B.L.D.E.A's V.P.Dr.P.G.HALAKATTI COLLEGE OF ENGINERING

AND TECHNOLOGY VIJYAPUR 586103

QUESTION PAPERS June July 2024

MECHANICAL ENGINEERING

21-VI Sem ME

CBCS SCHEME

USN | | | | | | | | | | | **21ME61**

Sixth Semester B.E. Degree Examination, June/July 2024
Production and Operations Management

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Discuss the three major functional areas of business organizations and describe how they interrelate. **(10 Marks)**

b. List some factors that affect productivity and some ways that productivity can be improved. **(06 Marks)**

c. Calculate the multifactor productivity for an eight-hour day, in which the output is 300units, produced by three workers who use 600kg of material. The workers are paid wages of Rs.50 and material cost is Rs.10 per kg. Overhead is 1.5 times labour cost. **(04 Marks)**

OR

2 a. Describe the following :

i) Decision making characteristics

ii) Break Even Point (BEP). **(10 Marks)**

b. A furniture company produces inexpensive tables and chairs. Each table takes 4 hours of carpentry and 2 hours in the painting department. Each chair requires 3 hours of carpentry and 1 hours in the painting department. During the current production period, 240 hours of carpentry time is available and 100 hours in painting is available. Each table sold yields a profit of Rs.7; each chair produced is sold for a profit of Rs.5. Find the best combination of tables and chairs to manufacture in order to reach maximum profit. Use LPP (Linear programming) method. **(10 Marks)**

Module-2

3 a. Discuss qualitative forecast and its types. **(10 Marks)**

b. Given the following data :

Period	1	2	3	4	5
Number of complaints	60	65	55	58	64

Prepare a forecast for period 6 using each of these approaches :

i) The appropriate naïve approach

ii) A three-period moving average

iii) A weighted average using weights of 0.50(most recent), 0.30 and 0.20

iv) Exponential smoothing with a smoothing constant of 0.40. **(10 Marks)**

OR

4 a. Discuss the sources of idea for new design and services. **(10 Marks)**

b. Explain the 3R's with respect to sustain ability in product design. **(10 Marks)**

Module-3

5 a. Discuss the determinants for effective capacity. **(10 Marks)**

b. A small firm produces and sells automotive items in a five-state area. The firm expects to consolidate assembly of its battery charger line in a single location. Currently operations are in three widely scattered locations. The leading candidate for location will have a monthly fixed cost of Rs.42,000 and variable costs of Rs.3 per charger. Charger sell for Rs.7 each. Prepare a table that shows total profits, fixed costs, variable costs and revenues for monthly volumes of 10,000, 12,000 and 15,000 units. What is the breakeven point? **(10 Marks)**

OR

6 a. Discuss the primary regional factors involved in identifying a region during location decision. **(10 Marks)**

b. Use the information contained in the table shown :

Task	a	b	c	d	e	f	g	h
Immediate predecessor	–	a	–	c	b	d, e	f	g
Task taken, min	0.2	0.2	0.8	0.6	0.3	1	0.4	0.3

Do each of the following :

i) Draw a precedence diagram

ii) Assuming an eight – hour workday, compute the cycle time needed to obtain an output of 400units per day

iii) Determine the minimum number of workstations required

iv) Assign tasks to workstations according to the greatest number of following tasks. Compute the resulting percent idle time and efficiency of the system. **(10 Marks)**

Module-4

7 a. Explain briefly the strategies used in aggregate planning. **(10 Marks)**

b. Company manufacturing several models of bicycles are about to prepare a aggregate plan that will cover six periods. They have assembled the following information :

Period	1	2	3	4	5	6	Total
Forecast	200	200	300	400	500	200	1800

Output : Regular time = Rs.200 per bicycle
Inventory = Rs.100 per bicycle per period an average
Back orders = Rs.50per bicycle per period

The firm wants to evaluate a plan that calls for a steady rate of regular–time output. Prepare an aggregate plan and determine the total cost. Assume a level output rate of 300 units. **(10 Marks)**

OR

8 a. Discuss master scheduling process with the help of a flow chart. **(10 Marks)**

b. A manufacturing plant is in the process of updating its Master Production Schedule (MPS) for its products. The plant produces a product as a produce to stock basis. The table below shown hours the estimates of demand for the product for the next six weeks.

Type of demand	Week					
	1	2	3	4	5	6
Customers (forecasts) and orders	700	1200	700	500	400	1200
Warehouses	100	100	400	500	200	100
Market research	–	50	–	–	10	–
Production Research	10	–	–	–	–	–

The safety stock level, minimum lot sizes and beginning inventory level for the product are :

Minimum lot size	Safety stock	Beginning inventory
2000	500	1500

Prepare a six week detailed MPS for the product and determine the production run periods. **(10 Marks)**

Module-5

9 a. With a flow chart, discuss inputs to and outputs from MRP system. **(10 Marks)**

b. Compute the material requirement plan for an item shown in below. This item has an independent demand and a safety lock of 40 is desired :

Order quantity = 70 Lead time = 4 weeks safety lock = 40	Week											
	1	2	3	4	5	6	7	8	9	10	11	12
Projected requirement	20	20	25	20	20	25	20	20	30	25	25	25
Receipts		70										
Available on hand /65												
Planned order release												

(10 Marks)

OR

10 a. Discuss the concepts of tenders and explain its types. **(10 Marks)**

b. Give a comparison between the two approaches to supply management. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME62

Sixth Semester B.E. Degree Examination, June/July 2024
Heat Transfer

Time: 3 hrs. Max. Marks: 100

Note:* 1. *Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of HMT data handbook is permitted.

Module-1

1 a. Explain the modes of Heat Transfer. **(04 Marks)**

b. Derive General 3D heat conduction equation in Cartesian coordinates. **(08 Marks)**

c. An exterior wall of a house may be approximated by a 0.1 m layer of common brick (K = 0.7 W/m°C) followed by a 0.04 m layer of gypsum plaster (K = 0.48 W/m°C). What thickness of loosely packed rock wool insulation (K = 0.065 W/m°C) should be added to reduce the heat loss or (gain) through the wall by 80 percent? **(08 Marks)**

OR

2 a. Derive 2-D Heat conduction equation for Hollow cylinder. **(10 Marks)**

b. A standard cast iron pipe (ID = 50 mm and OD = 55 mm) is insulated with 85 percent magnesium insulation (K = 0.02 W/m°C). Temperature at the interface between the pipe and insulation is 300°C. The allowable heat loss through the pipe is 600 W/m length of pipe and for safety, the temperature of the outside surface of insulation must not exceed 100°C. Determine:

(i) Minimum thickness of insulation required

(ii) The temperature of inside surface of pipe assuming its thermal conductivity 20 W/m°C. **(10 Marks)**

Module-2

3 a. Derive heat dissipation equation for a fin with insulated end. **(10 Marks)**

b. A steel rod (K = 32 W/m°C), 12 mm in diameter and 60 mm long, with an insulated end is to be used as a spine. It is exposed to surroundings with a temperature of 60°C and a heat transfer coefficient of 55 W/m^2°C. The temperature at the base of the fin is 95°C. Determine:

(i) Fin efficiency

(ii) The temperature at the edge of the spine

(iii) The heat dissipation **(10 Marks)**

OR

4 a. Obtain an expression for Instantaneous and total heat transfer for lumped system analysis of heat conduction. **(12 Marks)**

b. A 50 cm × 50 cm copper slab 6.25 mm thick has a uniform temperature of 300°C. Its temperature is suddenly lowered to 36°C. Calculate the time required for the plate to reach the temperature of 108°C. Take ρ = 9000 kg/m^3, c = 0.38 kJ/kg°C, k = 370 W/m°C and h = 90 W/m^2°C. **(08 Marks)**

Module-3

5 a. Explain: (i) Stefan-Boltzmen law (ii) Wien's displacement law (iii) Radiation shield (iv) Radiosity (v) Black body **(10 Marks)**

b. Consider two large parallel plates one at $t_1 = 727°C$ with emissivity $\varepsilon_1 = 0.8$ and other at $t_2 = 227°C$ with emissivity $\varepsilon_2 = 0.4$. An aluminum radiation shield with an emissivity, $\varepsilon_3 = 0.05$ on both sides is placed between the plates. Calculate the percentage reduction in heat transfer rate between the two plates as a result of the shield. **(10 Marks)**

OR

6 a. Explain how Stefan Boltzman constant is determined using Stefan Boltzman apparatus experimentally. **(10 Marks)**

b. An electric heating system is installed in the ceiling of a room 5 m (length) × 5m (width) × 2.5 m (height). The temperature of the ceiling is 315 K whereas under equilibrium conditions the walls are at 295 K, if the floor is non-sensitive to radiations and the emissivities of the ceiling and wall are 0.75 and 0.65 respectively. Calculate the radiant heat loss from the ceiling to the walls. **(10 Marks)**

Module-4

7 a. Explain briefly with sketches:
(i) Boundary layer thickness (ii) Thermal boundary layer thickness **(08 Marks)**

b. A cylindrical body of 300 mm diameter and 1.6 m height is maintained at a constant temperature is 36.5°C. The surrounding temperature is 13.5°C. Find out the amount of heat to be generated by the body per hour if $\rho = 1.025$ kg/m^3, $C_p = 0.96$ kJ/kg°C, $V = 15.06 \times 10^{-6}$ m^2/s, $K = 0.0892$ kJ/m-h°C and $\beta = \frac{1}{298}$ K^{-1}. Assume $Nu = 0.12 (Gr.Pr)^{1/3}$. **(12 Marks)**

OR

8 a. Explain the significance of :
(i) Reynolds number (ii) Prandtl number
(iii) Grashoff number (iv) Stenton number **(10 Marks)**

b. Air at 30°C and at atmospheric pressure flows at a velocity of 2.2 m/s over a plate maintained at 90°C. The length and the width of the plate are 900 mm and 450 mm respectively. Using exact solution calculate the heat transfer rate from:
(i) First half of the plate (ii) Full plate (iii) Next half of the plate
The properties of air at temperature 60°C are $\rho = 1.06$ kg/m^3, $\mu = 7.211$ kg/hm, $V = 18.97 \times 10^6$ m^2/s, $Pr = 0.696$, $k = 0.02894$ W/m°C. **(10 Marks)**

Module-5

9 a. With a neat sketch, explain the different regimes of pool boiling. **(10 Marks)**

b. A vertical plate 350 mm high and 420 mm wide at 40°C is exposed to saturated steam at 1 atm. Calculate the following:
(i) The film thickness at the bottom of plate.
(ii) The maximum velocity at the bottom of plate
(iii) The total heat flux to the plate. **(10 Marks)**

OR

10 a. Derive the expression for LMTD of a parallel flow heat exchanger. **(10 Marks)**

b. Water ($C_p = 4200$ J/kg°C) enters a counter flow double pipe heat exchanger at 38°C flowing at 0.076 kg/s. It is heated by oil ($C_p = 1880$ J/kg°C) flowing at the rate of 0.152 kg/s from an inlet temperature of 116°C. For an area of 1 m^2 and $U = 340$ W/m^2°C. Determine the total heat transfer rate. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME63

Sixth Semester B.E. Degree Examination, June/July 2024
Machine Design

Time: 3 hrs. Max. Marks: 100

Note: ***1. Answer any FIVE full questions, choosing ONE full question from each module.***
2. Use of data hand book is permitted.
3. Missing data if any may be suitably assumed.

Module-1

1 a. Explain the design procedure with the help of flow chart. **(06 Marks)**

b. Derive Soderberg's equation when a member is subjected to fatigue axial loading. **(06 Marks)**

c. A cantilever beam is C-45 steel is subjected to completely reversed bending load varying from 5F to –F as shown in Fig.Q1(c). Determine the maximum load the member can carry for infinite life. Take σ_y = 353 MPa and σ_u = 640 MPa for the material. Assume FoS = 2.

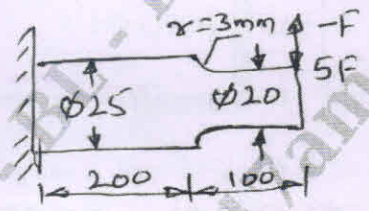


Fig.Q1(c) **(08 Marks)**

OR

2 a. Briefly discuss factors influencing the selection of suitable material for machine element. **(06 Marks)**

b. Explain the following theories of failure:
(i) Maximum normal stress theory
(ii) Maximum shear stress theory
(iii) Distortion energy theory **(06 Marks)**

c. A bar of rectangular cross section is subjected to an axial pull of 500 kN as shown in Fig.Q2(c). Calculate its thickness if the allowable tensile stress in the bar is 200 MPa.

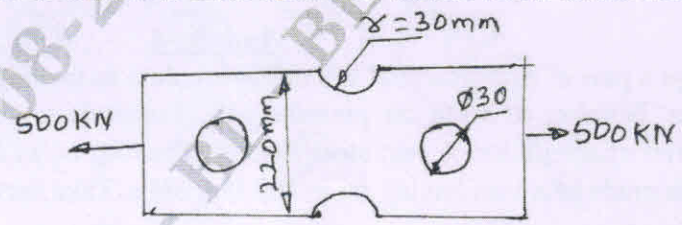


Fig.Q2(c) **(08 Marks)**

Module-2

3 A steel shaft 600 mm long supported between bearings carries a pulley of diameter 400 mm, weighing 400 N and is mounted in the middle of the shaft.

This shaft receives 40 KW at 600 rpm by a flat belt drive, power from the shaft is transmitted through another pulley of diameter 600 mm weighing 600 N overhanging the right bearing by 200 mm. The belt drives on the pulleys are at right angles to each other. Taking ratio of belt tensions as 3. Determine the diameter of the shaft required taking design shear stress as 40 MPa. **(20 Marks)**

OR

4 a. Derive an equation for shear stress due to twisting moment and deflection of helical spring. **(08 Marks)**

b. Design an helical spring for an operating load range from 90 N to 135 N. The deflection for this load range is 7.5 mm. Other data are as follows:
Spring index = 10
Permissible shear stress for the material = 480 MPa
Shear modulus = 80 GPa **(12 Marks)**

Module-3

5 a. Explain the following:
(i) Failure of riveted joints
(ii) Efficiency of riveted joint **(08 Marks)**

b. Determine the required fillet weld size for the bracket shown in Fig.Q5(b).

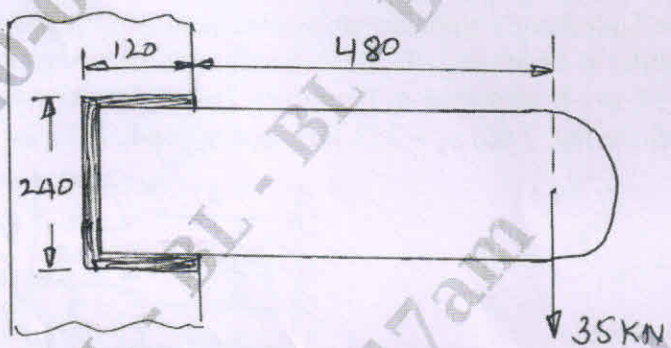


Fig.Q5(b) **(12 Marks)**

OR

6 a. Explain different types of stresses due to various loading on threaded fasteners. **(10 Marks)**

b. A cover plate is bolted on to the flanged end of a pressure vessel through 6 bolts. The inner diameter of the pressure vessel is 200 mm and is subjected to an internal pressure of 10 MPa. Selecting carbon steel C-40 as the material with σ_y = 324.6 MPa for the bolts, determine the size of the bolts also considering the initial tension for the following cases:
(i) Metal to metal joint
(ii) A gasket joint **(10 Marks)**

Module-4

7 Design a pair of spur gear 20° full depth involute to transmit 30 KW of power at 600 rpm of pinion. Number of teeth on pinion is 15. Transmission ratio (gear reduction ratio) is 5. Material of the pinion is cast steel untreated having σ_y as 137.34 MPa. Material of the gear is high grade cast iron having σ_y as 103.005 MPa. Take service factor (C_S) as 1.5. **(20 Marks)**

OR

8 A pair of helical gears for a turbine has a transmission ratio of 10 and the teeth are $14\frac{1}{2}$ involute. The pinion has 25 teeth and rotates at 5000 rpm. Material for both pinion and gear is 0.4% carbon steel heat treated having σ_y as 86.03 MPa. Power to be transmitted at 100 KW. Design the gears completely. Take helix angle $\beta = 20°$. **(20 Marks)**

Module-5

9 a. Design a single plate clutch used in automobile transmission for the following specification: Power to be transmitted = 20 KW, speed = 1500 rpm. Take μ = 0.35, pressure (p) = 1 N/mm^2, yield stress for shaft material = 328.6 MPa. **(08 Marks)**

b. A simple band brake is required to transmit a torque of 980 N-m. The brake drum is 400 mm diameter and coefficient of friction is 0.25. Find the effort required to operate the brake. Also design the band and the lever. Take θ = 270°, a = 680 mm and b = 80 mm. Yield stress (σ_y) for both band and lever = 328.6 MPa.

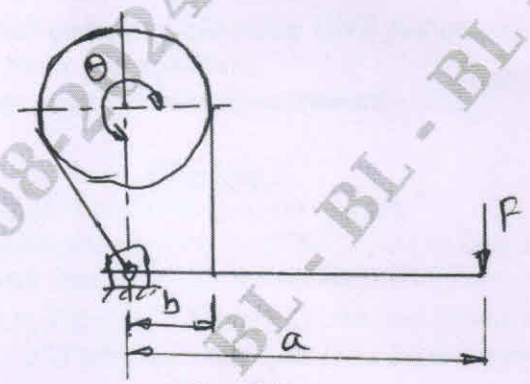


Fig.Q9(b) **(12 Marks)**

OR

10 a. Derive Petroff's equation with usual notations. **(10 Marks)**

b. A lightly loaded journal bearing has a load of 1 kN. The oil used is SAE 60 and mean effective temperature of operation is 40°C. The journal has a diameter of 50 mm and the bearing has a diameter of 50.5 mm. The speed of journal is 15000 rpm. The L/d ratio is limited to 1.2. Determine the coefficient of friction and power loss in friction. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

21ME642

Sixth Semester B.E. Degree Examination, June/July 2024
Mechatronics System Design

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define mechatronics, explain the key elements of a mechatronics system. **(10 Marks)**

b. Outline the key stages of the mechatronics design process. **(10 Marks)**

OR

2 a. Derive sensor and transducer. Write the classification of transducer. **(10 Marks)**

b. Explain the following terms used to derive the performance of transducers:
 (i) Sensitivity
 (ii) Range and Span
 (iii) Repeatability
 (iv) Stability
 (v) Dead band. **(10 Marks)**

Module-2

3 a. For the following mechanical system, construct the block diagram model and find the transfer function $\frac{X}{F}$. **(10 Marks)**

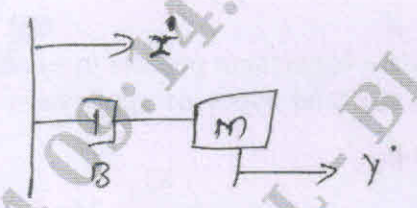


Fig. Q3 (a)

b. Explain Faraday's law in mechanical to electrical coupling and Lorentz's Force law. **(10 Marks)**

OR

4 a. Compute the block diagram representation for the following electrical circuit:

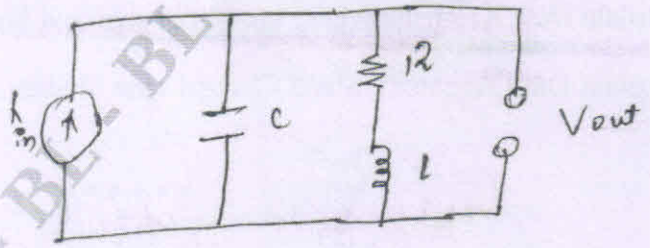
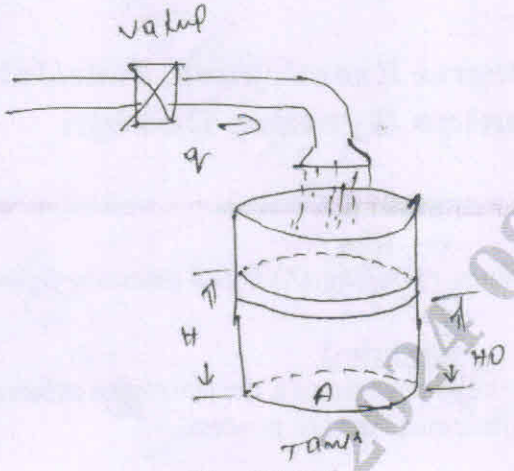


Fig. Q4 (a) **(10 Marks)**

b. Develop the block diagram model for the tank system using the analogy approach.



$$H = H_O + \frac{1}{A}\int q = H_O + \frac{1}{DA}q$$

$$Z_{tank} = \frac{D_{PV}}{F_V} = \frac{H - H_O}{q} = \frac{1}{DA}$$

Fig. Q4 (b)

(10 Marks)

Module-3

5 a. Explain the terminologies involved in modeling dynamic systems. **(10 Marks)**

b. Explain parity and error coding checks. **(10 Marks)**

OR

6 a. Describe the most common hardware faults. **(10 Marks)**

b. Explain the term, (i) Emulation (ii) Simulation. **(10 Marks)**

Module-4

7 a. Explain the importance of signal conditioning in a data acquisition system. **(10 Marks)**

b. Describe the key elements of data acquisition and control system. **(10 Marks)**

OR

8 a. Explain the data conversion process in a data acquisition system. **(10 Marks)**

b. Discuss the role and types of application software used in data acquisition and control systems. **(10 Marks)**

Module-5

9 a. Explain the comprehensive case studies of mass spring oscillation and damping in an example of a mechatronics technology demonstration. **(10 Marks)**

b. Explain Data Acquisition case studies of testing of transportation bridge surface materials. **(10 Marks)**

OR

10 a. Explain Data Acquisition case studies of solenoid Force-displacement calibration system. **(10 Marks)**

b. Explain Data Acquisition and Control case studies of Thermal cycle Fatigue of a Ceramic plate. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

21ME652

Sixth Semester B.E. Degree Examination, June/July 2024
Renewable Energy Power Plants

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Write the difference between renewable energy sources and nonrenewable energy sources. **(06 Marks)**

b. Write the statistics of
Solar power
Wind power
Small hydro power and
Biomass (Bagasse) cogeneration power, cumulative achievements as on May 2024 as per information of ministry of New and renewable energy. **(04 Marks)**

c. Explain need for nonconventional energy sources. **(10 Marks)**

OR

2 a. Writ a short note on Solar radiation at earth's surface. **(04 Marks)**

b. With neat sketch, explain sunshine recorder. **(08 Marks)**

c. With neat sketch, explain pyrheliometer. **(08 Marks**

Module-2

3 a. Define the following terms and draw neat sketch for each definition.
i) Declination Angle
ii) Zenith Angle
iii) Solar altitude Angle
iv) Surface azimuth Angle
v) Hour Angle **(10 Marks)**

b. Determine the number of day light hours in Srinagar on 5th January and 5th July [Latitude = 34°05′]. **(10 Marks)**

OR

4 a. Explain briefly with the help of a line diagram, How the solar energy is stored in a solar pond. **(10 Marks)**

b. With neat sketch, explain solar chimney. **(10 Marks)**

Module-3

5 a. List the six properties of wind energy. **(06 Marks)**

b. Discuss the problems associated with wind power. **(06 Marks)**

c. With neat sketch, Explain horizontal axis wind mill (2-blades only) for electricity generation. **(08 Marks)**

OR

6 a. What are the advantages and disadvantages of Biomass? **(10 Marks)**

b. With a neat sketch, explain construction and working of Janata model gobar gas plant. **(10 Marks)**

Module-4

7 a. Give a detailed classification of hydroelectric plant. **(10 Marks)**

b. The mean monthly discharge at a site is as shown in table (Q7 (b). Draw the hydrograph and flow duration curve.

Month	Discharge m^3/sec	Month	Discharge m^3/Sec
January	200	July	2000
February	450	August	2400
March	600	September	1800
April	1200	October	1200
May	1500	November	800
June	1600	December	400

(10 Marks)

OR

8 a. Explain the fundamental characteristics of tides. **(05 Marks)**

b. List the advantages and disadvantages of wave energy. **(05 Marks)**

c. With neat sketch, explain double basin arrangement of tidal power plant. Also mention the limitation of tidal energy. **(10 Marks)**

Module-5

9 a. With neat sketch, explain principle of conversion of geothermal energy and mention the advantages of geothermal energy over other energy forms energy over other energy forms. **(10 Marks)**

b. List the different kinds of geothermal energy sources and explain in detail any two. **(10 Marks)**

OR

10 a. With a neat schematic diagram, explain Rankine OTEC cycle. Also mention problems associated with OTEC. **(10 Marks)**

b. Write a brief note on geothermal stations in the world. **(05 Marks)**

c. List the disadvantages of geothermal energy. **(05 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME653

Sixth Semester B.E. Degree Examination, June/July 2024
Mechatronics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Mechatronics. Briefly explain Mechatronics Design Process. **(10 Marks)**

b. Explain with block diagram, the working of Antilock Breaking System (ABS) Control. **(10 Marks)**

OR

2 a. Define sensor and transducers. Write the classification of transducers. **(10 Marks)**

b. Explain with a neat, sketch (i) LVDT (ii) Proximity Switches **(10 Marks)**

Module-2

3 a. Define signal conditioning. Explain Multichannel Data Acquisition System (DAQS). **(10 Marks)**

b. What is a filter? How are filters classified? Write brief note on types of filter. **(10 Marks)**

OR

4 a. Define Solenoids. Explain two types of solenoids and mention their applications. **(10 Marks)**

b. Explain the types of Brush type D.C. motors, with filed coils with neat sketch. **(10 Marks)**

Module-3

5 a. Define Microprocessor. Explain with neat block diagram, the general form of Microprocessor system. **(12 Marks)**

b. List the difference between Microprocessor and Microcontroller. **(08 Marks)**

OR

6 a. With a neat sketch, explain 8085A Microprocessor Architecture. **(10 Marks)**

b. Explain briefly the following forms of memory units:
(i) ROM (ii) PROM (iii) EPROM (iv) EEPROM (v) RAM **(10 Marks)**

Module-4

7 a. Define PLC (Programmable Logic Controller). Explain with a neat diagram working of a PLC. **(10 Marks)**

b. Explain in detail the criteria used for selection of a PLC. **(10 Marks)**

OR

8 a. Briefly explain the basic structure of ladder logic diagram. **(10 Marks)**

b. Explain the control of two pneumatic pistons, with a neat sketch. **(10 Marks)**

Module-5

9 a. Explain friction guide ways and antifriction guide ways. **(10 Marks)**

b. Explain the working of hydrodynamic bearing with neat sketch. **(10 Marks)**

OR

10 a. Explain the different stages of mechatronic design process. **(10 Marks)**

b. Explain with neat sketch working of automatic car park barrier. **(10 Marks)**

* * * * *

18 VIII Sem. ME

CBCS SCHEME

USN | | | | | | | | | |

18ME71

Seventh Semester B.E. Degree Examination, June/July 2024
Control Engineering

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Describe the classification of control systems. **(08 Marks)**
b. Enumerate the difference between open loop and closed loop control systems. **(06 Marks)**
c. Explain PID controllers with characteristic curves. **(06 Marks)**

OR

2 a. Explain the models of mechanical systems. **(06 Marks)**
b. With a neat block diagram, explain the working of automatic electric iron. **(06 Marks)**
c. Derive an expression for transfer function of armature controlled DC motor. **(08 Marks)**

Module-2

3 a. Explain the standard test inputs. **(08 Marks)**
b. Define order and type of a system. **(04 Marks)**
c. The response of a system subjected to a unit step input is $C(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$. Obtain the expression for the closed loop transfer function. Also determine the undamped natural frequency and damping ratio of the system. **(08 Marks)**

OR

4 a. Derive the relation for transient response of a second order system. **(10 Marks)**
b. For the control system shown in Fig. Q4 (b), find the percentage overshoot and settling time for a unit step input.

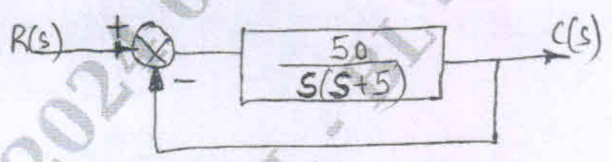


Fig. Q4 (b) **(10 Marks)**

Module-3

5 a. For the system shown in Fig. Q5 (a), determine closed loop transfer function.

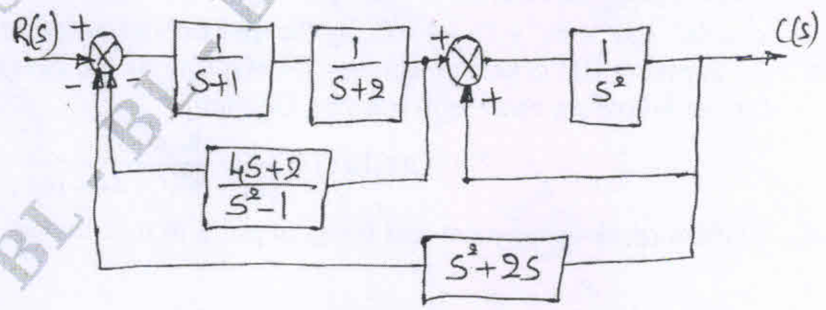


Fig. Q5 (a) **(10 Marks)**

14

b. Find the transfer function for the signal flow graph shown in Fig. Q5 (b), if $G_1 = 5$, $G_2 = G_4 = 10$, $G_3 = 1$, $G_5 = 2$, $H_1 = 1$, $H_2 = 2$, $H_3 = 0.5$ and $H_4 = 1$.

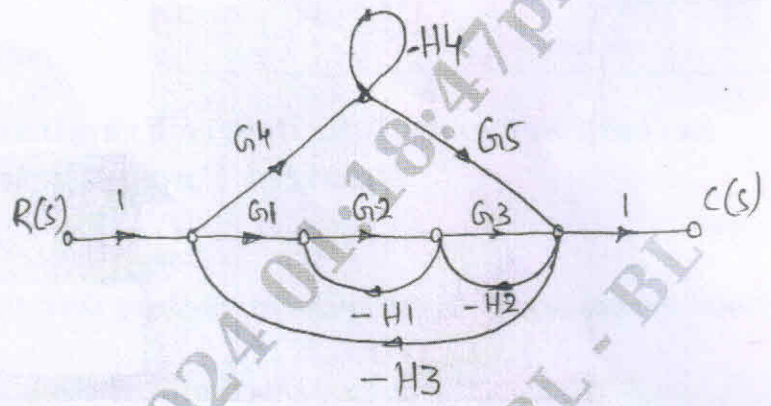


Fig. Q5 (b) **(10 Marks)**

OR

6 a. Draw the signal flow graph for the given block diagram shown in Fig. Q6 (a) and find its control ratio using Mason's gain formula.

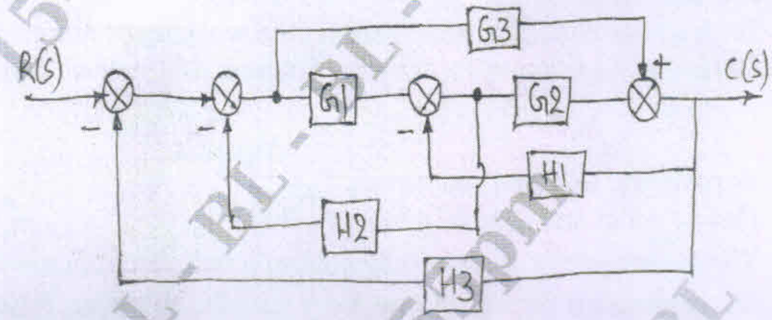


Fig. Q6 (a) **(10 Marks)**

b. Reduce the block diagram shown in Fig. Q6 (b) to its simplest possible form and find its closed loop transfer function.

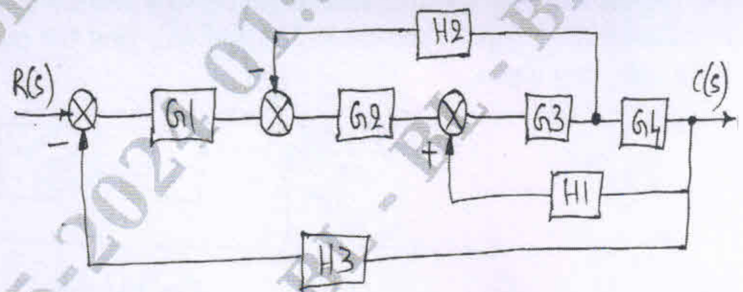


Fig. Q6 (b) **(10 Marks)**

Module-4

7 a. Comment on the stability of the system for the characteristic equation $s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$, by Routh-Hurwitz criterion. **(07 Marks)**

b. By applying RH criterion, discuss the stability of the closed loop system as a function of K for the following open loop transfer function,

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}$$ **(07 Marks)**

c. Explain break away point and break in point in root locus. **(06 Marks)**

OR

8 Construct a root locus for the open loop transfer function, $G(s)H(s) = \frac{k(s+2)}{s(s+1)(s+8)}$. **(20 Marks)**

Module-5

9 a. Sketch the Polar plot for the transfer function, $G(s) = \frac{10}{s(s+1)(s+2)}$. **(08 Marks)**

b. Using Nyquist criterion, investigate the stability of a system whose open loop transfer function is $G(s)H(s) = \frac{K}{(s+1)(s+2)(s+3)}$. **(12 Marks)**

OR

10 a. Explain gain margin and phase margin with sketches. **(04 Marks)**

b. Sketch the Bode plot for the transfer function,

$$G(s) = \frac{Ks^2}{(1+0.02s)(1+0.2s)}.$$

Determine the value of K, for the gain cross over frequency to be 5 rad/sec. **(16 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

18ME72

Seventh Semester B.E. Degree Examination, June/July 2024
Computer Aided Design and Manufacturing

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Define automation. Explain the reasons for automation in brief. **(10 Marks)**

b. An average part produced in a certain batch manufacturing plant must be processed through an average of six machines. 20 new batches are launched each week. Average operation time is 6min, average set up time is 5hr, average non operations time per batch is 10hr / machine and average batch size is 25 parts. There are 18 machines in the plant. The plant operates an average of 70 production hours per week. If the availability is 95%, determine

i) Manufacturing lead time for an average part.
ii) Production rate
iii) Production capacity
iv) Plant utilization
v) Work in process
vi) WIP ratio
vii) TIP ratio. **(10 Marks)**

OR

2 a. What are the symbols used in an automated flow line? **(05 Marks)**

b. Sketch and explain the walking beam transfer mechanism. **(06 Marks)**

c. The ideal cycle time of a 16 station transfer line is 2min. The average downtime is 6 min and the probability of breakdowns per cycle is equal for all cycles and is equal to 0.004. Determine the production rate and line efficiency using upper and lower bound approach. **(09 Marks)**

Module-2

3 a. Explain the functions of graphic package system. **(08 Marks)**

b. List and explain the phases involved in a design process. **(08 Marks)**

c. A point (3, 4) has to be translated at a distance of 6 units in x-axis and 2 units in y-axis. Determine the coordinates of the translated point. **(04 Marks)**

OR

4 a. Explain retrieval CAPP system with the help of a neat block diagram. **(10 Marks)**

b. Explain the various inputs and outputs of a MRP system. **(10 Marks)**

Module-3

5 a. What is group technology? Enumerate the advantages of GT. **(05 Marks)**

b. With a neat block diagram, explain the components of FMS. **(10 Marks)**

c. Define AS/RS and explain any two types of AS/RS system. **(05 Marks)**

OR

6 a. Explain the following:
   i) Total work content
   ii) Cycle time
   iii) Line efficiency. **(06 Marks)**

b. Define line balancing and list its objectives. **(04 Marks)**

c. In a plant, a product is to be assembled as per the following data:

Element	1	2	3	4	5	6	7	8	9	10
Time (min)	6	4	9	3	2	7	5	6	4	7
Precedence	-	1	1	2	2	3	4, 5	3, 5	7, 8	6, 9

   i) Construct precedence diagram.
   ii) If the cycle time is 12 min, calculate the number of stations required.
   iii) Determine the balance delay and balance efficiency of the line using largest candidate rule. **(10 Marks)**

Module-4

7 a. Explain the elements of CNC system with the help of a block diagram. **(10 Marks)**

b. Write a manual part program for multiple turning operation for the component shown in Fig.Q.7(b). **(10 Marks)**

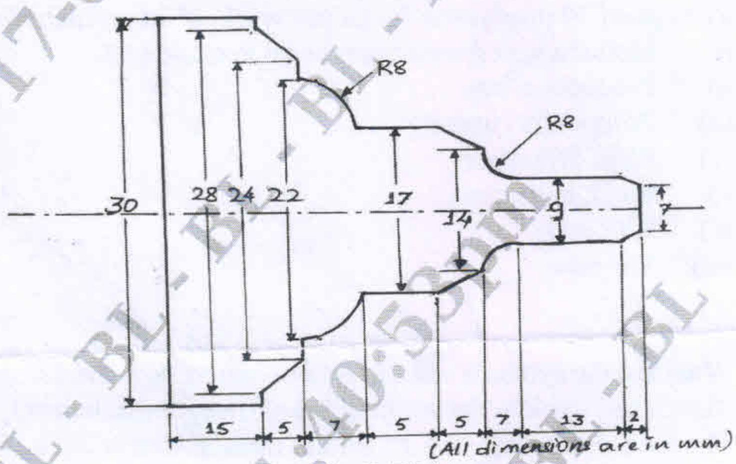


Fig.Q.7(b)

OR

8 a. Explain the following with neat diagram:
   i) Slip sensor
   ii) Range sensor
   iii) Tough sensor
   iv) Proximity sensor
   v) Force and torque sensor. **(10 Marks)**

b. Define robot. Explain the different types of robot joints with neat sketches. **(10 Marks)**

Module-5

9 a. Define additive manufacturing. Explain the steps involved in additive manufacturing process. **(10 Marks)**

b. With a neat sketch, explain photo polymerization process. **(10 Marks)**

OR

10 a. List and explain the components of Industry 4.0 in brief. **(10 Marks)**

b. Define IOT and explain its applications in manufacturing. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

18ME734

Seventh Semester B.E. Degree Examination, June/July 2024
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. Define TQM. Explain how TQM has contributed to the success of Corporate World. **(10 Marks)**

b. Explain any one contribution of Kaoru Ishikawa towards the development of TQM. **(10 Marks)**

OR

2 a. What is ISO Quality Management System? Explain few of its advantages. **(10 Marks)**

b. Explain the concept of MBNQA (Malcolm Baldridge National Quality Award) with a neat block diagram. **(10 Marks)**

Module-2

3 a. List and explain various characteristics of TQM Leaders. **(10 Marks)**

b. Explain the ethics management program used by Corporate World. **(10 Marks)**

OR

4 a. Explain all 7 stages of strategic planning. **(10 Marks)**

b. Explain with an example that has resulted in a good decision and helped a company to grow remarkably. **(10 Marks)**

Module-3

5 a. What is Customer Satisfaction? What are various customer perception of service quality? **(10 Marks)**

b. Explain with an example the KANO diagram to translate needs into requirements. **(10 Marks)**

OR

6 a. Explain different stages of Team development. **(10 Marks)**

b. Explain how performance appraisal can support an organisation for its growth. **(10 Marks)**

Module-4

7 a. Explain Juran's trilogy for improvement of process. **(10 Marks)**

b. Explain 7 Quality control tools. **(10 Marks)**

OR

8 a. Explain the various cases of declaring a process out of control even though the points are within 2 control limits. **(10 Marks)**

b. Explain various caused of variation in a process and what charts are used to plot these variations. **(10 Marks)**

Module-5

9	a.	Explain different types of maintenance.	(10 Marks)
	b.	Explain 5 'S' concept of TPM.	(10 Marks)

OR

10	a.	Explain the concept of Quality by design, with a neat block diagram.	(10 Marks)
	b.	Define EMS. Why EMS is important in present context? Explain.	(10 Marks)

* * * * *

CBCS SCHEME

USN | | | | | | | | | | | 18ME741

Seventh Semester B.E. Degree Examination, June/July 2024
Additive Manufacturing

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Define additive manufacturing. Explain the benefits of additive manufacturing. **(06 Marks)**
b. Explain 3D printing and rapid prototyping. **(06 Marks)**
c. Differentiate between CNC and additive manufacturing. **(08 Marks)**

OR

2 a. Explain the development of additive manufacturing technology. **(10 Marks)**
b. Explain the process chain (Steps) in AM. **(10 Marks)**

Module-2

3 a. With a neat sketch, explain stereo lithography process. **(10 Marks)**
b. Explain briefly powder fusion mechanisms. **(10 Marks)**

OR

4 a. With a neat sketch, explain selective laser sintering process. **(10 Marks)**
b. Explain the basic principles and key features of extrusion based systems. **(10 Marks)**

Module-3

5 a. Explain the evolution of printing as an additive manufacturing process. **(05 Marks)**
b. Explain the technical challenges of printing. **(05 Marks)**
c. With a neat sketch, explain ultrasonic additive manufacturing. **(10 Marks)**

OR

6 a. Explain material delivery system in beam deposition process. **(06 Marks)**
b. Write the benefits and drawbacks of beam deposition process. **(04 Marks)**
c. With a neat sketch, explain direct write thermal spray process. **(10 Marks)**

Module-4

7 a. Explain the selection methods for a part in AM. **(10 Marks)**
b. Illustrate the process of AM select operation. **(10 Marks)**

OR

8 a. Write a short note on:
i) Production planning and control
ii) Problems with STL files. **(10 Marks)**
b. Explain briefly post-processing techniques. **(10 Marks)**

Module-5

9 a. Explain the different strategies and reasons for multiple material approach to an AM process. **(10 Marks)**

b. Explain the use of AM to support medical applications. **(10 Marks)**

OR

10 Write a short note on:

a. Manufacturing vs Prototyping

b. DDM Drivers

c. Align Technology

d. Rapid Tooling. **(20 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

18ME751

Seventh Semester B.E. Degree Examination, June/July 2024
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. Outline with brief explanation the factors effects the India's energy development. **(10 Marks)**

b. Explain the various key energy trends in India. **(10 Marks)**

OR

2 a. Define Energy. List and explain forms of energy and differentiate energy and power. **(10 Marks)**

b. Interpret World Energy scenario with respect to production and consumption using relevant statistics. **(10 Marks)**

Module-2

3 a. List the different types of thermal energy storage system. Explain any two of them. **(10 Marks)**

b. Define Energy Audit. Explain the need for energy audit and mention the various phases of energy audit methodology. **(10 Marks)**

OR

4 a. Discuss the principles of Energy Management. **(10 Marks)**

b. Write a short note on Energy demand estimation. **(06 Marks)**

c. Write a short note on Energy pricing. **(04 Marks)**

Module-3

5 a. Define Ecosystem. List and explain the functions of an Ecosystem. **(10 Marks)**

b. Discuss : i) Food chain ii) Food web iii) Ecological succession iv) Ecological pyramid v) Energy flow. **(10 Marks)**

OR

6 a. Identify the need for public awareness on Environment. Discuss the effort of important institutions and people in Environment Management. **(10 Marks)**

b. List and briefly explain types of Ecosystem. **(10 Marks)**

Module-4

7 a. What is Air Pollution? Explain the main sources and effects of Air Pollution. **(10 Marks)**

b. Discuss Solid Waste Management techniques. **(10 Marks)**

OR

8 a. Discuss on the role of an individual in prevention of pollution. **(10 Marks)**

b. Define and elaborate the cause, effects and control measures of :
i) Soil pollution ii) Noise pollution. **(10 Marks)**

Module-5

9 a. What are the regulating Water Pollution Prevention Act? **(10 Marks)**

b. What is Global Warming? Explain the impact of Global Warming. **(10 Marks)**

OR

10 Discuss :

a. Acid rain. **(05 Marks)**

b. Ozone layer depletion. **(05 Marks)**

c. Wild Life Protection Act. **(05 Marks)**

d. Forest Conservation Act. **(05 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

18ME822

Eighth Semester B.E. Degree Examination, June/July 2024
Tribology

Time: 3 hrs. Max. Marks: 100

Note : 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of Design Data Handbook is permitted.***

Module-1

1 a. List and explain different types of Lubrication. **(10 Marks)**
b. Explain any five desirable properties of an oil. **(10 Marks)**

OR

2 a. Derive an expression for rate of flow through parallel stationary plates. State the assumptions made in deriving the equation. **(10 Marks)**
b. With a neat sketch, explain any two viscosity measuring instruments. **(10 Marks)**

Module-2

3 a. Define Friction. List and explain Friction theories. **(10 Marks)**
b. What are the different methods of measuring frictional force? Explain any one. **(10 Marks)**

OR

4 a. Explain the following types of wear with simple sketch : i) Adhesive wear ii) Abrasive wear iii) Erosive wear iv) Corrosive wear. **(12 Marks)**
b. Briefly explain Wear of Ceramic materials. **(08 Marks)**

Module-3

5 a. Derive an expression for Frictional Force and Co-efficient of friction for lightly loaded Journal bearing stating the assumptions. **(10 Marks)**
b. A lightly loaded Journal bearing has the following data :
Bearing length = 75mm ; Journal diameter = 60mm ;
Diametrical clearance ratio = 0.001 ; Speed = 18000 rpm ; Radial load = 200N ;
Oil used is SAE30 at a operating temperature of 65°C. Calculate the power loss in the Bearing , Torque , Co-efficient of friction. **(10 Marks)**

OR

6 a. Explain with a neat sketch, mechanism of pressure development in an oil film. **(10 Marks)**
b. An idealized Full Journal bearing has the following specifications :
Diameter of the Journal = 50mm ; Length of the Journal = 62.5mm ;
Speed of the Journal = 1200 rpm ; Radial clearance = 0.025mm ;
Average viscosity = 11 CP ; Altitude = 0.8. Determine
i) Check whether the bearing is lightly loaded or heavy loaded.
ii) Load carrying capacity of the bearing.
iii) Total Frictional resistance.
iv) Co-efficient of friction and power loss. **(10 Marks)**

Module-4

7 a. Derive an expression for load carrying capacity of Idealized plane slider bearing. **(10 Marks)**

b. A rectangular plane slider bearing has the following specification :
Bearing length in the direction of motion = 90mm ; Bearing width = 75mm ;
Load = 17850N ; Slider velocity = 2.5m/sec ; Inclination = - 0.00035 radians ;
Mean oil viscosity = 45 CP ; Minimum oil film thickness = 0.02mm.
Find, Load carrying capacity , Frictional force , Power loss in the bearing ,
Co-efficient of friction. **(10 Marks)**

OR

8 a. Derive an equation for load carrying capacity of Hydrostatic lubrication. **(10 Marks)**

b. A hydrostatic step bearing has the following characteristics :
Diameter of the shaft = 152mm ; Diameter of the pocket = 102mm ;
Vertical thrust on the bearing = 45,000N ; External pressure is zero ; Shaft speed = 900 rpm
Assume that viscosity of the lubricant under the operating condition is 24.15 CP and the desirable oil film thickness is 0.127mm. Find
i) Inlet or supply pressure ii) Quantity of oil flow iii) Power loss in the bearing
iv) Frictional force v) Co-efficient of friction vi) Torque on the shaft. **(10 Marks)**

Module-5

9 a. Explain any ten properties of bearing materials. **(10 Marks)**

b. Briefly discuss the common bearing materials that are used in practice. **(10 Marks)**

OR

10 a. What is Surface Engineering? Write a brief history of Surface Engineering. **(10 Marks)**

b. Briefly explain different techniques to achieve Surface modification. **(10 Marks)**

* * * * *

21-IIISem. ME

CBCS SCHEME

USN | | | | | | | | | | |

21ME33

Third Semester B.E. Degree Examination, June/July 2024
Material Science and Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is the difference between crystalline and amorphous materials? What is atomic packing factor? Show that the atomic packing factor for FCC crystal structure is 0.74. **(10 Marks)**

b. Distinguish between metals, ceramics and polymers with respect to bonding. **(05 Marks)**

c. Differentiate between Frankel and Schottky defects. **(05 Marks)**

OR

2 a. Mention the types of Bravias lattices possible in crystalline materials. Show that atomic packing factor for BCC crystal structure is 0.68. **(07 Marks)**

b. Define Burgers vector. Distinguish between edge and screw dislocations. **(07 Marks)**

c. Explain with neat sketch grain boundaries and stacking faults defects. **(06 Marks)**

Module-2

3 a. Explain with suitable examples the following:
i) Gibbs phase rule
ii) Rules of formation of solid solutions **(15 Marks)**
iii) Fick's laws of diffusion. **(05 Marks)**

b. Explain substitutional solid solution with an example.

OR

4 a. Draw Fe-C equilibrium diagram and label all the fields, also explain all the invariant reactions in the system. **(10 Marks)**

b. Discuss two component phase diagram. **(05 Marks)**

c. Discuss with suitable examples ordered substitutional and disordered substitutional solid solutions. **(05 Marks)**

Module-3

5 a. Differentiate between homogeneous and heterogeneous nucleation. **(04 Marks)**

b. Derive an expression for the critical size of the nucleus for homogeneous nucleation. **(06 Marks)**

c. Briefly differentiate the following:
i) Slip and twinning
ii) Recovery and recrystallization. **(10 Marks)**

OR

6 a. Discuss the following strengthening mechanisms:
Solid solution and precipitation hardening. **(08 Marks)**

b. What is meant by heat treatment? Discuss briefly cyaniding and flame hardening. **(12 Marks)**

Module-4

7 a. Write a note on corrosion as it pertains to materials. **(05 Marks)**

b. Discuss metallic and organic coating applied to metals for corrosion prevention. **(10 Marks)**

c. List the advantages and disadvantages of surface coatings. **(05 Marks)**

OR

8 a. Discuss briefly steps in powder metallurgy. **(10 Marks)**

b. Discuss briefly the applications of powder metallurgy. **(06 Marks)**

c. List the methods normally used for the production of metal powders. **(04 Marks)**

Module-5

9 a. Explain briefly the need for material selection in design. **(08 Marks)**

b. Discuss briefly related to material selection and design:

i) Evolution of engineering materials

ii) Design tools and material data. **(12 Marks)**

OR

10 Write a note on:

a. Processing of obtaining material data

b. Material property charts

c. Selection criteria for materials

d. Materials data bases. **(20 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME34

Third Semester B.E. Degree Examination, June/July 2024
Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of Thermodynamics data handbook is permitted.***

Module-1

1 a. State Zeroth law of thermodynamics and state its significance. **(06 Marks)**
b. Derive an expression for work done during polytropic process. **(08 Marks)**
c. Prove that work and heat are path function. **(06 Marks)**

OR

2 a. Give the precise statement of first law of thermodynamics as applied to a closed system undergoing a process and hence prove that internal energy is a property. **(12 Marks)**
b. Clearly write the steady flow energy equation for an open system and explain the terms involved. Apply steady flow energy equation to:
(i) Turbine (ii) Steam nozzle (iii) Heat exchanger **(08 Marks)**

Module-2

3 a. Explain the limitations of first law of thermodynamics. **(06 Marks)**
b. Explain the Kelvin-Plank statement of the second law of thermodynamics. Explain the PMM I and PMM II Kind. **(08 Marks)**
c. A reversible heat engine operates with two environments. In the first it draws 12000 KW from a source at 400°C and in the second it draws 25000 KW from a source at 100°C. In both operations the engine rejects heat to a thermal sink at 20°C. Determine the operation in which the engine delivers more power. **(06 Marks)**

OR

4 a. Explain the Clausius statement of second law of thermodynamics. Explain the Carnot cycle with P-V and T-S diagram. **(10 Marks)**
b. Prove that entropy is a property. Explain available energy. **(06 Marks)**
c. A rigid tank contains air at 35°C and is stirred by a paddle wheel which does 500 kJ of work on the air. During the stirring process, the temperature of air remains constant because of heat transfer to surroundings at 15°C. Estimate the change in entropy of air in the tank and the change is entropy of the surroundings. **(04 Marks)**

Module-3

5 a. Clearly distinguish between ideal and real gases. Mention any two equations you know off. **(06 Marks)**
b. Write a note on compressibility factor. **(04 Marks)**
c. State Dalton's law of partial pressure and derive an expression for the gas constant of a mixture of ideal gases. **(06 Marks)**
d. A gas mixture consists of 6 Kmol of H_2 and 4 Kmol of N_2. Determine the mass of each gas and the gas constant of the mixture. **(04 Marks)**

OR

6 a. Explain the following terms with reference to a combustion process:
(i) Enthalpy of formation
(ii) Enthalpy and internal energy of combustion
(iii) Adiabatic flame temperature
(iv) Combustion efficiency **(08 Marks)**

b. A blast furnace gas has the following volumetric composition:
$CO_2 = 11\%$, $CO = 27\%$, $H_2 = 2\%$ and $N_2 = 60\%$
Find the theoretical volume of air required for the complete combustion of 1 m^3 of the gas. Find the percentage composition of dry flue gases by volume. Assume that air contains 21% of O_2 and 79% of N_2 by volume. **(12 Marks)**

Module-4

7 a. Define the following: (i) Pure substance (ii) Triple point (iii) Critical point **(06 Marks)**

b. Briefly explain what you understand by two property rule. **(04 Marks)**

c. Define dryness fraction and briefly explain how one could estimate the same using separating and throttling calorimeter. **(06 Marks)**

d. A rigid container is filled with steam at 600 kPa and 200°C. At what temperature the steam begins to condense when cooled? Determine the corresponding pressure. **(04 Marks)**

OR

8 a. List out the factors affecting the efficiency of the Rankine cycle. **(05 Marks)**

b. Compare the Rankine and the Carnot cycles of steam power plants. **(05 Marks)**

c. In a steam power cycle, the steam supply is at 15 bar and dry saturated. The condenser pressure is 0.4 bar. Calculate Carnot and Rankine efficiency of the cycle neglect the pump work. **(10 Marks)**

Module-5

9 a. Compare the Otto, diesel and dual cycles on P-V diagram and T-S diagrams, when heat is supplied to each cycle is same. **(10 Marks)**

b. Derive air standard efficiency for dual combustion cycle. **(10 Marks)**

OR

10 a. With a schematic diagram, explain a closed cycle gas turbine. **(10 Marks)**

b. Consider on air standard cycle in which air enters the compressor at 1 bar and 20°C, the pressure of air leaving the compressor is 3.5 bar and temperature at turbine inlet is 600°C, determine per kg of air.
(i) Thermal efficiency
(ii) Heat supplied
(iii) Work available at the shaft
(iv) Heat rejected to the cooler
(v) Temperature of air leaving the turbine
(vi) Work ratio
Take $\gamma = 1.4$ and $C_p = 1.005$ kJ/kg°K. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | 2 | BL | 21 | CV | 019 |

21MAT31

Third Semester B.E. Degree Examination, June/July 2024
Transform Calculus, Fourier Series & Numerical Techniques

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the Laplace Transform of, $\left(\frac{4t+5}{e^{2t}}\right)^2$. **(06 Marks)**

b. The square wave function f(t) with period 2a is defined by,
$f(t) = t\ ;\ 0 \le t \le a$
$= 2a - t\ ;\ a \le t \le 2a$
Find L[f(t)]. **(07 Marks)**

c. Evaluate $L^{-1}\left[\frac{s^2}{(s^2+a^2)^2}\right]$ by applying convolution theorem. **(07 Marks)**

OR

2 a. Find inverse Laplace transform $\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$. **(06 Marks)**

b. Express the following function in terms of unit step function and hence find the Laplace transform.
$f(t) = 1;\ 0 < t \le 1$
$= t;\ 1 \le t \le 2$
$= t^2;\ t > 2$. **(07 Marks)**

c. Applying Laplace transform, solve the differential equation,
$y''(t) + 4y'(t) + 4y(t) = e^{-t}$,
Subject to the condition $y(0) = y'(0) = 0$. **(07 Marks)**

Module-2

3 a. Obtain the Fourier series of $f(x) = x^2$ over the interval $[-\pi, \pi]$, hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots + \infty$. **(06 Marks)**

b. Obtain the half range sine series of the function, $f(x) = x$ in the interval (0, 2). **(07 Marks)**

c. Obtain the constant term and co-efficient of first cosine and sine terms in the expansion of y from the following table :

x	0°	60°	120°	180°	240°	300°	360°
y	7.9	7.2	3.6	0.5	0.9	6.8	7.9

(07 Marks)

OR

4 a. Find the Fourier series of $f(x) = 2 - x\ ;\ 0 \le x \le 4$
$x - 6\ ;\ 4 \le x \le 8$ **(06 Marks)**

b. Obtain the half range sine series of the function, $f(x) = x^2$ over $(0, \pi)$. **(07 Marks)**

c. Obtain a_0, a_1, b_1 in the Fourier expansion of y using harmonic analysis for the data given,

x	0	1	2	3	4	5
y	9	18	24	28	26	20

(07 Marks)

Module-3

5 a. Find the Fourier sine and cosine transforms of $f(x) = e^{-\alpha x}$; $\alpha > 0$. **(06 Marks)**

b. Obtain the inverse z-transform of, $\frac{2z^2 + 3z}{(z^2 - 2z - 8)}$. **(07 Marks)**

c. Find the Fourier transform of,

$f(x) = x^2$; $|x| < a$

$= 0$; $|x| > a$

where a is +ve constant. **(07 Marks)**

OR

6 a. Find the Complex Fourier transform of the function,

$f(x) = 1$ for $|x| \le a$

$= 0$ for $|x| > a$

Hence deduce, evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(06 Marks)**

b. Evaluate $Z_T\left[2n + \sin\left(\frac{n\pi}{4}\right) + 1\right]$. **(07 Marks)**

c. Solve the difference equation, $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using Z-Transform. **(07 Marks)**

Module-4

7 a. Classify the following partial differential equation,

(i) $\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 4\frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$.

(ii) $x^2 \frac{\partial^2 u}{\partial x^2} + (1 - y^2)\frac{\partial^2 u}{\partial y^2} = 0, -\infty < x < \infty, -1 < y < 1$.

(iii) $(1 + x^2)\frac{\partial^2 u}{\partial x^2} + (5 + 2x^2)\frac{\partial^2 u}{\partial x \partial t} + (4 + x^2)\frac{\partial^2 u}{\partial t^2} = 0$

(iv) $(x + 1)\frac{\partial^2 u}{\partial x^2} - 2(x + 2)\frac{\partial^2 u}{\partial x \partial y} + (x + 3)\frac{\partial^2 u}{\partial y^2} = 0$ **(10 Marks)**

b. Find the numerical solution of the parabolic equation $\frac{\partial^2 u}{\partial x^2} = 2\frac{\partial u}{\partial t}$, using Schmidt formula. Given $u(0, t) = 0 = u(4, t)$ and $u(x, 0) = x(4 - x)$ by taking h = 1 find the values upto t = 5. **(10 Marks)**

OR

8 a. Solve $u_{xx} + u_{yy} = 0$ in the following square region with the boundary conditions as indicated in the Fig. Q8 (a). **(10 Marks)**

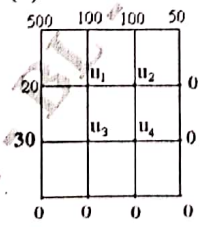


Fig. Q8 (a)

b. Solve numerically $u_{xx} = 0.0625\, u_{tt}$, subject to the conditions $u(0, t) = 0 = u(5, t)$, $u(x, 0) = x^2(x - 5)$ and $u_t(x, 0) = 0$ by taking $h = 1$ for $0 \le t \le 1$. **(10 Marks)**

Module-5

9 a. Use Runge-Kutta method to find y(0.2) for the equation, $\frac{d^2y}{dx^2} - x\frac{dy}{dx} - y = 0$. Given that $y = 1$, $y' = 0$ when $x = 0$. **(06 Marks)**

b. Find the curves on which the function, $\int_0^1 \{(y')^2 + 12xy\}dx$ with $y(0) = 0$ and $y(1) = 1$ can be extremised. **(07 Marks)**

c. Derive the Eulers equation in the form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$ **(07 Marks)**

OR

10 a. Solve the differential equation $y'' + xy' + y = 0$ for $x = 0.4$, using Milne's predictor-corrector formula given that, **(06 Marks)**

x	0	0.1	0.2	0.3
y	1	0.995	0.9802	0.956
$\frac{dy}{dx}$	0	-0.0995	-0.196	-0.2863

b. Find the curve on which functional $\int_0^{\frac{\pi}{2}} [(y')^2 - y^2 + 2xy]dx$ with $y(0) = y\left(\frac{\pi}{2}\right) = 0$ can be extremized. **(07 Marks)**

c. Prove that shortest distance between two points in a plane is a straight line. **(07 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME32

Third Semester B.E. Degree Examination, June/July 2024
Metal Casting, Forming and Joining Processes

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the various processes available for manufacturing a product with an example for each process. **(10 Marks)**

b. Explain the classification of Metals used in Foundry. Name the factors that determine the selection of a casting alloy. **(10 Marks)**

OR

2 a. Name the types of base sand used in moulding? What are requirements of base sand? **(10 Marks)**

b. Explain concept of Gating? What are open and blind risers? **(10 Marks)**

Module-2

3 a. Explain the classification of melting furnaces? How to find efficiency of Cupola. **(10 Marks)**

b. Name and explain the types of centrifugal casting processes with simple diagram for each. **(10 Marks)**

OR

4 a. Compare Coreless Induction furnace with Resistance furnace with simple sketch and naming. **(10 Marks)**

b. Discuss various casting defects, their causes and remedies. **(10 Marks)**

Module-3

5 a. Name and explain yield criteria with regards to metal forming processes. **(10 Marks)**

b. Explain stress-strain relation with regards to mechanical behavior of metal. **(10 Marks)**

OR

6 a. Explain bulk forming processes with an example for each. **(10 Marks)**

b. Write in brief about compound die and progressive die with sketch. **(10 Marks)**

Module-4

7 a. Explain Manual Arc Welding with a simple diagram. **(10 Marks)**

b. Explain the types of flames with their characteristics used in Gas welding. **(10 Marks)**

OR

8 a. Explain Gas-Tungsten arc welding process with a neat sketch. **(10 Marks)**

b. Explain submerged arc welding process with sketch. **(10 Marks)**

Module-5

9 a. Explain various welding defects with remedies. **(10 Marks)**

b. What is the difference between Brazing, Soldering and Welding? Explain. **(10 Marks)**

OR

10 a. Explain Friction stir welding process? Mention the applications of FSW. **(10 Marks)**

b. What are thermal effects occurring in welding processes. **(10 Marks)**

* * * * *

21 - IV Sem. ME

CBCS SCHEME

USN | | | | | | | | | | |

21ME42

Fourth Semester B.E. Degree Examination, June/July 2024
Machining Science and Jigs & Fixtures

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. write a neat sketch wherever necessary.
3. Missing data, if any, may be suitably assumed.

Module-1

1 a. With a line at diagram explain the construction and working of an engine lathe. **(08 Marks)**

b. List the various operations that can be performed in a lathe and explain any two methods of taper turning process. **(06 Marks)**

c. Explain the different operations that can be performed on a drilling machine. **(06 Marks)**

OR

2 a. Differentiate between drilling machine and milling machine. **(06 Marks)**

b. Differentiate between up milling and down milling process. **(06 Marks)**

c. With a neat sketch explain construction of CNC milling machine. **(08 Marks)**

Module-2

3 a. Differentiate between orthogonal and oblique cutting process. **(04 Marks)**

b. With usual notations prove that, where Q is shear angle r – chip thickness ratio and α rake angle. **(06 Marks)**

c. In an orthogonal cutting the following observations were made :

Pipe diameter	100mm
Pipe thickness	0.3mm
Cutting speed	200m/min
Feed	0.26mm/rev
Cutting force	1000N
Feed force	600N
Chip thickness	0.3mm
Contact length	1mm
Power consumed	2KW

Back rake angle = 10° (negative) = –10°.
Calculate the shear strain and shear energy. **(10 Marks)**

OR

4 a. With the help of merchant circle diagram desire an expansion for co-effcient of friction and show that $\mu = \left[\frac{F_c \tan\alpha F_T}{F_c - F_r \tan\alpha}\right]$. **(06 Marks)**

b. Explain the different zones of heat generation and the parameters influencing in heat generation in metal cutting. **(06 Marks)**

c. What is cutting fluid? What are requirements of ideal cutting fluid and list–factors for selection of cutting fluid? **(08 Marks)**

Module-3

5 a. What is tool wear and explain different types of tool wear with a neat sketch. **(08 Marks)**

b. What is tool life and explain Taylor's tool life equation. **(04 Marks)**

c. A 50mm dia M S Rod is turned at 300rpm. The tool failure occurs in 10 mins the speed was changed to 200 rpm and the tool failure occurred offer 50 mins. Calculate the cutting speed to obtain the fool life of 30 mins. **(08 Marks)**

OR

6 a. Explain the variables affecting tool life. **(06 Marks)**

b. Explain any two of the following finishing process :
   i) Honing
   ii) Capping
   iii) Power coating **(08 Marks)**

c. What is machinability index?
   i) Explain
   ii) Galvanizing. **(06 Marks)**

Module-4

7 a. Explain the process parameters in abrasive jet machining process that affect surface finish of machined surface and MRR. **(06 Marks)**

b. Explain the later beam machining with a neat sketch. **(07 Marks)**

c. Explain electron bean machining process with its advantage, limitations and applications. **(07 Marks)**

OR

8 a. With a neat sketch explain the electro chemical machining and discuss about tool design in ECM. **(06 Marks)**

b. Explain the principle of EDM electric discharge machining. What are the functions and dielectric fluid in EDM process? Mention advantages and limitations of EDM process. **(08 Marks)**

c. Explain the following process with a neat sketch :
   i) Ultrasonic assisted electric discharge machining (UAEDM)
   ii) Electro discharge grinding. **(06 Marks)**

Module-5

9 a. Differentiate between Jigs and fixtures. **(04 Marks)**

b. Explain the factors to be considered for design of Jibs of fixtures. **(06 Marks)**

c. With a sketch explain leaf drill. **(10 Marks)**

OR

10 With a sketch explain any two of the following fixtures in detail :
   a. Turning fixture
   b. Milling fixture
   c. Welding fixture
   d. Fixtures for indexing. **(20 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME44

Fourth Semester B.E. Degree Examination, June/July 2024
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following terms:
(i) Stress (ii) Strain (iii) Young's modulus
(iv) Poisson's ratio (v) Hooke's law **(05 Marks)**

b. Derive an expression for the total elongation of a tapered circular bar cross section of diameter 'D' and 'd' subjected to an axial load 'p'. **(05 Marks)**

c. A bar of 800 mm length is attached rigidly at A and B as shown in Fig.Q1(c). Determine reaction at both ends and stress in each portion. Bar diameter is 25 mm and Young's modulus E = 200 MPa.

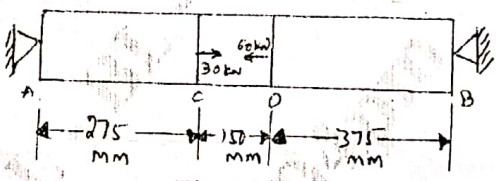


Fig.Q1(c) **(10 Marks)**

OR

2 a. A steel rail is 12.6 m long and is laid at a temperature of 24°C. The maximum temperature is expected to raise to 44°C.
(i) Estimate the minimum gap between the rails to be left so that temperature stress do not develop.
(ii) If the stress developed is 20 N/mm^2, what is the gap left between the rails?
Take E = 2×10^5 N/mm^2 and $\alpha = 12 \times 10^{-6}$/°C **(10 Marks)**

b. Derive a relation between modulus of elasticity and modulus of rigidity. **(10 Marks)**

Module-2

3 a. Derive the expression for normal stress and tangential stress or a plane inclined at 0 to the vertical axis in a biaxial stress system with shear stress. **(08 Marks)**

b. State of stress at a point in a strained material is as shown in Fig.Q3(b). Determine:
(i) Direction of principal plane and magnitude of principal stresses
(ii) Maximum shear stress and its directions
(iii) Sketch and indicate above planes.

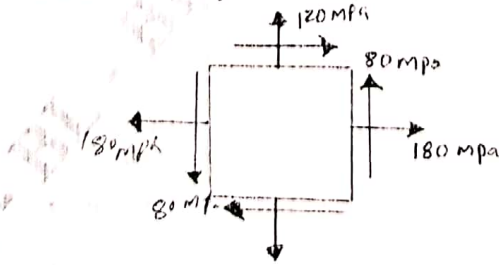


Fig.Q3(b) **(12 Marks)**

OR

4 The state of stress at a point in a strained material is shown in Fig.Q4. Determine:
(i) Direction of principal plane and magnitude of principal stress.
(ii) Direction of maximum shear stress and its magnitude
(iii) Draw Mohr's circle to verify the results obtained analytically

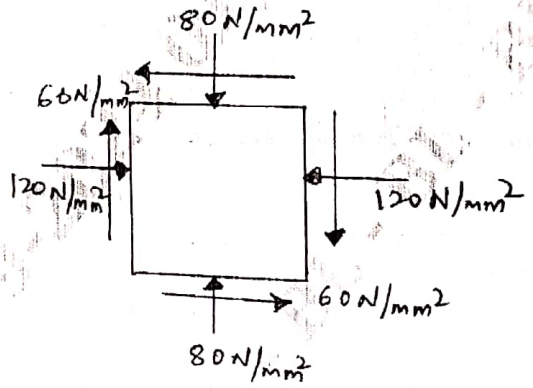


Fig.Q4 **(20 Marks)**

Module-3

5 a. A cantilever of length 2m carries an uniform distributed load of 1 kN/m run over a length of 1.5 m from the free end. Draw the shear force and bending moment diagram for the cantilever beam. **(06 Marks)**

b. Draw the BMD and SFD for the overhanging beam shown in Fig.Q5(b). Find also point of contraflexure with corresponding value of bending moment.

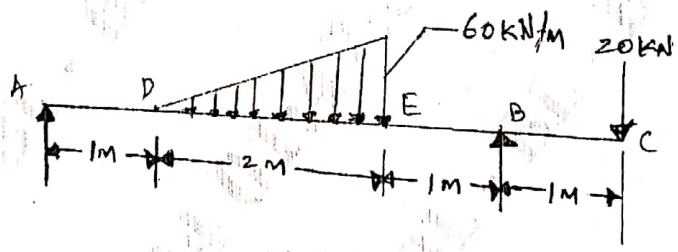


Fig.Q5(b) **(14 Marks)**

OR

6 a. Prove the relation $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$ with usual notations. **(10 Marks)**

b. Fig.Q6(b) shows the cross-section of a beam which is subjected to a shear force of 20 kN. Draw shear stress distribution across depth marking values at salient points.

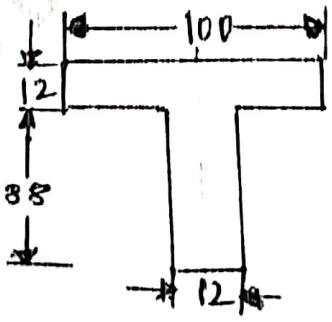


Fig.Q6(b) All dimension are in mm **(10 Marks)**

Module-4

7 a. Derive an expression for deflection, slope and maximum deflection of simply supported beam of span 'L' subjected to a concentrated load W at its mid span using differential equation for deflection. **(10 Marks)**

b. A simply supported beam of 6m span is subjected to a point load of 18 kN at 4 m from left support. Calculate:

(i) The position and the value of maximum deflection

(ii) Slope at mid-span

Assume E = 200 GPa and I = 15×10^6 mm^4. **(10 Marks)**

OR

8 a. Derive the torsional equation for a circular shaft with usual notations. State the assumptions made. **(10 Marks)**

b. A shaft is required to transmit 245 KW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40 N/mm^2 and the twist 1° per metre length. Determine the diameter required if shaft is hollow with external diameter twice the internal diameter. Take modulus of rigidity, G = 80 kN/mm^2. **(10 Marks)**

Module-5

9 a. A thick cylinder of outside diameter 300 mm and internal diameter 200 mm is subjected to an internal fluid pressure of 14 N/mm^2. Determine the maximum hoop stress developed in the cross section. Sketch the variation of hoop stress across the thickness of the cylinder. **(10 Marks)**

b. What is strain energy? Explain in brief. **(05 Marks)**

c. Obtain an expression for strain energy due to shear stress. **(05 Marks)**

OR

10 a. State the assumptions made while deriving Euler's column formula. Also derive Euler's expression of buckling for column with both ends hinged. **(10 Marks)**

b. A hollow cast from iron whose outside diameter is 200 mm and has a thickness of 20 mm is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankine's formulae with factor of safety 2.5. Find the ratio of Euler's to Rankine's loads. Assume E = 1×10^5 N/mm^2, Rankine's constant = 1/1600 for both ends pinned and f_c = 550 N/mm^2. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | |

21MATME41

Fourth Semester B.E. Degree Examination, June/July 2024
Complex Analysis, Probability and Linear Programming

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Show that $w = f(z) = \log z$ $(z \neq 0)$ is analytic, using Cauchy – Riemann equation and find $\frac{dw}{dz}$ **(06 Marks)**

b. Derive Cauchy – Riemann equation in Cartesian form. **(07 Marks)**

c. Find the analytic function f(z) whose imaginary part is $e^x(x \sin y + y \cos y)$ **(07 Marks)**

OR

2 a. Show that $f(z) = \cosh z$ is analytic and hence find $f'(z)$. **(06 Marks)**

b. If f(z) is analytic function show that $\left(\frac{\partial}{\partial x}|f(z)|\right)^2 + \left(\frac{\partial}{\partial y}|f(z)|\right)^2 = |f'(z)|^2$ **(07 Marks)**

c. Find the analytic functions whose real part is $\frac{x^4 - y^4 - 2x}{x^2 + y^2}$. Hence determine V. **(07 Marks)**

Module-2

3 a. Discuss the transformation $w = e^z$. **(06 Marks)**

b. State and prove Cauchy's integral formula. **(07 Marks)**

c. Find the bilinear transformation which maps the points z = 1, i, –1 in to w = 2, i, –2. **(07 Marks)**

OR

4 a. Find the bilinear transformation which maps the points $z = \infty$, i, 0 into w = –1, –i, 1. **(06 Marks)**

b. Discuss the transformation $w = z + \frac{1}{z}$. **(07 Marks)**

c. Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z+1)^2(z-2)} dz$, where C is the circle (i) $|z| = 3$, (ii) $|z| = \frac{1}{2}$ **(07 Marks)**

Module-3

5 a. The probability density function of a variate X is given by the following table.

x	0	1	2	3	4	5	6
P(x)	K	3K	5K	7K	9K	11K	13K

Find K. Also find $P(x \geq 5)$ and $P(3 < x \leq 6)$ **(06 Marks)**

b. Find the Mean and Variance of a Poisson distribution. **(07 Marks)**

c. The number of telephone lines busy at an instant of time is binomial variate with probability 0.1 that a line is busy if 10 lines are choosen at random, what is the probability that (i) no line is busy (ii) all lines are busy (iii) atleast one line is busy (iv) atmost 2 lines are busy. **(07 Marks)**

OR

6 a. The probability density function of a random variable X is

$$f(x) = \begin{cases} Kx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$$

Find (i) the value of K, (ii) $P(1 < x < 2)$, (iii) $P(x \leq 1)$ **(06 Marks)**

b. Find the mean and variance of binomial distribution. **(07 Marks)**

c. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviations. Find the number of students whose marks will be
(i) Less than 65, (ii) More than 75 (iii) Between 65 and 75. **(07 Marks)**

Module-4

7 a. Using the Simplex method to solve the L.P.P.
Maximize $Z = 5x_1 + 7x_2$
Subject to constraint $x_1 + x_2 \leq 4$
$3x_1 - 8x_2 \leq 24$
$10x_1 + 7x_2 \leq 35$
and $x_1, x_2 \geq 0$ **(10 Marks)**

b. Use Big-M method to solve the L.P.P.
Maximize $Z = -2x_1 - x_2$
Subject to constraint $3x_1 + x_2 = 3$
$4x_1 + 3x_2 \geq 3$
$x_1 + 2x_2 \leq 4$
and $x_1, x_2 \geq 0$ **(10 Marks)**

OR

8 a. Define the following terms :
i) A linear Programming problems
ii) Basic solution
iii) Basic feasible solution
iv) Optional solution
v) Artificial variables of an LPP. **(10 Marks)**

b. Use Big-M method to solve the LPP.
Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$
Subject to constraints $x_1 + 2x_2 + 3x_3 = 15$
$2x_1 + x_2 + 5x_3 = 20$
$x_1 + 2x_2 + x_3 + x_4 = 10$
$x_1, x_2, x_3, x_4 \geq 0$ **(10 Marks)**

Module-5

9 a. Find the feasible solution to the following transportation problem using North West corner method.

	D_1	D_2	D_3	D_4	
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
	6	10	15	4	

(10 Marks)

b. The processing time in hours for the Jobs when allocated to the different machines are indicated below. Assign the machines for the Jobs so that the total processing time is minimum.

		Machines				
		M_1	M_2	M_3	M_4	M_5
Jobs	J_1	9	22	58	11	19
	J_2	43	78	72	50	63
	J_3	41	28	91	37	45
	J_4	74	42	27	49	39
	J_5	36	11	57	22	25

(10 Marks)

OR

10 a. Solve the following transportation problem by least cost method.

5	4	3	6
4	7	6	8
2	5	8	12
8	6	7	4
8	10	12	

(10 Marks)

b. Four jobs are to be done on four different machines. The cost (in rupees) of producing i^{th} Job on the J^{th} machine is given below.

		Machines			
	J\ M	M_1	M_2	M_3	M_4
Jobs	J_1	15	11	13	15
	J_2	17	12	12	13
	J_3	14	15	10	14
	J_4	16	13	11	17

Assign the Jobs to different machines so as to minimize the total cost. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21MAT41

Fourth Semester B.E. Degree Examination, June/July 2024
Complex Analysis, Probability and Statistical Methods

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Normal distribution tables can be permitted.
3. Use of Students distribution tables can be permitted.

Module-1

1 a. Derive the C-R equations in Polar form. **(06 Marks)**

b. Construct the analytic function whose real part is $\psi = x^2 - y^2 + \frac{x}{x^2+y^2}$. **(07 Marks)**

c. If f(z) is a regular function, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$. **(07 Marks)**

OR

2 a. State and prove the Cauchy's integral formula. **(06 Marks)**

b. Show that $f(z) = e^x(\cos y + i \sin y)$ is analytic and find its derivative. **(07 Marks)**

c. Evaluate $\int_C \frac{e^{2z}}{(z-1)(z-2)}dz$, where $C: |z| = 3$. **(07 Marks)**

Module-2

3 a. Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. **(06 Marks)**

b. Prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$, $\alpha \neq \beta$. **(07 Marks)**

c. Express $x^3 - 5x^2 + x + 2$ in terms of Legendre's polynomial. **(07 Marks)**

OR

4 a. Show that $J_{-n}(x) = (-1)^n J_n(x)$. **(06 Marks)**

b. Prove that $P_4(x) = \frac{1}{8}(35x^4 - 30x^2 + 3)$. **(07 Marks)**

c. Show that $x^3 - 5x^2 + x + 2 = \frac{2}{5}P_3(x) - \frac{10}{3}P_2(x) + \frac{8}{5}P_1(x) + \frac{1}{6}P_0(x)$. **(07 Marks)**

Module-3

5 a. Find the regression line y on x and calculate y when x = > 0.

x:	71	68	66	67	70	71	70	73	72	65	66
y:	69	64	65	63	65	62	65	64	66	59	62

(06 Marks)

b. Ten participants in a contest are ranked by two judges as follows:

x:	1	6	5	10	3	2	4	9	7	8
y:	6	4	9	8	1	2	3	10	5	7

Calculate the rank co-efficient of correlation. **(07 Marks)**

c. Fit a curve $y = ax^b$ from the following data :

x:	1	2	3	4	5
y:	0.5	2.0	4.5	8.0	12.5

(07 Marks)

OR

6 a. Given the equation of the lines $8x - 10y + 66 = 0$ and $40x - 18y = 214$. Compute the mean's of x and y, the coefficient of correlation and find σ_y if $\sigma_x = 3$. **(06 Marks)**

b. Fit a second degree parabola $y = ax^2 + bx + c$ in the least squares for the following data :

x :	1	2	3	4	5
y :	10	12	13	16	19

(07 Marks)

c. Find the lines of regression of the following data :

x :	1	2	3	4	5	6	7
y :	9	8	10	12	11	13	14

(07 Marks)

Module-4

7 a. A random variable X has the following probability density function :

X :	-2	-1	0	1	2	3
P(X) :	0.1	K	0.2	2K	0.3	K

Find the value of K, mean and variance. **(06 Marks)**

b. Derive the mean and variance of Binomial distribution. **(07 Marks)**

c. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students whose marks will be, (i) less than 65 (ii) more than 75 (iii) between 65 and 75. **(07 Marks)**

OR

8 a. A random variable X has the pdf $f(x) = \begin{cases} Kx^2, & -3 < x < 3 \\ 0, & \text{elsewhere} \end{cases}$

Evaluate K, find (i) $P(1 \le x \le 2)$ (ii) $P(x \le 2)$ (iii) $P(x > 1)$. **(06 Marks)**

b. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals more than two will get a bad reaction. **(07 Marks)**

c. In an examination 7% of students score less than 35 marks and 89% of students score less than 60 marks. Find the mean and standard deviation, if the marks are normally distributed. **(07 Marks)**

Module-5

9 a. The following joint probability distribution of the random variable X and Y as follows:

X \ Y	1	3	9
2	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$
4	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$

Determine the marginal distributions of X and Y. Find (i) E(X) and E(Y) (ii) COV(X, Y). **(06 Marks)**

b. A sample of 900 items has mean 3.4 and S.D 2.61. Can the sample be regarded from population with mean 3.25 at 5% LOS? **(07 Marks)**

c. The theory predicts the proportion be in the four groups G_1, G_2, G_3, G_4 should be in the ratio 9 : 3 : 3 : 1. In experiment with 1600 beans the numbers in the groups were 882, 313, 287 and 118. Do the experimental result support the theory. **(07 Marks)**

OR

10 a. Define the terms : (i) Type – I and Type – II errors (ii) Null hypothesis (iii) Level of significance. **(06 Marks)**

b. A machinist is making engine parts with axle diameter of 0.7 inch. A random sample of 10 parts shows mean diameter 0.742 inch with S.D. of 0.04 inch. On the basis of this sample would you say that the work is inferior? **(07 Marks)**

c. Fit a Poisson distribution to the following data is and test for its goodness of fit at 5% LOS.

x	0	1	2	3	4
y	419	352	154	56	19

(07 Marks)

* * * * *

D/ 21' V sem · ME

CBCS SCHEME

USN | | | | | | | | | | | **21ME51**

Fifth Semester B.E. Degree Examination, June/July 2024
Theory of Machines

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following :
(i) Mechanism
(ii) Machine
(iii) Link
(iv) Kinematic pair.
(v) Degree of freedom. **(10 Marks)**

b. Explain with a neat diagram, the crank and slotted lever mechanism. **(10 Marks)**

OR

2 a. What is completely constrained motion and partially constrained motion? Explain with example. **(04 Marks)**

b. In a Slider crank mechanism, the crank OB is 30 mm long and the connecting rod BC is 120 mm long. The crank rotates at a uniform speed of 300 rpm clockwise about center 'O'. For a crank position $\angle BOC$ equal to 60 degree, draw the configuration and find
(i) Velocity of position C and angular velocity of connecting rod BC.
(ii) Acceleration of Piston C and angular acceleration of connecting rod BC. **(16 Marks)**

Module-2

3 a. Discuss the static equilibrium of,
(i) Two forces.
(ii) Three forces.
(iii) Member with two forces and a torque. **(06 Marks)**

b. A four bar mechanism under the action of two external forces is shown in Fig. Q3 (b). Find the required input torque on the link AB for static equilibrium. The dimensions of the links are AB = 50 mm, BC = 66 mm, CD = 55 mm, CE = 25 mm, CF = 30 mm, angle BAD = 60° and AD = 100 mm.

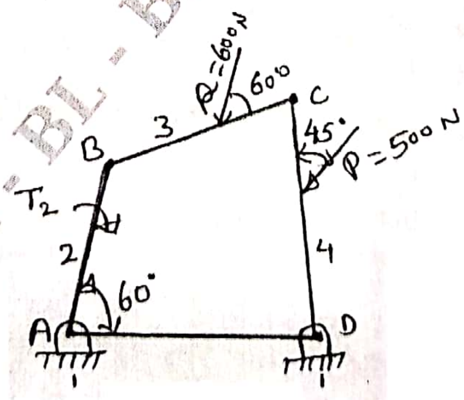


Fig. Q3 (b) **(14 Marks)**

OR

4 a. State and explain D'Alembert's principle. **(06 Marks)**

b. When the crank is 45 degree from the inner dead centre on the down stroke, the effective steam pressure on the piston of a vertical steam engine is 2.5 bars. The diameter of the cylinder = 0.75 m, Stroke of the piston = 0.50 m and length of the connecting rod = 1 m. Determine the torque on the crank shaft, if the engine runs at 350 rpm and the mass of the reciprocating parts is 200 kg. **(14 Marks)**

Module-3

5 a. State and prove the law of gearing for constant velocity ratio. **(10 Marks)**

b. Two involute gears with number of teeth 28 and 45 are in mesh. If they have standard addendum of 3 mm and pressure angle is 20 degree, find the following :

(i) Path of approach
(ii) Path of recess
(iii) Contact ratio.

Assume module is 3 mm. **(10 Marks)**

OR

6 The arm C of an epicyclic gear train rotates at 100 rpm in anticlockwise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B, if wheel A instead of being fixed makes 200 rpm clockwise? **(20 Marks)**

Module-4

7 a. Explain briefly static balance and dynamic balance as applied to revolving masses in different planes. **(06 Marks)**

b. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm respectively. The distance from the plane A are 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y, the distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses at a radius of 100 mm, find their magnitudes and angular positions. **(14 Marks)**

OR

8 a. With usual notations, explain the primary and secondary unbalanced forces of reciprocating masses. **(04 Marks)**

b. Derive an expression for speed of a porter governor with usual notations taking friction into account. **(08 Marks)**

c. In a spring loaded Hartnell governor the extreme radii of rotation of the balls are 80 mm and 120 mm. The balls arm and sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at the two extreme positions are 400 rpm and 420 rpm. Find :

(i) Spring stiffness
(ii) Initial compression of the control spring.
(iii) Sleeve lift. **(08 Marks)**

Module-5

9 a. Define logarithmic decrement. Show that logarithmic decrement δ is given by $\frac{2\pi\zeta}{\sqrt{1-\zeta^2}}$ for underdamped system. **(08 Marks)**

b. A spring mass damper system has m = 3 kg, K = 100 N/m, C = 3 N-sec/m. Determine
   (i) Damping factor
   (ii) Natural frequency of damped vibration.
   (iii) Logarithmic decrement.
   (iv) The ratio of two successive amplitudes.
   (v) Number of cycles after which the original amplitude is below 20%. **(12 Marks)**

OR

10 a. Derive an expressions for the natural frequency of free transverse vibration for a simply supported beam or shaft carrying several loads by using,
   (i) Dunkerley's method.
   (ii) Energy method. **(10 Marks)**

b. The following data relate to a shaft held in long bearings :
   Length of shaft = 1.2 m
   Diameer of shaft = 14 mm
   Mass of a rotor at mid point = 16 kg
   Eccentricity of centre of mass of rotor from centre of rotor = 0.4 mm
   Modulus of elasticity of shaft material = 200 GN/m^2
   Permissible stress in shaft materials = 70×10^6 N/m^2
   Determine the critical speed of the shaft and the range of speed over which it is unsafe to run the shaft. Assume the shaft to be mass less. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME52

Fifth Semester B.E. Degree Examination, June/July 2024
Thermo Fluids Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of steam tables and thermodynamics Data Hand Book is permitted.***

Module-1

1 a. Explain clearly how the frictional power of a multi cylinder Internal Combustion Engine can be determined through Morse Test. **(10 Marks)**

b. The following data were obtained from a Morse test on a 4 cylinder 4 stroke cycle SI engine coupled to a hydraulic dynamometer operating at a constant speed of 1500 rpm :
Brake load with all 4 cylinders firing = 296 N,
Brake load with cylinder 1 not firing = 201 N,
Brake load with cylinder 2 not firing = 206 N,
Brake load with cylinder 3 not firing = 192 N,
Brake load with cylinder 4 not firing = 200 N.

The brake power in kW is calculated using the equation $BP = \frac{WN}{42300}$, where W = Brake load in Newton, N = Speed of the engine in rpm. Calculate :
(i) Brake power (ii) Indicated power
(iii) Frictional power (iv) Mechanical efficiency **(10 Marks)**

OR

2 a. Obtain an expression for the volumetric efficiency of a single stage reciprocating air compressor in terms of the pressure ratio, the clearance ratio and the index of expansion. **(10 Marks)**

b. Air at 1 bar and 27°C is compressed to 7 bar by a single stage reciprocating compressor according to the law $P\gamma^{1.3}$ = constant. The free air delivered was $1 m^3/min$. Speed of the compressor is 300 rpm. Stroke to bore ratio is 1.5 : 1. Mechanical efficiency is 85% and motor transmission efficiency is 90%. Determine :
(i) Indicated power and isothermal efficiency
(ii) Cylinder dimensions and power of the motor required to drive the compressor. **(10 Marks)**

Module-2

3 a. Define the following terms with respect to refrigeration :
(i) Refrigerating effect.
(ii) Unit of refrigeration.
(iii) COP. **(06 Marks)**

b. With the help of a neat sketch, explain the working principle of a vapour absorption refrigeration system. **(08 Marks)**

c. In an air refrigeration plant working on a reversed Brayton cycle, air enters the compressor at 1 bar and −15°C where it is compressed to a pressure of 5.5 bar. Air enters the expander at 15°C. Determine :
(i) COP of the cycle
(ii) Mass flow rate of air into the compressor per minute for one ton of refrigeration. Assume both compression and expansion processes as isentropic. **(06 Marks)**

OR

4 a. Define the following terms with respect to psychrometry :
(i) Specific humidity
(ii) Relative humidity. **(04 Marks)**

b. With a neat sketch, explain the working of summer air conditioning system for hot and dry weather. Represent the processes involved on a psychrometric chart. **(08 Marks)**

c. Atmospheric air at 1.01325 bar has 30°C DBT and 15°C DPT. Without using the psychrometric chart, using the property values from the tables, calculate
(i) Partial pressure of air and water vapour (ii) Specific humidity (iii) Relative humidity (iv) Enthalpy of moist air. **(08 Marks)**

Module-3

5 a. Define a turbo machine. Differentiate between a turbo machine and a positive displacement machine. **(08 Marks)**

b. Identify the following as power generating on power absorbing turbomachine :
(i) Francis turbine (ii) Centrifugal blower
(iii) Centrifugal compressor (iv) De-Laval turbine. **(04 Marks)**

c. With inlet and outlet velocity triangles and with usual notations, derive the alternate form of Euler's turbine equation for a general turbo machine. **(08 Marks)**

OR

6 a. Describe the principle and working of a reciprocating pump with a neat sketch. **(08 Marks)**

b. Define the following terms with respect to reciprocating pump :
(i) Slip (ii) Percentage slip (iii) Negative slip. **(06 Marks)**

c. With a neat sketch, explain the working principle of a gear pump. **(06 Marks)**

Module-4

7 a. Define the following efficiencies of a hydraulic turbine :
(i) Hydraulic efficiency
(ii) Mechanical efficiency
(iii) Overall efficiency. **(06 Marks)**

b. Explain the different parts and functioning of a Kaplan turbine with the help of a sectional arrangement diagram. **(06 Marks)**

c. A three jet Pelton wheel is required to generate 10,000 kW under a head of 400 m. The blade angle at outlet is 15° and the reduction in the relative velocity over the buckets is 5%. If the overall efficiency = 80%, $C_v = 0.98$ and speed ratio = 0.46, find : (i) Diameter of each jet (ii) Total flow rate (iii) Force exerted by a jet on the buckets. **(08 Marks)**

OR

8 a. What is Cavitation? What are the causes of Cavitation? What are steps to be taken to reduce the effect of Cavitation? **(04 Marks)**

b. Explain with flow diagram, the purpose of multi stage pump when connected in,
(i) Series (ii) Parallel. **(08 Marks)**

c. A Centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 45°. The velocity of flow at the outlet is 2.5 m/s. The discharge through the pump is 0.2 m^3/s when the pump is working against a head of 20 m. If the manometric efficiency is 80%, draw the outlet velocity diagram and calculate :
(i) The diameter of the impeller at the outlet.
(ii) Width of the impeller at the outlet. **(08 Marks)**

Module-5

9 a. Define the following with respect to centrifugal compressor :
(i) Power input factor (ii) Pressure coefficient (iii) compressor efficiency. **(06 Marks)**

b. Explain the following with appropriate sketches :
(i) Surging. (ii) Choking. **(06 Marks)**

c. A centrifugal compressor runs at a speed of 15000 rpm and delivers 30 kg/s of air. The exit diameter is 70 cm. The relative velocity at exit is 100 m/s at an exit angle of 75°. Assume axial inlet and consider the inlet total temperature as 300 K, inlet total pressure as 1 bar. Determine :
(i) Power required to drive the compressor (ii) Ideal head developed
(iii) Work done (iv) Total exit pressure **(08 Marks)**

OR

10 a. Explain the following methods of compounding of steam turbines :
(i) Velocity compounding
(ii) Pressure compounding. **(10 Marks)**

b. A single stage impulse turbine rotor has a diameter of 1.2 m running at 3000 rpm. The nozzle angle is 18°. The blade speed ratio is 0.42. The ratio of the relative velocity at outlet to the relative velocity at inlet is 0.9. The outlet angle of the blade is 3° less than the inlet angle. Steam flow rate is 5 kg/s. Draw the velocity triangles and find :
(i) Blade angles
(ii) Axial thrust on bearing
(iii) Power developed
(iv) Blade efficiency. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME53

Fifth Semester B.E. Degree Examination, June/July 2024
Finite Element Analysis

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define FEA. Explain the basic steps involved in problem solving in FEA. **(10 Marks)**

b. A rectangular bar is subjected to an axial load 'P' as shown in Fig. Q1 (b). Determine the expression for potential energy functional and also find the extreme value of P.E. for the following data :
E = 200 GPa, P = 3 kN, L = 100 mm, b = 20 mm, t = 10 mm.

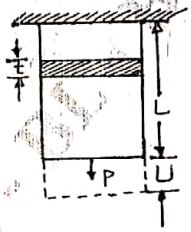


Fig. Q1 (b) **(10 Marks)**

OR

2 a. Explain plane stress and plane strain problems with suitable examples. **(10 Marks)**

b. Explain Simplex, Complex and Multiplex elements. **(10 Marks)**

Module-2

3 a. With usual notations, obtain the expression for shape functions of a 1-D Quadratic bar element in Natural co-ordinate system. **(10 Marks)**

b. Write the set of commands employed in ANSYS software to perform structural analysis for a uniform bar structure as shown in Fig. Q3 (b).

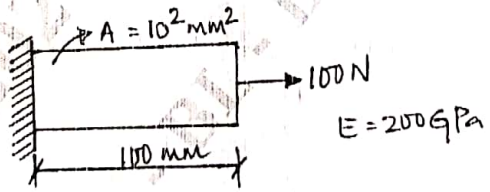


Fig. Q3 (b) **(10 Marks)**

OR

4 a. Determine the nodal displacement and elemental stresses for a bar subjected to uniform distributed load 'P_0' as shown in Fig. Q4 (a). Given E = 70 GPa and A = 10^{-4} mm^2.

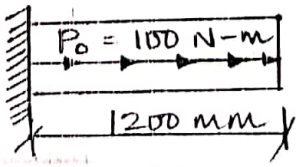


Fig. Q4 (a) **(10 Marks)**

b. Determine the nodal displacement and elemental stresses for a truss as shown in Fig. Q4 (b). Given $A = 200\ mm^2$ and $E = 2\times10^5\ N/mm^2$.

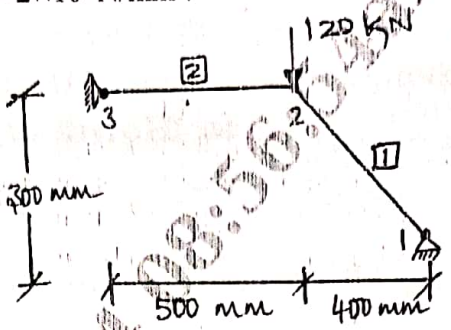


Fig. Q4 (b) **(10 Marks)**

Module-3

5 a. Derive the Hermite shape functions for a beam element. **(10 Marks)**

b. A Cantilever beam subjected to a point load of 250 kN as shown in Fig. Q5 (b). Determine the deflection at the free end and support reactions. Take $E = 200\,GPa$ and $I = 4\times10^6\ mm^4$.

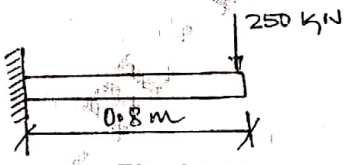


Fig. Q5 (b) **(10 Marks)**

OR

6 a. Derive the stiffness matrix for a circular shaft subjected to pure torsion. **(10 Marks)**

b. A solid stepped bar of circular cross section is subjected to a torque of 1 KN-m at its free end and to a torque of 3 KN-m at its change in cross section as shown in Fig. Q6 (b). Determine the angle of twist and shear stresses in the bar. Take $E = 2\times10^5\ N/mm^2$ and $G = 7\times10^4\ N/mm^2$.

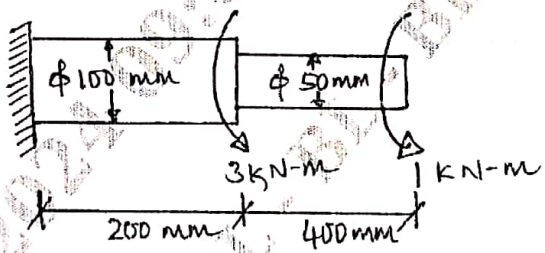


Fig. Q6 (b) **(10 Marks)**

Module-4

7 a. With usual notations, derive the differential equation for 1-D heat conduction body. **(10 Marks)**

b. Determine the temperature distribution in the rectangular fin as shown in Fig.Q7 (b). Assume steady state and only conduction process. Take heat generated inside the fin as $400\ W/m^3$.

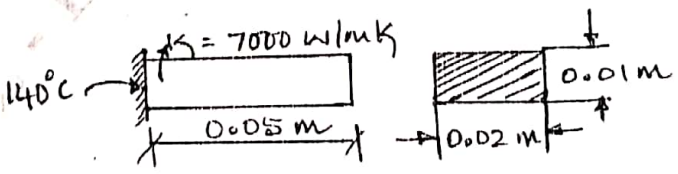


Fig. Q7 (b) **(10 Marks)**

OR

8 a. With usual notations, derive the differential equations for a fluid flow through a porous medium. **(10 Marks)**

b. For a smooth pipe with uniform cross section of 1 m^2; determine the flow velocities at the centre and at the right end of the Fig. Q8 (b). Given velocity at the left is 2 m/sec.

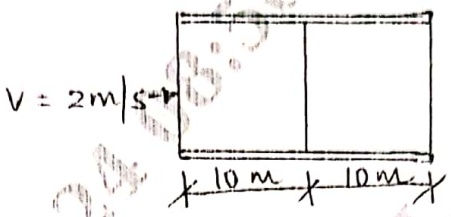


Fig. Q8 (b) **(10 Marks)**

Module-5

9 a. Derive an expression for the body force vector of an axisymmetric solid element. **(10 Marks)**

b. For the element of an axisymmetric body rotating with a constant angular velocity $\omega = 1000$ rpm as shown in Fig. Q9 (b). Determine the body force vector by considering the specific density as 7850 kg/m^3.

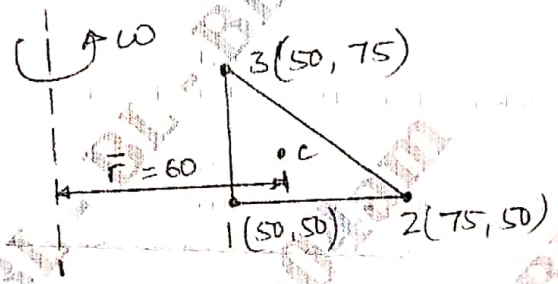


Fig. Q9 (b) **(10 Marks)**

OR

10 a. With usual notations, derive the consistent element mass matrices equation for a 1-D bar element. **(10 Marks)**

b. Determine the natural frequency of vibration of the Cantilever beam as shown in Fig. Q10 (b). Take E = 200 GPa, $\rho = 7840$ kg/m^3 ; $I = 2000$ mm^4 and $A = 240$ mm^2.

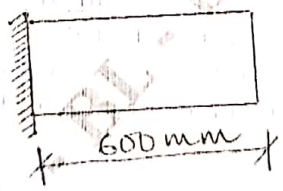


Fig. Q10 (b) **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ME54

Fifth Semester B.E. Degree Examination, June/July 2024
Modern Mobility and Automotive Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List the components of automotive engine. Mention their functions and materials used for manufacturing. **(07 Marks)**

b. What is the necessity of cooling valve? Explain sodium cooled valve with neat sketch. **(06 Marks)**

c. What are the functions of the lubricating system in an automobile? Explain with a neat sketch the splash lubricating system. **(07 Marks)**

OR

2 a. Explain with a neat sketch, working of a battery ignition system. **(08 Marks)**

b. Explain different method of supercharging. **(08 Marks)**

c. Explain the function of Engine Management System (EMS). **(04 Marks)**

Module-2

3 a. With a neat sketch, explain the working of telescopic type shock absorber. **(06 Marks)**

b. Difference between torque converter and fluid flywheel. **(06 Marks)**

c. What is the function of differential? Explain its operation with neat diagram. **(08 Marks)**

OR

4 a. Explain with neat sketch, single plate clutch. **(06 Marks)**

b. Explain the followings:
(i) Automatic Manual Transmission (AMT)
(ii) Automatic Transmission (AT) **(08 Marks)**

c. Explain with neat sketch types of rear axles. **(06 Marks)**

Module-3

5 a. Define the following and explain their effects on steering:
(i) Camber
(ii) King pin angle or steering axis inclination
(iii) Castor
(iv) Toe-in and Toe-out
(v) Included angle and scrub radius **(10 Marks)**

b. Explain the principle of braking system. Write the functions of Brake and its requirement in automobile. **(06 Marks)**

c. Difference between disc brake and drum brake. **(04 Marks)**

OR

6 a. Explain the different safety measures taken in modern vehicles. **(05 Marks)**

b. Explain with neat sketch steering linkage used in the vehicle with rigid axle front suspension. **(08 Marks)**

c. Explain the followings: (i) Seat belt (ii) Air bags **(07 Marks)**

Module-4

7 a. Write the exhaust gas pollutants and their effects on environment. **(07 Marks)**

b. Explain with neat sketch Ethanol Engine Vehicles. **(07 Marks)**

c. Explain the types of bio-fuels. **(06 Marks)**

OR

8 a. Explain with a line diagram of refining of crude oil. **(07 Marks)**

b. Explain with neat sketch, CNG engine vehicles. **(06 Marks)**

c. Explain with neat sketch, Hydrogen Engine Vehicles. **(07 Marks)**

Module-5

9 a. Explain the following:

(i) Lead acid battery

(ii) Lithium and metal air battery

(iii) Nickel based battery **(14 Marks)**

b. Explain the regenerative braking system in EV vehicles. **(06 Marks)**

OR

10 a. What are the types of motors used in electrical vehicles? Explain the BLDC motor with neat sketch. **(08 Marks)**

b. Explain the necessity of battery cooling. **(04 Marks)**

c. Explain the type of electrical vehicles. **(08 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21RMI56

Fifth Semester B.E. Degree Examination, June/July 2024
Research Methodology and Intellectual Property Rights

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Identify the meaning of Research and brief out the objectives and motivation in Engineering Research. **(10 Marks)**

b. Identify the steps to find the "Solve a worthwhile problem". **(10 Marks)**

OR

2 a. Identify the types of Engineering Research and briefly explain them. **(10 Marks)**

b. Identify the ethical issues related to authorship and brief out them. **(10 Marks)**

Module-2

3 a. Identify the essence of new and existing knowledge and explain briefly. **(10 Marks)**

b. Identify how search operators are used to narrow down the search results. **(10 Marks)**

OR

4 a. Identify the impacts of title and keywords on citation. **(10 Marks)**

b. Identify acknowledgement and attributions in research process and briefly explain. **(10 Marks)**

Module-3

5 a. Define Intellectual Property (IP). Explain the major types of IP. **(10 Marks)**

b. Identify the process of patenting. Briefly explain. **(10 Marks)**

OR

6 a. Explain briefly the Commercialization of a patent. **(10 Marks)**

b. What are the exclusions (product and processes) that cannot be patented? Explain. **(10 Marks)**

Module-4

7 a. Explain the classes or types of copyrights. **(10 Marks)**

b. What is a Trademark? Explain the symbols in TM. **(10 Marks)**

OR

8 a. What are the advantages "the registration of a trademark provides to the proprietor"? **(10 Marks)**

b. Identify process of Trademark registration and explain briefly the classification of TM. **(10 Marks)**

Module-5

9 a. Define Industrial design. Briefly explain acts and laws to govern Industrial design. **(10 Marks)**

b. Identify procedure for registration of Industrial design by taking example of Aple Inc Vs Samsung Electronics Co. **(10 Marks)**

OR

10 a. Define Geographical Identification (GI) and briefly explain acts, laws and rules pertaining to GI. **(10 Marks)**

b. Identify IP Organizations in INDIA. Explain schemes and programs for Intellectual Property Rights. **(10 Marks)**

* * * * *