DEPARTMENT OF MECHATRONICS ENGINEERING
MC301 DESIGN OF MECHATRONICS SYSTEMS
QUESTION BANK

UNIT 1 FUNDAMENTALS
PART-A

1. What is Mechatronics?
2. Define Physical System Modeling.
3. Draw the block diagram of Key elements of Mechatronics.
4. Write the Sub-Classifications of Mechatronic Systems.
5. Write the properties of Mechatronic Design System.
6. Write the Design steps involved in Mechatronics system design.
7. Define Model based Fault detection.
8. Define Safety in Mechatronic System Design.
9. Draw the block diagram of ways of integration within mechatronic system.
10. Write the merits of Control Prototyping.

PART-B

11 a). Compare hardware in loop simulation and control prototyping processes in the design ofMechatronics system.
(Keywords: Block Diagram, Flow Chart, Programming, Intelligence Manufacturing, Feedback Process and Analyzed.)

b). Discuss with flow diagram the stages of Mechatronics design process.
(Keywords: Flow Diagram, Modeling, Simulation, Project Management, Design, Analysis, Real-Time Interface, Code generator and Embedded Processor Interface.)

12 a).What are the steps involved in the design of Mechatronics system? Explain.
(Keywords: Modeling, Simulation, Prototyping and Development.)

b). Why a system should be designed ergonomically? Explain with an example.
(Keywords: Human Factors, Applications, Physical Skills, Limitations, Safe and Effective Working.)

13 a). Discuss in detail the advanced approaches in Mechatronics such as intelligent supervisorycontrol structure and model based monitoring system.
(Keywords: High Quality, Life Cycle, Plant Management, Intervention, Inspection system, Servo Control and Monitoring.)

b). With the help of a block diagram, explain the key elements of a Mechatronics system.

(Keywords: Block Diagram, Mechatronics, Simulation and Modeling, Automatic Control, Optimization, Mechanical Systems, Electrical Systems, Real time Interfacing and Computer systems.)

14 a). What are the applications of a Mechatronics system? What are its merits and demerits?
(Keywords: Washing Machine, pH Control system, Auto Focus Camera, Motor control, Engine Control, Tracking System and Surface Measurement.)

b). Explain the role of modeling and simulation in the analysis of Mechatronicssystems.
(Keywords: Mathematical Equations, Real Systems, Physical Systems, Matter AndEnergy, Static and Dynamic, Heat transfer, Signals, Programming and Analog Computers.

UNIT 2 SYSTEM MODELLING
PART-A

1. Write the benefits of simulation.
2. Write the disadvantages of Simulation.
3. What is Replicative Validity?
4. What is Predictive validity?
5. What is Structural validity?
6. Write the merits of top down design sequence.
7. Write the difference between the electronic and mechanics models.
8. What do you mean by Analogy?
9. Draw the structure of simulator backplane.
10. What is band graph?

PART B

11 a)Explain with block diagram the principle of simulator plane used to couple simulators.

(Keywords: Commercial Simulators,Simulator Backplane, Partitioning, Synchronization, Exchange of Data, Coupling and Lockstep algorithm.)

b) Discuss methods adopted to carry out the following process.

i) Model validation.

(Keywords: Introduction, Empirical validity, Theoretical validity, Pragmatic validity, Heuristic validity,measured data and System identification.)

ii) Model verification.

(Keywords: Envisaged task, Applications, Errors, Boundary conditions, Chief Modeller, Plausibility tests, Causality, Balance principles, Value Range and Consistency of units.)

12 a) Explain the process of building up of models for the following system with an example.

i) Mechanical system.   ii) Pneumatic system.

iii) Hydraulic system.

(Keywords: Structural Modeling, Circuit Diagrams, State Graphs, Physical Modeling,Perspective of Modeling, Resulting equations and Experimental Modeling.)

b) Explain a sequential control system with an example.

(Keywords: Circuit Diagrams, State Graphs, Multi body diagrams, Finite Elementsand Dimensions.)

13 a)Discuss in detail the major components of a data acquisition and control system and their interconnections for a system with four sensors and two actuators.

(Keywords: Sensors, Signal Conditioning, Multiplexing, Data Conversion, Data Processing, Data Handling and Transmission.)

b)Elaborate on the necessary ingredients for the general I/O process required as part of aMechatronics system.

(Keywords: Communicates, Sensors, Actuators, Hardware and Software, Applications, Software and Speed.)

14 a) Explain the fields of applications in model development.

(Keywords: Simulation, Bottom up design and Top down design.)

b) Explain the various modeling techniques.

(Keywords: Structural Modeling, Physical Modeling andExperimental Modeling.)

UNIT 3 SYSTEM INTERFACING
PART-A
1. Draw the schematic diagram of a simple DAQ system.
2. Define Interface.
3. Define Overframing.
4. Write the difference between bit rate and baud rate.
5. What do you mean by handshaking?
6. Write the difference between the Analog signal and Digital Signal
7. Draw the typical arrangement for the UART.
8. What is null modem?
9. What is DAQ?
10. What is DAC and ADC?

PART B
11 a)What are the features of a data acquisition system?
> *(Keywords: Control Systems, Aircraft Control, Turbovisory instrumentation, Wide Temperature, Digital Signals, Resolution and Accuracy.)*

b) Describe the procedure including both hardware and software adopted to interface computertorealworld process using general purpose input output cards.
> *(Keywords: Samples, Algorithm, Converters, Channels, GPIO card, Modeling, Real time and Application Program.)*

12 a) Describe the functions that are required for an interface.
> *(Keywords: Communication, Monitors, keyboards, Printers, disks, Real time interface, Sensors, Actuators, Computer, and Real world process.)*

b) Explain about system interfacing using RS 232 interface.
> *(Keywords: Binary data, Signals, Hardwired, Asynchronous, Unique rates, Connector,Signal Levels, Communicates, Signal Ground, Transmitted data, Receive data, Data format.)*

13 a) What are the primary differences between RS 232, RS 422 and RS 485 serial interfaces? Explain.
> *(Keywords: Controllers, Address, Length, Bus Network, Modules, Shielding, Grounds, Communications, Converters, Multi-drop, Transmit data, Receive data.)*

b) Explain the various IEEE 488 standard interface.
> *(Keywords: Standard, Address space, Data Format, Transfer type, Timing, Speed, References, Driver, Bus length, Error Handling, Arbitration.)*

14 a) Explain the modes of operation of GUI card.
> *(Keywords: Interface, Interact, Computers, Hand held devices, Commands, Icons, Indicators, Manipulations, Display, Dimensional, Operates, machine tools.)*

b) Explain Ethernet switch in detail.
> *(Keywords: Half Duplex, Full Duplex, Receives data, Monitoring, Topology.)*

UNIT 4 CASE STUDIES ON MECHATRONIC SYSTEM
PART-A
1. Write the applications of Mechatronics systems.
2. Write the general components of data acquisition system.
3. Write the wide variety of applications of position control of D.C. motor.
4. What are all the components required for the implementation of real system.
5. Draw the comparison chart for the real system and dynamical system.
6. Draw the block diagram for pH control using mechatronic system.
7. What are all the main components used for skip control in the CD player.
8. Draw the De-icing application diagram.
9. What do you mean by compound block?
10. What is the purpose of transducer calibration system in automotive application?

PART B
11 a) Discuss in detail the data acquisition application of controlling the temperature of a hot/cold reservoirsystem.
> *(Keywords: Water, Temperature, Mixing value, Reservoirs, output temperature, Thermistor, Analog input, Data acquisition cards, Position.)*

b) Explain the design of fuzzy based Washing machine system with suitable diagram.
> *(Keywords: Process, Sensor System, Fuzzy Logic, Input, Output variables, Degree of dirt,Types, Information, Transparency, Cloths, Analyzed.)*

12 a) Discuss the working of Autofocus camera with exposure control.
> *(Keywords: Stress shielding, Implant, Micro Motion, Optical encoder, Micro Rotation, Simplicity, Accuracy, Reliability, Degrees, Directions.)*

b) In a conveyor system a robot is used to pick the object and place it on a drilling machine, With ablock diagram explain the working of robot.
> *(Keywords: Conveyor System, Robot, Arm, Manipulator, Data acquisition, Computer,Drill bit, Camera, Placing, Timing.)*

13 a) Explain the Mechatronics system for Engine management system.
> *(Keywords: Engine, System, Oxygen, Environment, Safety, Fuel, Consumption, Control.)*

b) What is image processing? How will you measure the surface using image processing?
> *(Keywords: Material, Strength, Bridge, Blacktop, Testing, Strain gauges, Bolting, Amplification, Scaling factor.)*

14 a) How will you control the skipping of CD player
> *(Keywords: Tilt sensor, Actuators, Pin ball mechanism, CD player)*

b)What is RFID? Explain the part identification and tracking technique using RFID.
> *(Keywords: Radio, Frequency, Identification, Device, Signal, Transmits, Receives, Tracking.)*

UNIT 5 MICRO MECHATRONIC SYSTEM
PART-A
1. Write the materials that used in MEMS.
2. What are substrates and wafers?
3. Write the types of scaling in heat transfer.
4. Define Actuators.
5. Write the different types of actuation motions in micro devices.

6. What are the applications of micro-valves?
7. Define selectivity ratio.
8. What are the mechanical problems associated with surface micromachining?
9. Write the four typical constraints for Microsystems.
10. Write the major factors that affect the packaging of Microsystems.

PART B

11 a) Describe the design construction and working of micro motors with an application.
(Keywords: Diagram, Electrostatic Micromotor, Micromachines, Electrostatic forces, andRotary Motors.)

b) Discuss the design and working of micro robot.
(Keywords: Diagrams, Gripping, Parallel Plates, Drive Arm and Microgripper.)

12a) With suitable example, discuss the working of a micro actuator.
(Keywords: Controlling, Actuating, Thermal forces, Memory alloys, Crystals and Electrostatic force.)

b) Describe the construction and working of micro pump with its applications.
(Keywords: Diagram, Electrostatic Actuation, Silicon diaphragm, Upward motion, And Piezopump.)

13a) Explain surface micro machining in detail.
(Keywords: Building of Layers, Complex Masking, Sacrificial Layer, MoreExpensive, Thickness, Thin Film Materials, Complex Geometry, Adhesion, Interfacial Stress and Stiction.)

b) Explain the scaling laws used for micro elements.
(Keywords: Geometry, Rigid Body, Electrostatic, Electromagnetic, Fluid Mechanics AndHeat Transfer.)

14a) Explain the bulk micro-manufacturing in detail.
(Keywords:Microsensors, Bulk Substrates, Sculptors, Shaping, Etching, Isotropic and Anisotropic, Orientation, Etch stop, Dopant controlled, Electrochemical Etch stop, Dry Etching, Plasma Etching, and Deep Reactive Ion Etching.)

b) Explain the principle science and engineering disciplines involved in Microsystem design and manufacture with the neat diagram.
(Keywords: Block Diagram, Electrochemistry, Electrohydrodynamics, Molecular Biology, Plasma Physics, Scaling Laws, Quantum Physics, Molecular Physics, and Engineering Disciplines.)