Department of Mechanical Engineering

III Year V Semester

5ME3-01: Mechatronics System

Note: Each Assignment of Maximum marks10.All question carries equal marks.

ASSIGNMENT-I

Q1 Describe the historical development of mechatronics and its evolution over the decades.	BLT-2	CO-1
Q2 Draw and explain a basic block diagram of a mechatronic system, highlighting the main components and their functions.	BLT-2	CO-1
Q3 Explain the difference between verification and validation in the context of systems engineering.	BLT-1	CO-1
Q4 State and explain Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL).	BLT-2	CO-1
Q5 Discuss the role of operational amplifiers and signal conditioning in electrical systems.	BLT-3	CO-1

ASSIGNMENT-II

Q1What are the differences between Linear Time-Invariant (LTI) and Linear Time-Variant (LTV) systems, and why is modeling important for these systems?	BLT-6	CO-2
Q2 Explain the steps involved in the modeling process of a physical system.	BLT-2	CO-2
Q3 Explain the steps involved in the modeling process of a physical system.	BLT-1	CO-2
Q4 Describe how the Root Locus Method is used for stability analysis of control systems.	BLT-2	CO-2
Q5 What are the components of a PID controller, and how do time delays affect its performance?	BLT-2	CO-2

ASSIGNMENT-III

Q1 What are the key static characteristics of sensors and actuators, and why are they important in system design?	BLT-2	CO-3
Q2 Describe the working principles and applications of force and torque sensors.	BLT-2	CO-3
Q3 What factors should be considered when selecting a sensor for a specific application?	BLT-2	CO-3
Q4 Explain the differences between a DC motor, a servo motor, and a BLDC motor in terms of operation and typical applications.	BLT-1	CO-3
Q5 Outline the basic principles of designing hydraulic and pneumatic circuits for actuation systems.	BLT-2	CO-3

*BLT: BLT shows the **Bloom's taxonomy** levels.

Department of Mechanical Engineering

III Year V Semester

5ME3-01: Mechatronics System

Note: Each Assignment of Maximum marks10. All question carries equal marks.

ASSIGNMENT-IV

Q1 What are the primary differences between synchronous and asynchronous sequential systems in digital logic design?	BLT-2	CO-4
Q2 Describe the role of system interfaces in microcontroller-based systems and provide an example of a common interface type.	BLT-2	CO-4
Q3 Explain the importance of communication protocols in computer networks within mechatronic systems. Name at least two commonly used communication protocols.	BLT-2	CO-4
Q4 What are some common methods used for fault analysis in mechatronic systems, and how do they help maintain system reliability?	BLT-1	CO-4
Q5 Compare the architecture of a microcontroller to that of a microprocessor. What makes microcontrollers particularly suitable for embedded systems?	BLT-2	CO-4

ASSIGNMENT-V

Q1 Describe the basic architecture of a Programmable Logic Controller (PLC). What are the main components?	BLT-1	CO-5
Q2 How are number systems used in PLC programming, and why is it important to understand binary and hexadecimal systems?	BLT-1	CO-5
Q3 Explain the function of timers and counters in PLC programming. Provide an example of how each might be used in an industrial automation scenario.	BLT-2	CO-5
Q4 What are some typical applications of PLCs in real-time industrial automation systems? Mention at least two examples.	BLT-2	CO-5
Q5 Outline the key steps involved in designing a pick and place robot using PLCs. What are the critical factors to consider in the design process?	BLT-4	CO-5

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Department of Mechanical Engineering
III Year V Semester
5ME4-02: Heat Transfer
Note: Each Assignment of Maximum marks10.All question carries equal marks.

ASSIGNMENT-I

Q1 State Fourier's law of heat conduction and explain how thermal conductivity varies between solids, liquids, and gases.	BLT-2	CO-1
Q2 What is Newton's law of cooling, and how is the overall heat transfer coefficient defined?	BLT-2	CO-1
Q3 How does temperature affect the thermal conductivity of materials, and why is this important in heat transfer analysis?	BLT-1	CO-1
Q4 Write the general 3-dimensional heat conduction equation in Cartesian coordinates and discuss its significance	BLT-2	CO-1
Q5 What is the critical thickness of insulation, and why is it important in the context of heat conduction through composite walls?	BLT-3	CO-1

ASSIGNMENT-II

Q1 What is the governing differential equation for heat transfer in a fin, and how are fin efficiency and effectiveness defined for different boundary conditions?	BLT-6	CO-2
Q2 Explain the use of Heisler charts in solving unsteady state heat conduction problems for slabs, cylinders, and spheres.	BLT-2	CO-2
Q3 Briefly describe the Navier-Stokes and energy equations and their significance in the study of convection heat transfer.	BLT-1	CO-2
Q4 What are hydrodynamic and thermal boundary layers, and why are they important in the analysis of convective heat transfer?	BLT-2	CO-2
Q5 Discuss the laminar boundary layer equations and the effect of the Prandtl number on forced convection. What are some empirical relations for flow over a flat plate and through pipes?	BLT-2	CO-2

ASSIGNMENT-III

Q1 What is the Grashof number, and how is it used in the dimensional analysis of natural convection heat transfer?	BLT-2	CO-3
Q2 Describe the development of boundary layers in natural convection flow over a flat plate and explain the significance of the boundary layer equations.	BLT-2	CO-3
Q3 What are heat transfer correlations in the context of natural convection, and how are they typically derived and used?	BLT-2	CO-3
Q4 Explain the different regimes of boiling heat transfer and describe how the nature of vaporization phenomena changes across these regimes.	BLT-1	CO-3
Q5 How does condensation occur on flat plates, and what are the key correlations used to predict heat transfer rates during drop-wise and film-wise condensation?	BLT-2	CO-3

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Department of Mechanical Engineering
III Year V Semester
5ME4-02: Heat Transfer
Note: Each Assignment of Maximum marks10.All question carries equal marks.

ASSIGNMENT-IV

Q1 Name and briefly describe three different types of heat exchangers. What are the advantages and typical applications of each type?	BLT-2	CO-4
Q2 Explain the concepts of arithmetic mean temperature difference (ΔTm) and logarithmic mean temperature difference (ΔTlm). How are these used in the design of heat exchangers?	BLT-2	CO-4
Q3 Compare the heat transfer coefficients for parallel, counter, and cross flow type heat exchangers. What factors influence these coefficients in each configuration?	BLT-2	CO-4
Q4 Define the effectiveness of a heat exchanger. How is it related to the NTU (Number of Transfer Units) method? Explain the significance of effectiveness in assessing heat exchanger performance.	BLT-1	CO-4
Q5 What is a fouling factor in the context of heat exchangers? How does fouling affect heat transfer efficiency? Briefly discuss key considerations in the construction and manufacturing of heat exchangers to mitigate fouling issues.	BLT-2	CO-4

ASSIGNMENT-V

Q1 Explain Planck's distribution law and its significance in thermal radiation. What parameters does it depend on?	BLT-1	CO-5
Q2 State Kirchhoff's law of thermal radiation. How does it relate emission and absorption of radiation for a surface?	BLT-1	CO-5
Q3 Define diffuse radiation and Lambert's law in the context of thermal radiation. How are they applied in practical scenarios?	BLT-2	CO-5
Q4 Describe radiation intensity and its role in heat exchange between two black bodies. How is it different for gray bodies?	BLT-2	CO-5
Q5 What is a shape factor in the context of radiation heat transfer? How can it be analogously understood in electrical systems? What role do reradiating surfaces play in heat transfer?	BLT-4	CO-5

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Department of Mechanical Engineering
III Year V Semester
5ME4-03 Manufacturing Technology
Note: Each Assignment of Maximum marks10.All question carries equal marks.

Assignment -1

Q.1 Explain mechanics of metal cutting and discuss theory of metal cutting.	BLT-2	CO-1
Q.2 What is the thermal aspects of machining? Discuss briefly a technique for measuring average chip tool interface temperature.	BLT-1	CO-1
Q3 The orthogonal cutting of steel is done with 10°rake tool with a depth of cut 2 mm and feed of 0.20mm/min. The cutting speed is 200m/min. The chip thickness ratio is 0.31. the vertical cutting force is 1200 N and the horizontal cutting force is 650 N. calculate from the merchant's theory, the various work done in metal cutting and shear stress.	BLT-3	CO-1
Q4 Explain the chip formation process and type of chips with neat diagram	BLT-2	CO-1
Q5 Classify various metal removal Processes.	BLT-2	CO-1

Assignment -2

Q-1 Define Taylor tool life equation?	BLT-6	CO-2
Q-2 Explain economics of machining?	BLT-2	CO-2
Q-3 Write short note on cutting fluid?	BLT-1	CO-2
Q-4 If the Taylor's tool life exponent n-0.2 and tool changing time TCT=1.5 min, then find out tool life (in min) for maximum production rate? (Ans- 6 min)	BLT-2	CO-2
Q-5 For a certain job, the cost of metal cutting is Rs 18C/V, and cost of tooling is Rs 270C/V, where C-constant, V-Cutting speed-m/min, T-tool life, Find out the cutting speed in m/min for minimum total cost? (57.9 m/min)	BLT-2	CO-2

Assignment-3

Q.1 Explain working of a cylindrical grinding machine?	BLT-2	CO-3
Q.2 Write the classification of automatic lathe?	BLT-2	CO-3
Q.3 Determine the cutting time in cutting 125mm long keyway using HSS end mill of 20mm dia, having four cutting teeth. The depth of keyway is to be 4.5mm. Feed per tooth is 0.1mm and cutting speed is 90m/min.	BLT-2	CO-3
Q.4 Write the Gear hobbing process in detail	BLT-1	CO-3
Q5 Find the time required for drilling a 18mm hole in a workpiece having thickness 50mm. Assume cutting speed 12m/min and feed 0.2mm/rev. Neglect the length of approach.	BLT-2	CO-3

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Department of Mechanical Engineering
III Year V Semester
5ME4-03 Manufacturing Technology
Note: Each Assignment of Maximum marks10.All question carries equal marks.

Assignment-4

Q1 Grinding wheel characteristics or the performance of a grinding wheel depends on type of abrasive, grain size, grade, structure, and bonding material. Discuss the effect of each.	BLT-2	CO-4
Q2Why it is undesirable to continue running coolant on to a grinding wheel after the wheel has stopped?	BLT-2	CO-4
Q3 How the grinding wheel is manufacture?	BLT-2	CO-4

Assignment -5

Q1 What are the various factors to be considered in selection of grinding wheel? Discuss each in detail.	BLT-1	CO-5
Q2 Write the difference between honing and lapping process.	BLT-2	CO-5

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Department of Mechanical Engineering
III Year V Semester
5ME4-04: Design of Machine Elements-I
Note: Each Assignment of Maximum marks10.All question carries equal marks.

ASSIGNMENT-I

Q1. What is grey cast iron . How will you designate grey cast iron. Discuss various types of grey cast iron.	BLT-2	CO-1
Q2. Discuss various types of steel used in engineering .How will you designate steel.	BLT-2	CO-1
Q3. Discuss design consideration in casting and machining.	BLT-1	CO-1
Q4. Discuss various types of fit.	BLT-2	CO-1
Q5. What are the advantages of hole basis system over shaft basis system	BLT-3	CO-1

ASSIGNMENT-II

Q1. What are the various types of fits? Explain them with the help of neat diagrams.	BLT-6	CO-2
Q2.. Write short notes on the following: (a) Interchangeability; (b) Tolerance; (c) Allowance;	BLT-2	CO-2
Q3. Explain the following terms in connection with design of machine members subjected to variable loads: (a) Endurance limit, (b) Size factor, (b) Surface finish factor, and (d) Notch sensitivity	BLT-1	CO-2
Q4. Write the procedure to design and a cotter joint with the help of neat and labelled diagram.	BLT-2	CO-2
Q5. Explain modes of failure	BLT-2	CO-2

ASSIGNMENT-III

Q1. What is lever? Describe type of lever.	BLT-2	CO-3
Q2. What is nipping?	BLT-2	CO-3
Q3. A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 MPa. Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring.	BLT-2	CO-3
Q4 A semi-elliptical laminated vehicle spring to carry a load of 6000 N is to Consist of seven leaves 65 mm wide, two of the leaves extending the full length of the spring. The spring is to be 1.1 m in length and attached to the axle by two U-bolts 80 mm apart. The bolts hold the central portion of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts. Assume a design stress for spring material as 350 MPa. Determine :1. Thickness of leaves, 2. Deflection of spring, 3. Diameter of eye, 4. Length of leaves, and 5. Radius to which leaves should be initially bent. Sketch the semi-elliptical leaf-spring arrangement. The standard thickness of leaves are : 5, 6, 6.5, 7, 7.5, 8, 9, 10, 11 etc. in mm.	BLT-1	CO-3
Q5. Explain. A. free length B. Solid length C. Spring Rate D. Spring Index E. Stress factor F. Active and inactive coils.	BLT-2	CO-3

*BLT: BLT shows the **Bloom's taxonomy** levels.

Department of Mechanical Engineering
III Year V Semester
5ME4-04: Design of Machine Elements-I
Note: Each Assignment of Maximum marks10.All question carries equal marks.

ASSIGNMENT-IV

Q1. Write design procedure of muff coupling.	BLT-2	CO-4
Q2. Write types of coupling.	BLT-2	CO-4
Q3. A 45 mm diameter shaft is made of steel with a yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with a yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2.	BLT-2	CO-4
Q4. A hoisting drum 0.5 m in diameter is keyed to a shaft which is supported in two bearings and driven through a 12 : 1 reduction ratio by an electric motor. Determine the power of the driving motor, if the maximum load of 8 kN is hoisted at a speed of 50 m/min and the efficiency of the drive is 80%. Also determine the torque on the drum shaft and the speed of the motor in r.p.m. Determine also the diameter of the shaft made of machinery steel, the working stresses of which are 115 MPa in tension and 50 MPa in shear. The drive gear whose diameter is 450 mm is mounted at the end of the shaft such that it overhangs the nearest bearing by 150 mm. The combined shock and fatigue factors for bending and torsion may be taken as 2 and 1.5 respectively.	BLT-1	CO-4
Q5. What are the advantage and disadvantages of hollow shaft over solid shaft?	BLT-2	CO-4

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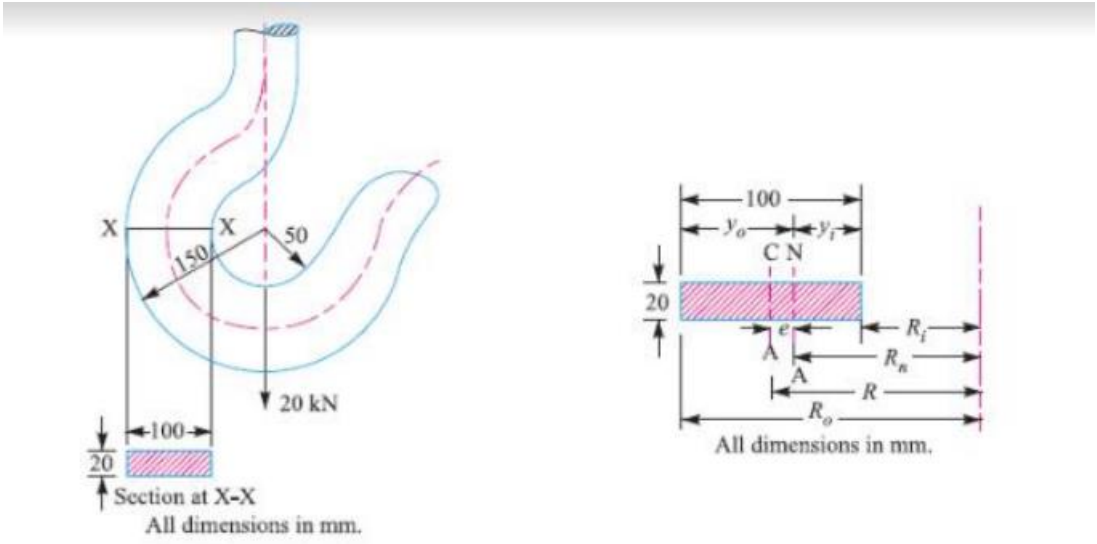
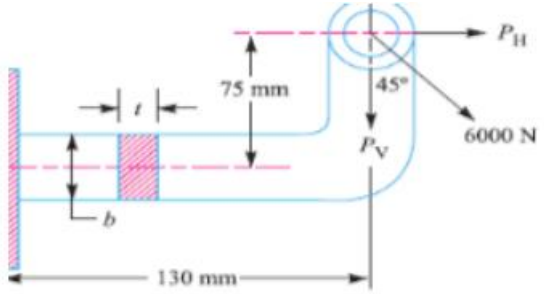
Department of Mechanical Engineering
III Year V Semester
5ME4-04: Design of Machine Elements-I
Note: Each Assignment of Maximum marks10.All question carries equal marks.

ASSIGNMENT-V

Q1. What is initial tension in bolts	BLT-1	CO-5
Q2. What is self-locking screw?	BLT-1	CO-5
Q3. Explain theories of failures?	BLT-2	CO-5
Q4. The crane hook carries a load of 20 kN as shown in Fig. The section at X-X is rectangular whose horizontal side is 100 mm. Find the stresses in the inner and outer fibres at the given section. 	BLT-2	CO-5
Q5. 4. A mild steel bracket as shown in Fig. 5.28, is subjected to a pull of 6000 N acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the cross-sectional dimensions of the bracket, if the permissible stress in the material of the bracket is limited to 60 MPa. 	BLT-4	CO-5

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Department of Mechanical Engineering
III Year V Semester
5ME4-05: Principles of Management
Note: Each Assignment of Maximum marks10.All question carries equal marks.

Assignment 1

Q.No.	Question	CO	BT
1	Define Management?	CO-1	BT-1
2	What is Contingency?	CO-1	BT-1
3	Write the different levels of management?	CO-1	BT-2
4	Explain the contribution of Management thinkers Peter Drucker and C.K. Prahalad.	CO-1	BT-3
5	Explain the contribution of Management thinkers Kauytilya and Taylor.	CO-1	BT-3

Assignment -02

Q.No.	Question	CO	BT
1	What is MBO.	CO-2	BT-1
2	Write a short note on Strategies and Policies.	CO-2	BT-6
3	List down the functions of Management.	CO-2	BT-2
4	Explain entrepreneuring and Reengineering.	CO-2	BT-3
5.	Explain Organizational Structure and its Design.	CO-2	BT-3

Assignment -03

Q.No.	Question	CO	BT
1	Define Career Startegy.	CO-3	BT-1
2	What is Behaviourally Anchored Rting Scale (BARS)	CO-3	BT-1
3	Define the term Performance Appraisal.	CO-3	BT-1
4	Write a short note on HRM.	CO-3	BT-6
5	Explain in detail on Staffing.	CO-3	BT-2

Assignment -04

Q.No.	Question	CO	BT
1	What do you mean by Committees.	CO-4	BT-1
2	Define Productivity.	CO-4	BT-1
3	Explain the different styles of Leadership.	CO-4	BT-2
4	Explain the concept of Total Quality Management.	CO-4	BT-2
5	Write the elements in the Maslow's Hierarchy of needs.	CO-4	BT-1&6

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Department of Mechanical Engineering
III Year V Semester
5ME4-05: Principles of Management
Note: Each Assignment of Maximum marks10.All question carries equal marks.

Assignment -05

Q.No.	Question	CO	BT
1	Discuss about the management practices of Famous Management Gurus.	CO-5	BT-1
2	Discuss about the leadership style of Famous Management Gurus.	CO-5	BT-1

*BLT: BLT shows the **Bloom's taxonomy** levels.

Department of Mechanical Engineering
III Year V Semester
5ME5-12: Automobile Engineering
Note: Each Assignment of Maximum marks10.All question carries equal marks.

ASSIGNMENT-I

Q1. What do you understand by automobile? Categorize the vehicle according to position of engine and its drive.	BLT-2	CO-1
Q2. Describe Non-conventional or frameless chassis. How does it differ from frame-full chassis?	BLT-2	CO-1
Q3. Explain types of chassis Frames, with their advantages and disadvantages.	BLT-1	CO-1
Q4. Describe the functions of Chassis and its operating conditions.	BLT-2	CO-1
Q5. Identify various material used for Vehicle frame. Also explain why Al is preferred over steel.	BLT-3	CO-1

ASSIGNMENT-II

Q1. Express the construction and working of constant mesh gear box.	BLT-6	CO-2
Q2. Discuss the working and salient features of Hotchkiss drive with a neat diagram.	BLT-2	CO-2
Q3. Interpret construction and working of hydraulic torque converter with the help of neat sketch.	BLT-1	CO-2
Q4. Describe construction and working of a differential.	BLT-2	CO-2
Q5. Express the working and salient features of all wheel drive with a neat diagram.	BLT-2	CO-2

ASSIGNMENT-III

Q1. What is the function of wheel in an automobile? Describe the types & constructional features of tyre.	BLT-2	CO-3
Q2. What do you mean by Tyre Rethreading?	BLT-2	CO-3
Q3. Write the causes which reduce the tyre life.	BLT-2	CO-3
Q4. Explain the working of power steering.	BLT-1	CO-3
Q5. List the objectives and requirements of suspension system in automobiles.	BLT-2	CO-3

*BLT: BLT shows the **Bloom's taxonomy** levels.

Department of Mechanical Engineering
III Year V Semester
5ME5-12: Automobile Engineering
Note: Each Assignment of Maximum marks10.All question carries equal marks.

ASSIGNMENT-IV

Q1. Describe the construction and working of lead acid battery with diagram.	BLT-2	CO-4
Q2. Explain magneto ignition system with help of neat sketch.	BLT-2	CO-4
Q3. Explain the starting and Battery charging system. Discuss the general maintenance requirements in this system.	BLT-2	CO-4
Q4. Describe the construction and working of electric horn with diagram.	BLT-1	CO-4
Q5. Explain battery ignition system with help of neat sketch.	BLT-2	CO-4

ASSIGNMENT-V

Q1. List the common fault related to automotive air conditioning system. How these faults are diagnosed and rectified.	BLT-1	CO-5
Q2. Draw the layout of the air conditioning system for a car.	BLT-1	CO-5
Q3. Define refrigerants. Explain different types of refrigerants.	BLT-2	CO-5
Q4. Define air conditioning. Identify automotive air conditioning system. Explain its components.	BLT-2	CO-5
Q5. Explain the working of Night Vision System (NVS).	BLT-4	CO-5

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