5	6
	3	6	5	9	11	3	11	2
	4	6	8	11	2	2	10	9
Demand		4	4	6	2	4	2	22
								22

OR

- 6 a. An expert operations researcher provided the following transportation schedule. Check if this solution is optional. If not, get the optimal solution. [Refer Fig. Q6 (a)]

(08 Marks)

	3	1	7	4	
		(300)			
	2		6	5	9
	(250)		(150)		
	8	3	3	2	
		(50)	(250)	(200)	

Fig. Q6 (a)

- b. There are five jobs to be assigned, one each to five machines and the associated cost matrix is as follows. Find the optimum assignment schedule.

(08 Marks)

		Machines				
		1	2	3	4	5
Jobs	A	11	17	8	16	20
	B	9	7	12	6	15
	C	13	16	15	12	16
	D	21	24	17	28	26
	E	14	10	12	11	15

Table Q6(b)

- c. Explain in brief, travelling salesman problem.

(04 Marks)

Module-4

- 7 a. What is critical path? How does it help project manager? (04 Marks)
 b. For the network shown (Refer Fig. Q7 (b)), the estimates to, tm and tp are given in this order for each of the activities. Find the probability of completing the project in 25 days. (08 Marks)

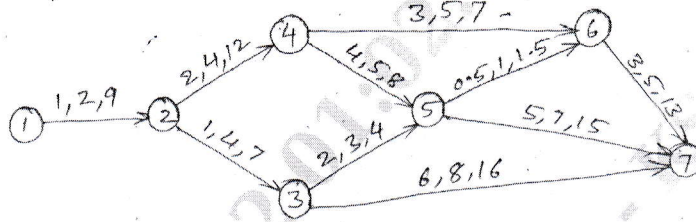


Fig. Q7 (b)

- c. A project schedule has the following characteristics,

Activity	1-2	1-3	2-4	3-4	3-5	4-9	5-6	5-7	6-8	7-8	8-10	9-10
Time (days)	4	1	1	1	6	5	4	8	1	2	5	7

- i) Construct a network diagram.
 ii) Compute the earliest event time and latest event time.
 iii) Determine the critical path and total project duration.
 iv) Compute total float for each activity. (08 Marks)
 v)

OR

- 8 a. Explain Kendall's notations for representing queuing models. (04 Marks)
 b. Describe the characteristics of queuing models. (08 Marks)
 c. In a railway yard goods train arrive at a rate of 30 trains per day. Assume that the inter arrival time follows exponential distribution and the service time distribution is also exponential with an average of 36 min. Calculate the following:
 (i) The average number of trains in the system.
 (ii) The probability that the queue size exceeds 10.
 (iii) Expected waiting time in the queue.
 (iv) Average number of trains in the queue.
 (v) The changes in (i) and (ii) if the input of trains increase to an average 33 per day. (08 Marks)

Module-5

- 9 a. Define the following:
 (i) Payoff matrix.
 (ii) Saddle point.
 (iii) Pure strategy.
 (iv) Two-person zero-sum game. (04 Marks)
 b. Find the value of 'X' and 'Y', so that the following game has a saddle point. (Refer Table Q9 (b)).

		Player B		
		18	Y	36
Player A	X	54	99	
	63	27	36	

Table Q9 (b)

- c. Solve the following game using dominance rule (Table Q9 (c)):

		Player B			
		3	2	4	0
Player A	3	4	2	4	
	4	2	4	0	
	0	4	0	8	

Table Q9 (c)

(10 Marks)

OR

- 10 a. List out the basic assumptions for solving sequencing problems. (04 Marks)
 b. Find the sequence that minimizes the total elapsed time required to complete the following tasks. (Table Q10 (b)).

Tasks	A	B	C	D	E	F	G
Time on Machine I	3	8	7	4	9	8	7
Time on Machine II	4	3	2	5	1	4	3
Time on Machine III	6	7	5	11	5	6	12

Table Q10 (b)

(08 Marks)

- c. Processing times and due dates for six jobs waiting to be processed at a work center are given in the following table (Table Q10 (c)). Determine the sequence of jobs, the average flow time, average tardiness and number of tardy jobs for each of the following priority rules:

- (i) FCFS
 (ii) SPT
 (iii) EDD.

Job	A	B	C	D	E	F
Processing time (days)	2	8	4	10	5	12
Due date	7	16	4	17	15	18

Table Q10 (c)

(08 Marks)

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18ME741

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022

Additive Manufacturing

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define Additive Manufacturing. With neat sketch, explain Genetic A.M. process. (10 Marks)
b. Briefly distinguish any five differences between AM and ANC machining. (10 Marks)

OR

- 2 a. List and explain varieties of materials used in A.M. process. (10 Marks)
b. Discuss material handling issues in A.M. Process. Mention any five applications of A.M. process. (10 Marks)

Module-2

- 3 a. With neat sketch, explain Stereolithography process. (10 Marks)
b. Briefly explain the benefits and drawbacks of photopolymerization process. (10 Marks)

OR

- 4 a. Briefly explain the process of Selective Laser Sintering. (10 Marks)
b. With neat sketch, explain Fused Deposition Modeling (FDM) process. (10 Marks)

Module-3

- 5 a. What is Laminated Object Manufacturing? With neat sketch, explain gluing techniques. (10 Marks)
b. With neat sketch, brief the Ultrasonic Additive manufacturing. (10 Marks)

OR

- 6 a. Briefly explain Laser Transfer direct. Write with neat sketch. (10 Marks)
b. Briefly discuss the applications of direct write technology. (10 Marks)

Module-4

- 7 a. With neat sketch, brief the Flow chart of A.M. selection. (10 Marks)
b. Briefly explain the Surface Texture improvements and Accuracy Improvements in Post process of A.M. (10 Marks)

OR

- 8 a. With neat sketch, briefly explain the properties enhancements using Thermal techniques. (10 Marks)
b. Briefly discuss how STL file is manipulated in A.M. (10 Marks)

Module-5

- 9 a. Briefly explain Multi – material process mechanism in A.M. process. (10 Marks)
b. What are the factors enable the DDM application in A.M. process. (10 Marks)

OR

- 10 a. Briefly discuss the use of A.M. in Medical applications and Dental applications. (10 Marks)
b. Briefly explain the application of A.M. in Aerospace and Automobile sectors. (10 Marks)

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Seventh Semester B.E. Degree Examination, Feb./Mar.2022 Theory of Plasticity

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Derive the three dimensional equilibrium equation in Cartesian co-ordinate system. (10 Marks)
- b. Rectangular component of stresses at a point are given as follows:
 $\sigma_x = 100 \text{ MPa}$, $\sigma_y = -60 \text{ MPa}$, $\sigma_z = 25 \text{ MPa}$, $\tau_{xy} = 50 \text{ MPa}$, $\tau_{yz} = 25 \text{ MPa}$, $\tau_{xz} = 10 \text{ MPa}$.
Determine stresses on a plane which is equally inclined to all the three axis. (10 Marks)

OR

- 2 a. Derive the compatibility equations in terms of strains and state their significance. (08 Marks)
- b. The following state of strain exist at a point P. Determine the principal strains and the direction of maximum principal strain.
 $\epsilon_x = 0.02$, $\epsilon_y = 0.06$, $\epsilon_z = 0$
 $\gamma_{xy} = -0.04$, $\gamma_{yz} = 0.02$, $\gamma_{xz} = 0$ (08 Marks)
- c. Explain the generalized Hooke's law. (04 Marks)

Module-2

- 3 a. What is the mechanism of plastic deformation in metals? Explain with special emphasis on slip and twinning. (10 Marks)
- b. Derive an expression for the critical resolved shear stress. Explain how this can be used to predict plastic deformation. (10 Marks)

OR

- 4 a. The state of stress at a point is given by $\sigma_x = 70 \text{ MPa}$, $\sigma_y = 120 \text{ MPa}$ and $\tau_{xy} = 35 \text{ MPa}$.
If the yield strength for the material is 125 MPa, determined in tensile test, whether yielding will occur according to Tresca's and Von-Mises yield condition or not. (10 Marks)
- b. Explain Taylor and Quinney's experiment in support of yield criterias. What are the important conclusions to be drawn from these experiments? (10 Marks)

Module-3

- 5 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. Explain the various empirical equations used to represent the stress-strain curves for the materials. (10 Marks)

OR

- 6 a. Explain the various theories of plastic flow and give their limitations. (10 Marks)
- b. Explain the Saint-Venant's theory of plastic flow in detail. What are the limitations of this theory? (10 Marks)

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Module-4

- 7 a. Derive the equations for bending moment in Incipient yielding, Elasto-plastic yielding and fully plastic yielding for an idealized stress-strain curve. (10 Marks)
- b. A Cantilever beam of length L carries an end load W . The stress-strain diagram for the beam material is given by $\sigma = H \epsilon^n$. Determine the end deflection. (10 Marks)

OR

- 8 a. Derive the equation for torque in incipient yielding, Elasto-Plastic yielding and full yielding for elastic-perfectly plastic-materials. (10 Marks)
- b. A circular shaft of inner radius 40 mm and outer radius 100 mm is subjected to a twisting couple so that the outer 20 mm deep shell yields plastically. Determine the twisting couple applied to the shaft. Yield stress in shear for the shaft material is 145 N/mm^2 . Also determine the couple for full yielding. (10 Marks)

Module-5

- 9 a. Derive Geiringer's continuity equations. (10 Marks)
- b. Explain the various properties of slip-lines. How these properties help us in drawing the slip line field. (10 Marks)

OR

- 10 a. State and prove Hencky's first theorem. (10 Marks)
- b. What do you understand by a slip line? How slip line nets can be drawn? (10 Marks)

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18ME751

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Energy and Environment

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. List and explain different forms of Energy. (10 Marks)
b. Explain briefly the factors affecting India's Energy development. (10 Marks)

OR

- 2 a. Discuss briefly the Demand and Consumption of coal in India. (10 Marks)
b. Explain the various key Energy trends in India. (10 Marks)

Module-2

- 3 a. Explain various Thermal Storage Systems. (10 Marks)
b. Explain the principles of Energy Management System. (10 Marks)

OR

- 4 a. Define Energy Audit and explain different phases involved in detailed Energy Audit Methodology. (10 Marks)
b. What is Energy Management? Explain Energy Management System and Energy Management Clarified Objectives. (10 Marks)

Module-3

- 5 a. What is Environment? Explain its Multidisciplinary Nature. (10 Marks)
b. Explain Scope and importance of Environment for Public awareness. (10 Marks)

OR

- 6 a. Explain structure and functions of Ecosystems. (10 Marks)
b. Write a short note on : i) Ecological Pyramid ii) Forest Ecosystem. (10 Marks)

Module-4

- 7 a. Discuss the causes, effects and control measures of Water Pollution. (10 Marks)
b. Discuss Solid Waste Management Techniques. (10 Marks)

OR

- 8 a. Explain the causes, effects and control measures of Soil Pollution. (10 Marks)
b. Discuss the role of an Individuals in Preventions of Pollutions. (10 Marks)

Module-5

- 9 a. Write a note on : Ozone Layer Depletion. (10 Marks)
b. What are the Regulation governing for Water Pollution Prevention Act? (10 Marks)

OR

- 10 a. Write a short note on : i) Global warming ii) Acid rain. (10 Marks)
b. Explain the needs for Reclaiming the wasteland and its development. (10 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.