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Periyanaickenpalayam, Coimbatore – 641020

DEPARTMENT OF ROBOTICS AND AUTOMATION

QUESTION BANK

III YEAR ODD SEMESTER

ACADEMIC YEAR 2024 – 2025

INDEX

HEAD OF THE DEPARTMENT

ACOE PRINCIPAL CHAIRMAN

CME396

PROCESS PLANNING AND COST ESTIMATION

UNIT I - INTRODUCTION TO PROCESS PLANNING

Introduction – methods of process planning – Drawing interpretation – material evaluation – steps in process selection – production equipment and tooling selection.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What is CAPP?	1	1	2
2	What are the Process Planning methods?	1	1	2
3	What are the factors affecting tool selection?	1	1	2
4	Compare between Retrieval and Generative Process planning.	1	2	2
5	What are four stages in machine selection?	1	1	2
6	What is manual process planning?	1	1	2
7	What are the main activities undertaken during process planning?	1	1	2
8	What are the stages of the tool selection process?	1	1	2
	PART B			
1	Explain the activities of Process Planning in detail.	1	2	16
2	Summarize the basic steps involve in process planning.	1	2	16
3	Outline the criteria used to evaluate materials for specific manufacturing processes, and how material selection impacts, product quality, cost, and performance.	1	2	16
4	Explain the detail procedure to evaluate production equipment and tooling selection.	1	2	16

UNIT II - PROCESS PLANNING ACTIVITIES

Process parameters calculation for various production processes – selection jigs and fixtures – election of quality assurance methods – set of documents for process planning – Economics of process planning – case studies.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	List the use of quality assurance.	2	1	2
2	What factors are considered in the selection of jigs and fixtures for manufacturing processes?	2	1	2
3	Find the spindle speed required to turn a 75 mm diameter shoulder on a low-carbon steel component using a high-speed steel tool (Surface cutting speed = 28m/min). What is the percentage increase in cutting speed if a carbide tool (Surface cutting speed = 180 m/min) is used instead?	2	2	2
4	List the functions of jig and fixture.	2	1	2
5	List the documents required for process planning	2	1	2
6	Define Break Even point.	2	1	2
7	Define the term Quality and TQM	2	1	2
8	List the use of quality assurance.	2	1	2
	PART B			
1	Explain the principles of jigs and fixtures design. Discuss the criteria used to evaluate materials for specific manufacturing processes, and how material selection impacts product quality, cost, and performance.	2	2	16
2	Outline the basic elements of jigs and Fixtures and explain in detail.	2	2	16
3	Construct the various types of charts, diagrams and other documents used in process planning and describe in detail.	2	3	16
4	Identify and discuss the economic considerations involved in process planning decisions	2	3	16

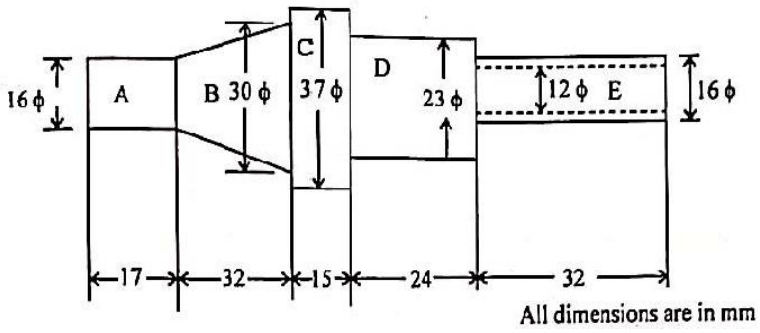
UNIT III - INTRODUCTION TO COST ESTIMATION

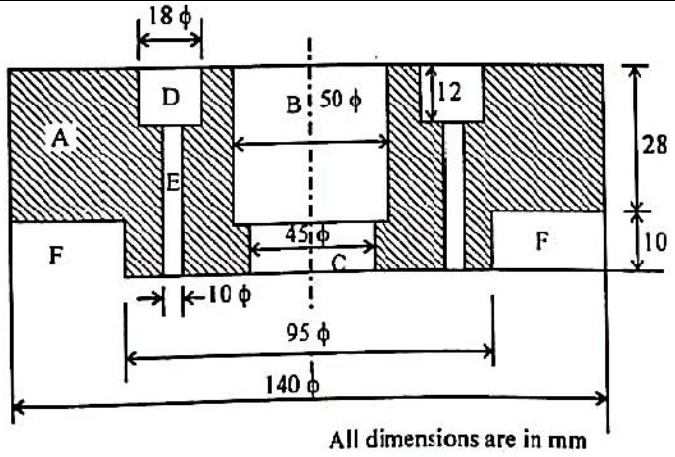
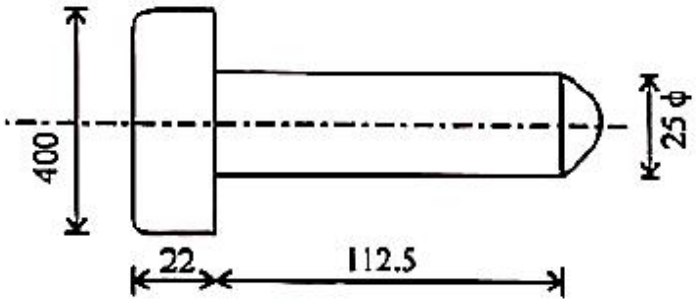
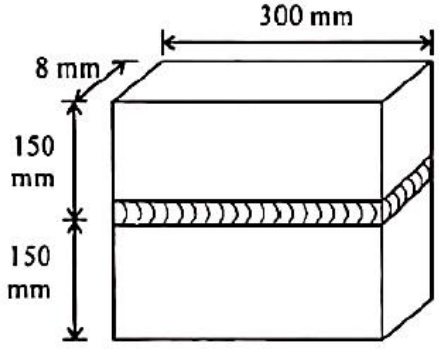
Importance of costing and estimation – methods of costing – elements of cost estimation – Types of estimates – Estimating procedure – Estimation of labor cost , material cost – allocation of overhead charges – calculation of depreciation cost.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	Define costing.	3	1	2
2	Compare Cost estimating vs Cost accounting	3	2	2
3	Define the term 'Direct material cost'.	3	1	2
4	List the elements involved in the allocation of overhead charges in cost estimation.	3	1	2
5	Outline the various types of estimates.	3	2	2
6	Why is costing and estimation important in manufacturing?	3	1	2
7	Define Overhead cost.	3	1	2
8	What are the main causes for depreciation?	3	1	2
	PART B			
1	Compare and explain the various methods of allocation of overhead expenses.	3	2	16
2	Explain the various methods of costing, such as job costing, process costing and activity based costing, highlighting their differences and suitability for different types of manufacturing processes.	3	2	16
3	Outline and discuss various method of costing in detail.	3	2	16
4	Compare the various methods of allocation of overhead expenses and describe in detail.	3	2	16

UNIT IV - PRODUCTION COST ESTIMATION

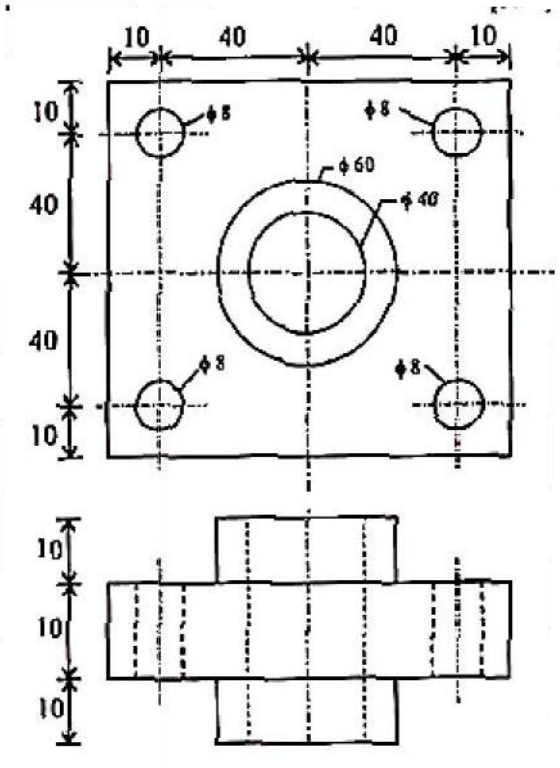
Estimation of different types of jobs – Estimation of forging shop, Estimation of Welding shop, Estimation of Foundry shop

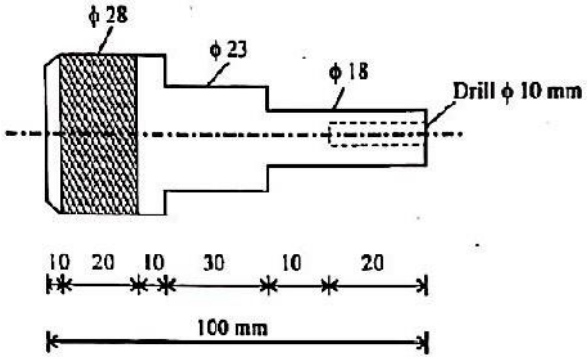
Q. No.	Questions	CO	BTL	Marks
	PART A			
1	Recall the various losses in forging process	4		2
2	What is right hand (RH) and left hand (LH) welding?	4		2
3	Define shrinkage allowance?	4		2
4	What are the costs to be considered for estimating electrical welding cost of product?	4		2
5	What are the various types of operations performed in forging?	4		2
6	List out the various allowances provided to the pattern.	4		2
7	What are the various elements considered while calculating the cost of a welded joint?	4		2
8	Define foundry, casting and mould.	4		2
	PART B			
1	Evaluate the weight of material required for manufacturing 230 pieces of shaft as shown in figure. The shafts are made of mild steel which weight is 7.87 gm/cm^3 and cost is Rs. 120 per kg. Also calculate the material cost for 230 shafts. 	4	4	16
2	Estimate the cost of material for the machine as shown in figure. Density of material may be taken as 8.2 gm/cu. cm. The cost of material is Rs. 30 per kg. Assume 20% wastage of material of the finished component and 6 holes for bolt.	4	4	16

				
3	200 pieces of bolt are to be made by upsetting from 25 mm diameter. Estimate the length of each bolt before upsetting? What length of the rod is required if 3.5% of the length goes as scrap? 	4	4	16
4	Estimate the material cost of welding two plates of size 300 mm length and 150 mm width and 8 mm thickness to make a piece 300x300 mm approximately. Use rightward technique with no edge preparation cost. Take overall cost of oxygen as Rs. 15 per cu.metre, cost of acetylene at Rs. 60 per cu. Metre, cost of filler metal Rs. 50 per kg and 1 cu.cm of filler metal weight 11.28 gms. Assume diameter of filler rod = 4 mm. filler rod used per metre of weld = 3.4 metre. Rate of welding = 2.1 metre/hour consumption of oxygen = consumption of acetylene = 7.1 cu.metre/hr. 	4	4	16

UNIT V - MACHINING TIME CALCULATION

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations, Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	Recall the formula to calculate the machining time for shaping/slotting/planning operation.	5	1	2
2	What is tear down time?	5	1	2
3	Why is machining time calculation important in manufacturing processes?	5	1	2
4	Recall the formula for calculating the grinding time for a cylindrical grinding operation.	5	1	2
5	Define the term of cutting speed.	5	1	2
6	Differentiate between feed and depth of cut	5	2	2
7	Recall the formula to calculate the machining time calculation for grinding operation.	5	1	2
8	Differentiate between shaping and planning	5	2	2
	PART B			
1	Evaluate the machining time to drill four 8 mm dia holes and one 40 mm dia central hole in the flange as shown in figure. 20 mm dia hole is drilled first and then enlarged to 40 mm f hole. Take cutting speed 10 m/min, feed for 8 mm drill 0.1 mm/rev, for 20 mm drill feed is 0.2 mm/rev and for 40 mm f drill feed is 0.4 mm/rev. 	5	4	16

2	Estimate the machining time for the figure shown, the initial diameter of the shaft is 30 mm 	5	4	16
3	Briefly explain the estimation of machining time for various lathe operations with sketches.	5	2	16
4	Summarize the procedure of estimating the machining time required during shaping operation on a shaper.	5	2	16

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MR3492

EMBEDDED SYSTEMS AND PROGRAMMING

UNIT I - INTRODUCTION TO MICROCONTROLLER

Fundamentals Functions of ALU - Microprocessor - Microcontrollers – CISC and RISC – Types Microcontroller - 8051 Family - Architecture - Features and Specifications - Memory Organization - Instruction Sets – Addressing Modes.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	List the features of 8051.	1	1	2
2	Differentiate Microprocessor and Microcontroller.	1	2	2
3	How do you select the register bank in 8051 microcontroller?	1	1	2
4	Explain about the instruction DJNZ.	1	1	2
5	What are the different ways of operand addressing in 8051?	1	1	2
6	What is the function of DPTR register?	1	1	2
7	Draw the format of PSW of 8051.	1	1	2
8	Explain the following instructions with examples 1) MOVC 2) SJMP 3) JB C 4) DAA	1	2	2
	PART B			
1	Explain in detail about the Architecture of 8051 in detail.	1	2	16
2	Discuss the Internal and External data memory organization of 8051.	1	2	16
3	Discuss the pin configuration of 8051 and explain the function of each pin in detail.	1	2	16
4	Explain the different Addressing modes of 8051 in detail.	1	2	16

UNIT II - PROGRAMMING AND COMMUNICATION

Fundamentals of Assembly Language Programming – Instruction to Assembler – Compiler and IDE - C Programming for 8051 Microcontroller – Basic Arithmetic and Logical Programming - Timer and Counter - Interrupts – Interfacing and Programming of Serial Communication, I^2C, SPI and CAN of 8051 Microcontroller – Bluetooth and WI-FI interfacing of 8051 Microcontroller.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What is jump range in8051?	2	1	2
2	Differentiate Timers and Counters.	2	2	2
3	What is an I2C bus? Write down its main features	2	1	2
4	Name the five interrupt sources of 8051.	2	1	2
5	Write an 8051 program to divide two 8-bit numbers.	2	1	2
6	What is IDE?	2	1	2
7	Differentiate between assembler and compiler.	2	1	2
8	Explain different modes of Timer for 8051 microcontroller	2	1	2
	PART B			
1	Discuss in detail about RTOS.	2	2	16
2	List the algorithms used for process scheduling.Explain any two algorithm with process scheduling.	2	2	16
3	Discuss about Multiple Task and Multiple Processes	2	2	16
4	Explain context switching in operating system	2	2	16

UNIT III - PERIPHERAL INTERFACING

I/O Programming – Interfacing of Memory, Key Board and Displays – Alphanumeric and Graphic, RTC, interfacing of ADC and DAC, Sensors - Relays - Solenoid Valve and Heater – Stepper Motors, DC Motors - PWM Programming – Closed Loop Control Programming of Servomotor – Traffic Light

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	How is keyboard interfaced with micro controller?	3	1	2
2	Define RTC interfacing.	3	1	2
3	What is Peripheral interfacing?	3	1	2
4	What is serial communication? How is this achieved with 8051 using RS232 standards	3	1	2
5	Define Baud rate.	3	1	2
6	Draw the interfacing diagram of DAC with 8051 microcontroller.	3	1	2
7	Write program to get values of hour, minute and second from RTC to RAM location 40h,41h and 42h respectively.	3	1	2
8	Write program to rotate stepper motor in clockwise direction continuously in full step mode.c	3	1	2
	PART B			
1	Explain the interfacing of Stepper motor.	3	2	16
2	Explain the interfacing of PWM.	3	2	16
3	Explain the interfacing of Traffic light with 8051.	3	2	16
4	Write an Assembly language program to interface D/A converter to generate Saw tooth Waveform.	3	2	16

UNIT IV - ARM PROCESSOR

Introduction ARM 7 Processor - Internal Architecture – Modes of Operations – Register Set –Instruction Sets – ARM Thumb - Thumb State Registers – Pipelining – basic programming of ARM 7 - Applications.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What are the modes of operation in ARM7?	4	1	2
2	Define thumb state registers.	4	1	2
3	Define Pipelining in ARM7.	4	1	2
4	Define Duty cycle with its expression?	4	1	2
5	How traps are handled in ARM processor?	4	1	2
6	Differentiate ARM and THUMB instruction set.	4	2	2
7	List the applications of ARM Processor.	4	1	2
8	Compare the basic task of SWI and SWP instructions	4	2	2
	PART B			
1	Discuss in detail about Functional block diagram of ARM architecture.	4	2	16
2	Examine about the concept of Pipelining.	4	2	16
3	List and explain the Thumb register instructions.	4	2	16
4	With a suitable example, explain about the PSR instructions. a) What is the difference between instruction set and thumb instruction set? b) Explain about the Branch instructions and register usage instructions	4	2	16

UNIT V - SINGLE BOARD COMPUTERS AND PROGRAMMING

System on Chip - Broadcom BCM2711 SoC – SBC architecture - Models and Languages – Embedded Design – Real Time Embedded Operating Systems - Real Time Programming Languages -– Python for Embedded Systems- GPIO Programming – Interfacing

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	Define Single board computer(SBC).	5	1	2
2	Define RTOS.	5	1	2
3	Define SoC.	5	1	2
4	What is GPIO?	5	1	2
5	What is Current program status register?	5	1	2
6	Give the specifications of BCM2711	5	1	2
7	What are the advantages and applications in choosing python?	5	1	2
8	What are the roles of python in RTOS?	5	1	2
	PART B			
1	Explain in detail about BCM2711 in detail with neat diagram.	5	2	16
2	Write a program for blinking of LED using pythons.	5	2	16
3	Explain the following: P inListener Interface PortListener Interface GPIOPinConfig Class GPIOPortConfig Class	5	2	16
4	Explain about RTOS which is used in BCM2711 SBC.	5	2	16

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RA3501

ROBOT PATH PLANNING AND PROGRAMMING

UNIT I - TRAJECTORY PLANNING APPROACHES

Definitions – Task planning and Trajectory planning – Representation of end-effector: Cartesian and joint space schemes. Workspace Analysis: work envelope of a multi DOF manipulator. Applications: Point to point motion and continuous path motion.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	Define a Robot?	1	1	2
2	Write are the Benefits of industrial automation?	1	1	2
3	Write Asimov's laws of robotics.	1	1	2
4	What is mean by workspace?	1	1	2
5	What is mean by work volume?	1	1	2
6	Write are the Benefits of industrial automation?	1	1	2
7	What is meant by Degrees Of Freedom?	1	1	2
8	What are the limitations of robot?	1	1	2
	PART B			
1	What is the work envelope of a robot, Sketch and explain two views to indicate the work envelope of a i) Cartesian robot. ii) Polar robot.	1	2	16
2	What is the function of a manipulator? Discuss the working of a robotic manipulator arm with a neat sketch.	1	2	16
3	Explain the difference between point to point and continuous path robotics system and state their application area	1	2	16
4	What do you understand by degree of freedom (DOF)? How many DOFs are required to position an end effectors at any point in 3-D space?	1	2	16

UNIT II - TRAJECTORY PLANNING AND MANIPULATOR

Joint space techniques – Motion profiles – Cubic polynomial, Linear Segmented Parabolic Blends and cycloidal motion – Cartesian space technique – Straight line and circular trajectories.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What is Cartesian space technique and Joint space technique.	2	1	2
2	What is the difference between Cartesian space and Euclidean space?	2	2	2
3	What is motion profile?	2	1	2
4	What is cycloidal motion?	2	1	2
5	Define straight line trajectory.	2	1	2
6	What is a circular trajectory?	2	1	2
7	What is Linear segment parabolic blend?	2	1	2
8	What is mean by pitch, yaw and roll?	2	1	2
	PART B			
1	Describe the cubic polynomial in detail.	2	2	16
2	Explain briefly about Linear Segmented Parabolic Blends.	2	2	16
3	Discuss about straight line trajectory in detail.	2	2	16
4	Discuss about circular trajectory in detail.	2	2	16

UNIT III - PATH PLANNING OF MOBILE ROBOT

Introduction – Representation of the Robot's Environment – Review of Configuration spaces – Visibility graphs – Voronoi diagrams – Potential Fields – Attractive and Repulsive – Cell Decomposition – Planning with moving obstacles – Probablistic Roadmaps – Random trees – Execution of Quadtree – Based path planner program

Q. No.	Questions	CO	BTL	Marks
PART A				
1	Define the term manipulation	3	1	2
2	How robots are programmed to perform tasks?	3	1	2
3	Relate the term online planning and offline planning.	3	1	2
4	What are the different types of planning?	3	1	2
5	What are the ways in which incomplete and incorrect information's can be handled in planning?	3	1	2
6	What is a Voronoi Diagram?	3	1	2
7	What is path planning? Explain the need for path planning in detail.	3	1	2
8	Explain path planning and avoidance of obstacles in robotics.	3	1	2
PART B				
1	Describe the configuration space of a robot system in detail.	3	2	16
2	Describe about the roadmap in detail	3	2	16
3	Sketch and explain a Generalized Voronoi Diagram in brief	3	2	16
4	How will you adapt the attractive / repulsive potential function method to handle moving obstacles. Discuss elaborately	3	2	16

UNIT IV - PATH PLANNING ALGORITHMS

Planning – A* Algorithm – the D* algorithm – Path control. Graph search and discrete planning algorithms. – Sensor-Based Motion Planning Algorithms – the "Bug" algorithms – the Tangent Bug algorithm.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What is A* algorithm?	4	1	2
2	What is D* algorithm	4	1	2
3	What path finding algorithm does Google Maps use?	4	1	2
4	What is bug 2 algorithm?	4	1	2
5	What is the difference between bug fixing and debugging?	4	1	2
6	What is bug 2 algorithm?	4	1	2
7	How to write a algorithm?	4	1	2
8	What is meant by a tree?	4	1	2
	PART B			
1	Explain A* Algorithm in brief.	4	2	16
2	Explain D* Algorithm in brief.	4	2	16
3	Discuss about Graph search and discrete planning algorithms.	4	2	16
4	Enumerate the Sensor-Based Motion Planning Algorithms in robotics.	4	2	16

UNIT V - ROS PROGRAMMING

Robot language classification – Programming methods: Lead through method, teach pendent method – Syntax features and applications of various programming languages – Examples – Inter locking commands – Safety features – Introduction to Robot Operating System (ROS) – ROS examples – Introduction to programming using ROS – Industrial ROS – ROS examples -Programming for point to point /continuous – operations – Case Study

Q. No.	Questions	CO	BTL	Marks
PART A				
1	What is teach pendant?	5	1	2
2	What is Robot kinematics?	5	1	2
3	What are the various ways of communication with a robot?	5	1	2
4	Give the reason for defining points in a program.	5	1	2
5	What is circular interpolation?	5	1	2
6	What do you mean by simulation?	5	1	2
7	What is word modeling in a robot?	5	1	2
8	What is meant by SCARA?	5	1	2
PART B				
1	Explain the teach pendant of Robot system.	5	2	16
2	Write down the capabilities and limitations of Lead through mode.	5	2	16
3	Explain detail manual lead through programming method in robot application	5	2	16
4	Briefly explain the Workplace design consideration for safety of Robots in detail.	5	2	16

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CMR333

COMPUTER AIDED INSPECTION AND TESTING

UNIT I - FUNDAMENTALS AND CONCEPTS IN METROLOGY

Standards of Measurement – Analog and Digital Measuring Instruments - Comparators – Limits, Fits and Tolerances – Gauge Design –Surface Roughness – Form Errors and Measurements.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What is Range of measurement?	1	1	2
2	What is measurement and why its necessary?	1	1	2
3	Compare system error and correction Error?	1	2	2
4	What is Calibration.	1	1	2
5	Compare between precision and accuracy.	1	2	2
6	What is measurement?	1	1	2
7	What are the components used in the measuring process?	1	1	2
8	What are the different types of standards?	1	1	2
	PART B			
1	Define standards. Discuss different type of standards in detail.	1	2	16
2	Demonstrate the block diagram of generalized measurement system and explain different stages with examples.	1	2	16
3	Compare with neat sketch, the precision and accuracy with illustration.	1	2	16
4	Show the different types of error in measurement and their causes and control methods in detail.	1	2	16

UNIT II - INSPECTION AND GENERAL MEASUREMENTS

Linear Measuring Instruments – Evolution – Types – Classification – Limit Gauges – Gauge Design – Terminology – Procedure – Concepts of Interchange Ability and Selective Assembly – Angular Measuring Instruments – Types – Bevel Protractor Clinometers Angle Gauges, Spirit Levels Sine Bar – Angle Alignment Telescope – Autocollimator Applications - Inspection of Gears And Threads – Tool Makers' Microscope – Universal Measuring Machine.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	List any four angular measuring instruments.	2	1	2
2	Define Bevel protractor.	2	1	2
3	Recall the principle of interferometry.	2	1	2
4	Why lasers are used in Metrology?	2	1	2
5	Define Interchangeability.	2	1	2
6	Define Least count.	2	1	2
7	Define Gauge Block	2	1	2
8	What is the application of spirit level?	2	1	2
	PART B			
1	List the various measurement methods and explain in detail.	2	2	16
2	Explain the working principle of Sine Bar with neat sketch.	2	2	16
3	Explain the working principle of autocollimator and briefly outline its application	2	2	16
4	Explain about Angle alignment telescope with neat sketch	2	2	16

UNIT III - OPTO ELECTRONICS IN ENGINEERING INSPECTION

Use of Optoelectronics in Tool Wear Measurements – Microhole Measurement and Surface Roughness – Applications in In-Process Measurement and On-Line Inspection.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	Define Optoelectronics.	3	1	2
2	What are the methods are used to measure the surface finish?	3	1	2
3	Explain the term Micro-Interferometer.	3	1	2
4	What is interferometer?	3	1	2
5	Which equipment is used for measuring the microholes?	3	1	2
6	What are the types of tool wear?	3	1	2
7	List any two application of Inline process measurement.	3	1	2
8	List any two application of Online Inspection.	3	1	2
	PART B			
1	Demonstrate the process of on-line Inspection with an suitable application.	3	2	16
2	Explain the use of Optoelectronics in Tool Wear measurement.	3	2	16
3	Explain Tomlinson Surface Meter with neat sketch.	3	2	16
4	Explain the use of Optoelectronics in Surface Roughness measurement.	3	2	16

UNIT IV - LASER METROLOGY

Precision instrument based on Laser - Use of Lasers - Principle –Interferometers, Interference microscope -Optical flats - Laser Interferometer - Application in Linear and Angular measurements - Testing of machine tools using Laser Interferometer. Use of Laser Interferometer in Machine Tool Inspection – Uses of Laser in On-Line Inspection – Laser Micrometer – Laser Alignment Telescope.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	Why lasers are used in Metrology?	4	1	2
2	What is the principle of laser?	4	1	2
3	Name the different types of interferometer.	4	1	2
4	What is interferometer?	4	1	2
5	What is wavelength?	4	1	2
6	What do you mean by alignment test on machine tool?	4	1	2
7	List the various geometric check made on machine tool.	4	1	2
8	What is Optical flat?	4	1	2
	PART B			
1	Explain the working principal of AC laser Interferometer and how the straightness is measured.	4	2	16
2	Sketch and explain the Michelson Interferometer.	4	2	16
3	Explain in detail the uses of laser interferometer in Machine Tool Inspection.	4	2	16
4	Explain in detail the working principle of laser micrometer with neat sketch.	4	2	16

UNIT V - COMPUTER AIDED INSPECTION AND ADVANCES IN METROLOGY

Co-ordinate Measuring Machines - Constructional features - Types - Applications of CMM – CNC CMM applications - Measurement arms, Laser tracker - Fundamentals of Computer Aided Inspection - Introduction to Nano metrology.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What is CMM?	5	1	2
2	Mention any four types of CMM.	5	1	2
3	List the uses of various types of probes used in CMMs	5	1	2
4	Compare the difference between CNC CMM and manual CMM?	5	2	2
5	Define Nanometrology.	5	1	2
6	What do you understand by the term Computer aided Inspection?	5	1	2
7	List the four basic types of machine vision system?	5	1	2
8	What is laser tracking?	5	1	2
	PART B			
1	Explain the need, types and constructional features of coordinate measuring machine.	5	2	16
2	Explain the term computer aided inspection with suitable applications.	5	2	16
3	With a neat sketch explain the various types of CMM based on its construction.	5	2	16
4	Interpret about Nano metrology in detail.	5	2	16

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AU3791

ELECTRIC HYBRID VEHICLE

UNIT I - DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES

Need for Electric vehicle- Comparative study of diesel, petrol, hybrid and electric Vehicles. Advantages and Limitations of hybrid and electric Vehicles. - Design requirement for electric vehicles- Range, maximum velocity, acceleration, power requirement, mass of the vehicle. Various Resistance- Transmission efficiency- Electric vehicle chassis and Body Design, Electric Vehicle Recharging and Refuelling Systems.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	Why is there a need for electric vehicles?	1	1	2
2	Compare hybrid and electric vehicles.	1	2	2
3	List two advantages of electric vehicles over conventional fuel vehicles.	1	1	2
4	What are the key factors affecting the range of an electric vehicle?	1	1	2
5	Define transmission efficiency in an electric vehicle.	1	1	2
6	What are the different types of resistance acting on an electric vehicle?	1	1	2
7	Mention two important design requirements for an electric vehicle.	1	1	2
8	What is the role of recharging and refueling systems in electric vehicles?	1	1	2
	PART B			
1	Compare and contrast diesel, petrol, hybrid, and electric vehicles in terms of efficiency, cost, and environmental impact.	1	2	16
2	Discuss in detail the advantages and limitations of hybrid and electric vehicles.	1	2	16
3	Explain the design requirements for an electric vehicle, including range, acceleration, power requirements, and mass calculations.	1	2	16
4	Describe the different types of resistances in electric vehicles and their effects on performance.	1	2	16

UNIT II - ENERGY SOURCES

Battery Parameters - Different types of batteries – Lead Acid- Nickel Metal Hydride - Lithium ion- Sodium based- Metal Air. Battery Modelling - Equivalent circuits, Battery charging- Quick Charging devices. Fuel Cell- Fuel cell Characteristics- Fuel cell types- Half reactions of fuel cell. Ultra capacitors. Battery Management System.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What are the key parameters of a battery?	2	1	2
2	List the different types of batteries used in electric vehicles.	2	1	2
3	What are the advantages of lithium-ion batteries over lead-acid batteries?	2	1	2
4	What is battery modeling?	2	1	2
5	Define quick charging in electric vehicles.	2	1	2
6	What are fuel cells? Name two types of fuel cells used in electric vehicles.	2	1	2
7	What is the role of an ultracapacitor in an electric vehicle?	2	1	2
8	What is a Battery Management System (BMS) and why is it important?	2	1	2
	PART B			
1	Explain in detail the different types of batteries used in electric vehicles, their working principles, and comparative advantages.	2	2	16
2	Discuss the equivalent circuit modeling of a battery and its significance in battery performance analysis.	2	2	16
3	Explain different battery charging techniques and the working of quick charging devices.	2	2	16
4	Describe the construction, working principle, and characteristics of fuel cells with their half-reactions.	2	2	16

UNIT III - MOTORS AND DRIVES

Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	List the different types of motors used in electric vehicles.	3	1	2
2	What is the main difference between BLDC and PMSM motors?	3	1	2
3	What are the advantages of using switched reluctance motors (SRM) in electric vehicles?	3	1	2
4	Write the working principle of a DC motor.	3	1	2
5	What are the key characteristics of an induction motor?	3	1	2
6	Why are PMSM motors preferred in high-performance applications?	3	1	2
7	Mention two advantages of BLDC motors over conventional DC motors.	3	1	2
8	What are the main components of a motor drive system?	3	1	2
	PART B			
1	Explain in detail the construction, working principle, and characteristics of DC motors used in electric vehicles.	3	2	16
2	Describe the construction, operation, and performance characteristics of induction motors.	3	2	16
3	Explain the working principle, advantages, and applications of BLDC motors with a suitable diagram.	3	2	16
4	Discuss the construction and characteristics of PMSM motors and compare them with BLDC motors.	3	2	16

UNIT IV - POWER CONVERTERS AND CONTROLLERS

Solid state Switching elements and characteristics – BJT, MOSFET, IGBT, SCR and TRIAC - Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSM motors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	List any two solid-state switching elements used in power converters.	4	1	2
2	What are the key characteristics of an IGBT?	4	1	2
3	Differentiate between rectifiers and inverters.	4	1	2
4	What is the function of a power converter in an electric vehicle?	4	1	2
5	Define four-quadrant operation of a motor drive.	4	1	2
6	What are the main types of motor drives used in electric vehicles?	4	1	2
7	What is the advantage of using MOSFETs in high-frequency applications?	4	1	2
8	Mention two applications of SCR in motor drive systems.	4	1	2
	PART B			
1	Explain the characteristics and working principles of solid-state switching devices: BJT, MOSFET, IGBT, SCR, and TRIAC.	4	2	16
2	Describe the different types of power converters (rectifiers, inverters, and DC-DC converters) with circuit diagrams and applications.	4	2	16
3	Explain the working and control of DC and AC motor drives in electric vehicles.	4	2	16
4	Discuss the working of PMSM, BLDC, and switched reluctance motor drives with their power converter requirements.	4	2	16

UNIT V - HYBRID AND ELECTRIC VEHICLES

Main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study on specification of electric and hybrid vehicles.

Q. No.	Questions	CO	BTL	Marks
	PART A			
1	What are the main components of a hybrid vehicle?	5	1	2
2	List the different configurations of hybrid and electric vehicles.	5	1	2
3	What is the function of a power split device in a hybrid vehicle?	5	1	2
4	Mention two operation modes of hybrid vehicles.	5	1	2
5	What are the advantages of hybrid vehicles over conventional vehicles?	5	1	2
6	Define the term "economy" in hybrid vehicles.	5	1	2
7	What are the key control strategies used in hybrid vehicle operation?	5	1	2
8	Name two electric or hybrid vehicles available in the market today.	5	1	2
	PART B			
1	Explain the main components and working principles of hybrid and electric vehicles with a block diagram.	5	2	16
2	Discuss the different configurations of hybrid and electric vehicles and compare their performance.	5	2	16
3	Describe the working of power split devices used in hybrid vehicles with suitable diagrams.	5	2	16
4	Explain the different operating modes of hybrid vehicles and their impact on efficiency.	5	2	16

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