Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's
Sharad Institute of Technology College of Engineering
(An Autonomous Institute)
Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Teaching and Evaluation Scheme for Final Year B. Tech.

Department of Mechatronics Engineering

Semester: VII

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV
DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE, Yadrav

Department: Mechatronics Engineering **Rev:** Course Structure/00/2021-22

Class: Final Year B. Tech **Semester:** VII

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
MT701	PCC	Industry 4.0	3	-	-	3	10	10	30	50	100	3
MT702	PCC	PLC and SCADA	3	-	-	3	10	10	30	50	100	3
MT703	PEC	Elective-III	3	-	-	3	10	10	30	50	100	3
MT704	PEC	Elective-IV	3	-	-	3	10	10	30	50	100	3
OEXXX	OEC	Open Elective-II	3	-	-	3	10	10	30	50	100	3
MT705	PCC	PLC and SCADA Laboratory	-	-	2	2	15	15	-	20	50	1
MT706	PCC	Simulation Laboratory	-	-	2	2	15	15	-	20	50	1
MT707	PCC	Robotics Laboratory	-	-	2	2	25	25	-	-	50	1
PRJ06	PROJ	Mega Project Phase – II	-	-	8	8	25	25	-	50	100	4
PRJ07	PROJ	Seminar	-	-	2	2	25	25		-	50	1
HMS09	HSMC	Values and Ethics	2	-	-	2	25	25	-	-	50	Audit
		Total	**17**	**-**	**16**	**33**	**180**	**180**	**150**	**340**	**850**	**23**

Elective –III

A. Biomedical Instrumentation
B. Wireless network and communication
C. Advanced Computer Networking
D. Internet of Things

Elective –IV

A. Robot Kinematics and Dynamics
B. Nano Technology
C. Electrical Hybrid vehicles
D. Mechatronics System Design

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Open Elective-III:

Micro Electro Mechanical Systems.

L: Lecture, T: Tutorial, P: Practical, MSE: Mid Semester Exam, ESE: End Semester Exam, TW: Term Work, OE: Oral Exam., POE: Practical and Oral Exam.

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV
DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

INDUSTRY 4.0

MT701	PCC	Industry 4.0	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain Industry 4.0 scenario.
CO2	Illustrate industrial IOT and smart manufacturing.
CO3	Outline Robotic Automation and Augmented Reality.
CO4	Explain security aspects of Industry 4.0.
CO5	List applications of Industry 4.0.
CO6	Discuss smart grid.

Course Contents:

Unit 1: Introduction to Industry 4.0: The Various Industrial Revolutions - Drivers, Enablers, Compelling Forcesand Challenges for Industry 4.0 - Need – Reason for Adopting Industry 4.0	[8]
Unit 2: Industry 4.0 And IOT: Internet of Things (IoT) and Industrial Internet of Things (IIoT) & Internetof Services - Smart Manufacturing - Smart Devices and Products – Smart Logistics - Lean Production system	[7]

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit 3: Robotic Automation and Augmented Reality: Recent Technological Components of Robots- Advanced Sensor Technologies - Internet of Robotic Things - Introduction, AR Hardware and Software Technology, Industrial Applications of AR	[8]
Unit 4: Industry 4.0 And Cyber Physical System: Introduction to Cyber Physical Systems (CPS), Architecture of CPS- Components - Emerging applications in CPS in different fields. Case study: Application of CPS in various domains.	[7]
Unit 5: Applications of Industry 4.0: Understanding Smart Appliances -Smart Operation-Smart Monitoring- Smart Energy Savings-Smart Maintenance, Case Study- Smart Cars, Self- Driving Cars, Introducing Google 's Self-Driving Car	[8]
Unit 6: SMART GRID: Smart grid definition and development Smart Grid, Understanding the Smart Grid, Smart grid solutions, Design challenges of smart grid and Industry 4.0.	[6]

Text Books:

1. Klaus Schwab, "The Fourth Industrial Revolution".
2. Jean-Claude André, —Industry 4.0l, Wiley- ISTE, July 2019, ISBN: 781786304827,2019
3. Hossam A. Gabbar, —Smart Energy Grid Engineeringl, Academic Press, 2017, ISBN 978- 0-12-805343-0.

Reference Books:

1. Miller M, —The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the worldl, Pearson Education, 2015, ISBN: 9780134021300.
2. Pengwei Du and Ning Lu, —Energy storage for smart grids: planning and operation for renewable and variable energy resources VERs l, Academic Press, 2018, Reprint edition, ISBN-13:978-0128100714
3. P. Kaliraj, T. Devi, Innovating with Augmented Reality: Applications in Education and Industry, 2022, ISBN 9781032008127, CRC Press, Taylor & Francis Group

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV • DEPT. OF MECHATRONICS ENGINEERING • sit

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

PLC and SCADA

MT702	PCC	PLC and SCADA	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Elaborate the concepts and I/O modules of Programmable Logic Controller
CO2	Develop Ladder Diagrams using various ladder programming instructions.
CO3	Construct ladder logic using PLC Timer and Counter instructions
CO4	Design and develop different programming applications of ladder programming
CO5	Illustrate and examine SCADA and HMI systems for PLC
CO6	Explain the applications of SCADA

Course Contents:

Unit 1: Programmable Logic Controller: Introduction to PLC, Definition of PLC, Advantages, Types of PLC: Unitary PLC, Modular PLC, Small PLC, Medium PLC, Large PLC, Block Diagram of PLC: Input/output (I/O) section, Processor Section, Power supply, Memory, Central Processing Unit: Processor Software / Executive Software, program scan PLC Languages, Ladder Language. PLC input output (I/O) modules: Discrete input module, Analog I/O Module, Sinking and sourcing. Special Modules	[6]
Unit 2: Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Introduction to ladder logic: PLC I/O Addressing, Relay type instructions, Arithmetic (Math) instructions, Logical Instructions, Comparison instructions, Data Handling instructions, Introduction to logic: Equivalent Ladder diagram of Logic Gates, equivalent ladder diagram to demonstrate De Morgan theorem. Ladder design.	[7]

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit 3: Programming Counters: PLC Timer Instruction: On Delay and OFF delay timers, Timer-on Delay, Timer off delay, Retentive and non-retentive timers. Format of a timer instruction. PLC Counter Instruction: Operation of PLC Counter, Counter Parameters, Count up (CTU) Count down (CTD). Combining Counter and Timer Functions. Ladder Programming using Timer/Counter	[8]
Unit 4: Applications of PLC: Automatic switching ON/OFF lights, Liquid level control, Traffic light control, Bottle filling plant, other ladder programming examples.	[7]
Unit 5: Introduction of SCADA and HMI: Introduction to SCADA, Application areas of SCADA, Block Diagram, Benefits, Types of SCADA: Single Master Single Remote, Multiple Master Multiple Remote, SCADA System Hardware: RTUs, MTUs, Communication System, Human Machine Interface (HMI): Definition, Application areas of HMI, Difference between HMI and SCADA	[6]
Unit 6: Interfacing and Applications of SCADA: Interfacing SCADA system with PLC: Connection Diagram, object linking and embedding for process control (OPC) architecture, Steps in creating SCADA screen for simple object, steps for linking SCADA object with PLC, ladder programming using OPC, Concept of Tag, Types of tags, Addressing of Tags, Alarm generation, Trend types Applications of SCADA: ON-OFF Control of lamp, traffic light control, level control system	[6]

Text Books:

1. "Programmable Logic Controller – Principles and Applications", 5/e, J. W. Webb, R.A. Reis; Prentice Hall of India Ltd.'s 81-203-2308-4.
2. "Programmable Logic Controller – Principles and Applications, by NIIT; Prentice Hall Publications Pvt. Ltd. India, ISBN 81-203-2525-7.
3. "Programmable Logic Controller – Programming methods and Applications", Hackworth John R. and Hackworth Frederick D. Jr.; Pearson Education LCE, ISBN 81-297-0340

Reference Books:

1. Introduction to PLC – Gary Dumming – Delmar Pub.
2. Various PLC manufacturers catalogue.
3. Programmable Logic Controller – FESTO Pneumatics, - Bangalore
4. SCADA, Stuart A. Boyer (ISA Publi.) ISBN 1-55617-660-0.
5. Practical SCADA for industry, David Bailey, (Elsevier Publi.) ISBN 0-7506-5805-3.

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Professional Elective -III

A. Biomedical Instrumentation
B. Wireless network and communication
C. Advanced Computer Networking
D. Internet of Things

Bio-Medical Instrumentation

MT703A	PEC	Bio-Medical Instrumentation	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Criticize the sources of biomedical signals and needs of using biomedical instruments & their limitations.
CO2	Explain pc based medical instrumentation & regulation of medical devices.
CO3	Illustrate and characterize medical instruments as per their specifications, static & dynamic
CO4	Analyze and design Bio-amplifiers
CO5	Design various medical recording systems & their components.
CO6	Demonstrate patient monitoring systems and its necessity in healthcare system

Course Contents:

Unit 1: Medical Instrumentation: Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, Microprocessors in medical instruments, PC based medical Instruments, General constraints in design of medical Instrumentation system, Regulation of Medical devices.	[8]

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit 2: Measurement systems: Specifications of instruments, Static & Dynamic characteristics of medical instruments, Classification of errors, Statistical analysis, Reliability, Accuracy, Fidelity, Speed of response, Linearization of technique, Data Acquisition System	[7]
Unit 3: Bioelectric signals and Bioelectric amplifiers Origin of bioelectric signals, Electrode-tissue interface, Galvanic Skin Response, BSR, Motion artifacts, Instrumentation amplifiers, Special features of bioelectric amplifiers, Carrier amplifiers, Chopper amplifiers, Phase sensitive detector	[8]
Unit 4: Biomedical recording systems: Basic Recording systems, General consideration for signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrocardiograph, Vector cardiograph, Phonocardiograph, Electroencephalograph, Electromyography, Other biomedical recorders, Biofeedback instrumentation, Electrostatic and Electromagnetic coupling to AC signals, Proper grounding, Patient isolation and accident prevention	[7]
Unit 5: Patient Monitoring Systems: [4] System concepts, Cardiac monitor, selection of system parameters, Bedside monitors, Central monitors, Heart rate meter, Pulse rate meter, Holter monitor and Cardiac stress test, Cardiac cauterization instrumentation, Organization and equipment's used in ICCU& ITU	[6]
Unit 6: Herapeutic equipment and Respiratory Instrumentation Pacemaker, Defibrillator, Shortwave diathermy. Haemodialysis machine, Spirometry, Pnemuotachograph Ventilator	[6]
Text Books: 1.R. S. Khandpur "Handbook of Bio-Medical Instrumentation", 2nd Edition, Tata McGraw Hill. 2.J.J. Carr & J.M.Brown, "Introduction to Biomedical Equipment Technology" Pearson Education, Asia 3.Cromwell, Weibell & Pfeiffer, "Biomedical Instrumentation & Measurement", Prentice Hall, India.	
Reference Books:	
1. Joseph Bronzino, "Biomedical Engineering and Instrumentation", PWS Engg., Boston. 2. J.Webster, "Bioinstrumentation", Wiley & Sons. 3. Joseph D.Bronzino, "The Biomedical Engineering handbook", CRC Press.	

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING · SIT

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Wireless Network & Communication

MT703B	PEC	Wireless Network & Communication	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Demonstrate functioning of wireless communication system and evolution of different wireless communication systems and standards.
CO2	Compare different technologies used for wireless communication systems.
CO3	Explain multiple access techniques for Wireless Communication
CO4	Explain the architecture, functioning, protocols, capabilities and application of various wireless communication networks.
CO5	Evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks.
CO6	Discuss various applications of Mobile Ad hoc Network.

Course Contents:

Unit 1: Introduction to Wireless communication. Overview of wireless communication, cellular communication, different generations and standards in cellular communication system, satellite communication including GPS, wireless local loop, cordless phone, paging systems, RFID.	[5]
Unit 2: Recent wireless technologies: multicarrier modulation, OFDM, MIMO system, diversity multiplexing trade-off, MIMO-OFDM system, smart-antenna; beamforming and MIMO, cognitive radio, software defined radio, communication relays, spectrum sharing.	

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit 3: Multiple access techniques Multiple access techniques in wireless communication: contention-free multiple access schemes (FDMA TDMA, CDMA, SDMA and Hybrid), contention-based multiple access schemes (ALOHA and CSMA).	[7]
Unit 4: Wireless Networks: Wireless personal area networks (Bluetooth, UWB and ZigBee), wireless local area networks (IEEE 802.11, network architecture, medium access methods, WLAN standards), wireless metropolitan area networks (WiMAX).	[6]
Unit 5: Ad-hoc wireless networks: Design Challenges in Ad-hoc wireless networks, concept of cross layer design, security in wireless networks, energy constrained networks. MANET and WSN. Wireless system protocols: mobile network layer protocol (mobile IP, IPv6, dynamic host configuration protocol), mobile transport layer protocol (traditional TCP, classical TCP improvements), support for mobility (wireless application protocol).	[7]
Unit 6: Mobile Ad hoc Network Introduction, Routing protocols- Routing, Dynamic source routing, Destination sequence distance vector, Overview ad-hoc routing protocols, Application- RFID, Bluetooth, Zigbee, NFC	[6]

Text Books:

1. Wireless Communications Principles and Practice Theodore S. Rappaport
2. J. Schiller, "Mobile Communication" 2/e, Pearson Education, 2012.
3. Wireless Communications and Networks William Stallings Pearson Education

Reference Books:

1. Vijay K Garg, "Wireless Communications and Networks", Morgan Kaufmann Publishers an Imprint of Elsevier, USA 2009
2. Sanjay Kumar, "Wireless Communication the Fundamental and Advanced Concepts" River Publishers, Denmark, 2015
3. Iti Saha Misra, "Wireless Communication and Networks: 3G and Beyond", 2/e, McGraw Hill Education (india) Private Ltd, New Delhi, 2013.
4. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005

DEPT. OF MECHATRONICS ENGINEERING SIT COLLEGE OF ENGINEERING TECHNOLOGY INSTITUTE OF ADMINISTRATION

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Advanced Computer Networks

MT703C	PEC	Advanced Computer Networks	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Computer Organization

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the basic terminologies used in networking and layered architecture of computer network
CO2	Illustrate reference models with layers, protocols and interfaces
CO3	Elaborate basic protocols of application layer and how they can be used to assist in network design and implementation.
CO4	Explain connectionless and connection-oriented protocols used for reliable data transfer, flow control and congestion control.
CO5	Apply various routing algorithms to find shortest paths for network-layer packet delivery
CO6	Demonstrate different link layer terminologies like error detection-correction, Multiple access protocol and Link layer addressing used in network

Course Contents:

Unit 1: Introduction to Computer Network Overview of OSI layer Model and TCP/IP protocol model, Addressing, Underlying technologies for LANs, WANs, and Switched WANs. **Data Link Layer:** Design issues for Data Link Layers, Framing methods, Error control: detection and correction, Flow control, Elementary Data Link protocols	[6]
Unit 2: Medium Access Control Sub layer Static and Dynamic channel allocation, Multiple Access protocols ALHOA, CSMA, Collision Free Protocols, Ethernet: IEEE 802.3, IEEE 802.4, IEEE 802.5 standards, Wireless LANS 802.11 standards	[6]
Unit 3: Network Layer: IPv4 Addresses: Classful Addressing Other Issues, Sub-netting and Super netting, Class less Addressing, Delivery, Forwarding and routing; Routing methods: shortest path, Link state, Distance vector routing and broadcast routing, Congestion control algorithms: Principles, Congestion prevention policies, congestion control in datagram subnet, Load Shedding, Jitter Control.	[6]

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING · DEPT. OF MECHATRONICS ENGINEERING, YADRAV

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit 4: Transport Layer: Introduction to the Transport Layer, Transport layer protocols (Simple protocol, Stop-and-wait protocol, Go-Back-n protocol, Selective repeat protocol, Bidirectional protocols), Transport layer services, User datagram protocol, Transmission control protocol protocols)	[6]
Unit 5: Internet Protocol IP Data gram format, Fragmentation and reassembly models, ARP, RARP, ICMP, IGMP	[7]
Unit 6: The Application layer WWW and HTTP, FTP, Telnet, Domain name system, SNMP, Multimedia data, Multimedia in the Internet.	[5]

Text Books:

1. Data Communication and Networking, Behrouz A. Forouzan, McGraw Hill, 5th Edition, 2012
2. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Pearson Education India; 5th edition, 2013.
3. "Data and Computer Communication", W. Stallings ,7th edition, PHI, New Delhi

Reference Books:

1. Computer networks, Mayank Dave, CENGAGE.
2. Computer Networks: A Systems Approach, LL Peterson, BS Davie, Morgan-Kauffman, 5th Edition, 2011.
3. Computer Networking: A Top-Down Approach JF Kurose, KW Ross, Addison-Wesley, 5th Edition, 2009.

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Internet of Things

MT703D	PEC	**Internet of Things**	3-0-0	3 Credits

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the function blocks, three-layer model and five-layer model of IoT
CO2	Develop an understanding of various communication network: HAN, NAN, FAN, WAN
CO3	Illustrate privacy, security and design related challenges of IoT
CO4	Select proper sensor technology for IoT application
CO5	Explain challenges in IOT design and development
CO6	Discuss various IoT applications

Course Contents:

Unit I. Introduction to Internet of Things: IoT: Definition and importance, Characteristics of IoT,Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Three-layer and Five-layer model of IoT.	[8]
Unit II. IoT Communication network: Architecture of IoT, Communication network: Home Area Network (HAN), Neighborhood Area Network (NAN), Field Area Network (FAN), Wide Area Network (WAN), Wireless Sensor Networks (WSNs).	[7]

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit III. IoT Protocols: IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRa WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT	[8]
Unit IV. IoT Sensors/Actuators: IoT: Sensor Technology, Mobile Phone Based Sensors, Medical Sensors, Neural Sensors, Environmental and Chemical Sensors, Radio Frequency Identification, Actuators,	[7]
Unit V. IoT Challenges: Design challenges, Development challenges, Privacy and Security challenges, Data Management and Other challenges	[6]
Unit VI. Application of IoT: Smart Homes: Smart Appliances, Security and Safety. Smart Energy: Smart Meters, Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Real Time Pricing, Smart grid, Smart Cities: Smart Vehicles, Smart Lighting, Smart Parking etc.	[6]

Text Books:

1. Internet of Things By Rajkamal, Tata McGraw Hill publication
2. Internet of things(A-Hand-on-Approach) By Vijay Madisetti and ArshdeepBahga1st Edition,Universal Press

Reference Books:

1. 1. The Internet of Things: Connecting Objects By Hakima Chaouchi Wiley publication
2. The Internet of Things – Key applications and Protocols By Olivier Hersent, DavidBoswarthick, Omar Elloumi,, Wiley, 2012

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Professional Elective -IV

A. Robot Kinematics and Dynamics
B. Nano Technology
C. Electrical Hybrid vehicles
D. Mechatronics System Design

Robot Kinematics and Dynamics

MT704A	PEC	Robot Kinematics and Dynamics	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week Tutorial: 1hr/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Kinematics of machines, Basics of the control system, CAD

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the various components and basics of a robotics system
CO2	Classify the robots with specification.
CO3	Solve the problems related to rotation, translation, and transformation in robotics
CO4	Solve the problems related to forward and inverse kinematics in robotic systems
CO5	Demonstrate the concepts of trajectory and motion planning in the robotics system.
CO6	Explain the basics of dynamics analysis in the robotics system.

Course Contents:

Unit 1: Introduction Kinematics and dynamics, Kinematic joints, Link, Kinematic pair, Constrained motion, Mechanism and machines, Robotics system, Robot joints, Robotic Terminology, components of robotics, Robot manipulation, Future of robotics	[6]
Unit 2: Robot Kinematics Basics Robot configurations, Classification of robots, Robot End-effectors, Workspace, Specification of Robot, Application of Robots, Robotics sensors, sensor calibration, Grubler's Formula, Degrees of Freedom of robot manipulators.	[6]

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV – DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit 3: Kinematics Representation of Robot Manipulator Representation of planer motion, Representation of spatial motion, Descriptions: Positions, Orientations, and Frames, Representation: Rotation, translation, transformation, Homogeneous transformation, Rolling, Pitching, and Yawing	[6]
Unit 4: Kinematics Analysis of robotic manipulators Forward and Inverse kinematics of robotic manipulators, Denavit Hartenberg Parameters, Rules for coordinate assignments, Robot coordinate system	[6]
Unit 5: Trajectory and Motion Planning Trajectory, General Considerations in Path Generation, work envelope of a robot, Cartesian space technique, Joint space technique- Cubic polynomial, Fifth order polynomial, Linear trajectory function, Robot motion planning, Sequence of robotic action, Motion planning approaches, classification of Robot motion planning	[7]
Unit 6: Basics of Robotic Dynamics (Theory) Key aspects of the dynamics of robotics systems, Forces in Manipulator, Robot dynamics – Rigid body dynamics, Newton-Euler, Lagrange-Euler, generalized D'Alembert equations of motion.	[6]

Text Books:

- Renfrew, Alasdair. "Introduction to robotics: Mechanics and control." *International Journal of Electrical Engineering & Education* 41.4 (2004): 388.
- Lumelsky, Vladimir J. *Sensing, intelligence, motion: how robots and humans move in an unstructured world*. John Wiley & Sons, 2005.
- Vukobratovic, Miomir. *Introduction to robotics*. Springer Science & Business Media, 2012.

Reference Books:

- Lewis, Frank L., Darren M. Dawson, and Chaouki T. Abdallah. *Robot manipulator control: theory and practice*. CRC Press, 2003.
- Robotics: Modelling, Planning and Control, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, Springer Science & Business Media, 07-Nov-2008 - Technology & Engineering - 632 pages
- Mueller, Andreas. "Modern robotics: Mechanics, planning, and control [bookshelf]." *IEEE Control Systems Magazine* 39.6 (2019): 100-102.

DEPT. OF MECHATRONICS ENGINEERING, SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV

Head
Dept. of Mechatronics Engineering
SIT COE, Yadrav

Nanotechnology

MT704 B	PEC	Nanotechnology	3-0-0	3 Credits

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain length scales concepts, nanostructures and nanotechnology.
CO2	Analyze the composition, properties of nanostructure metals and alloys, Nano- composites and carbon nanotubes.
CO3	Discover nanoparticles manufacturing methodology depending on its phase and application.
CO4	Examine behavior of materials at nanoscale.
CO5	Identify the phenomenal behaviors and functions of materials and structures at molecular scale.
CO6	Discover functional benefits of using nanotechnology in electronics.

Course Contents:

Unit 1: Introduction to Nanotechnology: Nanoscience, Nanotechnology, Applications of nanotechnology, Nanomaterials, types of Nanotechnology, Nano machines, Multiscale hierarchical structures built out of Nano sized building blocks (Nano to macro). Nanomaterials in Nature: Nacre, Gecko. Properties of Nanomaterials, Characterization of Nanomaterials.	[6]
Unit 2: Nanomaterials: Fundamental concept, materials used, Allotropes of carbon, graphene, fullerenes, carbon nanotubes- properties and application.	[7]

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit 3: Fabrication of Nanomaterials: Gas phase synthesis, liquid phase synthesis, solid phase synthesis, Lithography.	[7]
Unit 4: Nano Shapes: Nanoparticles and colloid, nanogold, nanocomposite, nanocrystal, nanostructure, Quantum dots-application of quantum dots, Nano wires, Nano tubes.	[6]
Unit 5: Molecular Nanotechnology: Projected applications and capabilities-Smart material, nano sensors. Molecular assembler, molecular machines and its types, Nanorobotics, self-reconfigurable, DNA nanotechnology.	[7]
Unit 6: Nanoelectronics: Diodes, Sensors, memories, batteries, super-capacitors, Micro-electromechanical system, nano-electromechanical system.	[7]

Text Books:

1. N. Phani Kumar, "Principles of nanotechnology" SciTech publications India Pvt. Ltd.
2. G. Mohan Kumar, "Nanotechnology: Nanomaterials and nanodevices" Narosa Publishing
3. House, 2016.
4. C. Koch, "Nanostructured materials: Processing, Properties and Potential Applications", Noyes Publications, 2002.
5. C. Koch, I. A. Ovidko, S. Seal and S. Veprek, "Structural Nano crystalline Materials:
6. Fundamentals & Applications", Cambridge University Press, 2011.

Reference Books:

1. Bharat Bhushan, "Springer Handbook of Nanotechnology", Springer, 2nd edition, 2006.
2. Laurier L. Schramm, "Nano and Microtechnology from A-Z: From Nano-systems to Colloids and Interfaces", Wiley, 2014.

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV ★ DEPT. OF MECHATRONICS ENGINEERING ★ sit

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Electrical Hybrid Vehicles

MT704C	PEC	**Electrical Hybrid Vehicles**	3-0-0	3 Credits

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Illustrate working principle of electric vehicles.
CO2	Explain hybrid electric vehicle architecture and the power electronics devices used in hybrid electric vehicles.
CO3	Survey various motors used in electric vehicles.
CO4	Interpret different configurations of electric vehicles and its components.
CO5	Discuss different energy storage technologies used for hybrid electric vehicles.
CO6	Explain different energy management strategies.

Course Contents:

Unit 1: Introduction to Electric Vehicle: Electric Vehicle- Need, Types of Electric Vehicles – Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV, Solar Powered Vehicles. Motion and Dynamic Equations of the Electric Vehicles: various forces acting on the Vehicle in static and dynamic conditions.	6
Unit 2: HEV Fundamentals: Vehicle Performance, Series Hybrid Vehicle, Parallel Hybrid Vehicle, Architecture of Electric Drive, Power electronics including switching, AC-DC, DC-AC conversion, electronic devices and circuits used for control and distribution of electric power, Thermal Management of HEV Power Electronics.	6
Unit 3: Electric Drive Trains: Basic concept of electric traction, introduction to various electric drivetrain topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.	7

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV ● DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Induction Motor Drives, Permanent Magnet Motor Drives, Switched Reluctance Motors.	
Unit 4: Integration of Subsystems Integration of Subsystems: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.	6
Unit 5: Energy Storage: Introduction, Different batteries for EV, Battery Characterization, Comparison of Different Energy Storage Technologies for HEVs, Battery Charging Control, Charge Management of Storage Devices, Flywheel Energy Storage System, Hydraulic Energy Storage System, Fuel Cells and Hybrid Fuel Cell Energy Storage System and Battery Management System.	6
Unit 6: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Introduction to various charging techniques and schematic of charging stations.	6

Text Books:

1. Jack Erjavec and Jeff Arias, "Hybrid, Electric and Fuel Cell Vehicles", Cengage Learning, 2012.
2. Jack Erjavec and Jeff Arias, "Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles", Cengage Learning Pvt. Ltd., New Delhi, 2007
3. Mehrdad Ehsani, Yimin Gao, sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2009.

Reference Books:

1. James Larminie, J. Lowry, "Electric Vehicle Technology Explaned", John Wiley & Sons Ltd. 2003.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies",Springer, 2015.
3. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Mechatronics System Design

MT704D	PEC	Mechatronics System Design	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the principles of Mechatronics and automation for the development of system.
CO2	Outline appropriate sensors and actuators for an engineering application
CO3	Identify Drives and Actuators
CO4	Elaborate Micro and Nano Manufacturing.
CO5	Illustrate Micro mechatronic systems
CO6	Discuss various applications of design of Mechatronic systems.

Course Contents:

Unit 1: Introduction: Definition of Mechanical Systems, Philosophy and approach; Systems and Design: Mechatronics approach, Integrated Product Design, Modelling, Analysis and Simulation, Man-Machine Interface Recognition of the Need, Conceptual Design and Functional Specification, First principle Modular Mathematical Modeling, Detailed Modular Mathematical Modeling, Control System Design, Design Optimization, Prototyping Hardware-in-the-loop Simulation, Deployment/Life Cycle, Deployment of Embedded Software, applications of RFID technology and machine vision	[8]
Unit 2: Sensors and transducers: classification, Development in Transducer technology, Sensor and Actuator Selection, Opto-Electronics-Shaft encoders, CD Sensors, Vision System, etc. Sensor Materials and Technologies- Materials, Surface Processing, Nano-Technology. Performance characteristics of sensors and transducers.Selection criteria for sensors and actuators, interfacing of sensors and actuators	[7]

SHARAD INS. OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV ● DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Unit 3: Drives and Actuators: Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control; Embedded Systems: Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems, applications of Arduino and Raspberry, Pi microcontroller, Applications of Microcontroller.	[8]
Unit 4: Micro and Nano Manufacturing: Nanofabrication Techniques: E-Beam and Nano-Imprint Fabrication, Epitaxy and Strain Engineering, Scanned Probe Techniques, Self-Assembly and Template Manufacturing. MEMS devices and applications: Pressure sensor, Inertial sensor, Optical MEMS and RF-MEMS, Micro-actuators for dual-stage servo systems	[7]
Unit 5: Micro Mechatronics systems: Micro sensors, Micro actuators; Micro-fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronics Systems from Robotics, Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology	[6]
Unit 6: Mechatronics systems: Traditional Vs Mechatronics Design, Case studies of Mechatronics systems designs, like piece counting system, pick and place manipulator, simple assembly task involving a few parts, part loading / unloading system, automatic tool and pallet changers etc. Design of Autonomous Mobile Robot, Design of cantilever beam vibration control system based on piezo sensors and actuators	[6]

Text Books:

1. Sami Franssila, "Introduction to Micro fabrication", Wiley 2nd Edition.
2. Marc J Madou, Fundamentals of Microfabrication, The Science of minituarization, second edition, CRC press.
3. Yi Qin, Micromanufacturing Engineering and Technology, Micro and Nanotechnology series, Elsevier. .
4. A Textbook of Mechatronics, R.K.Rajput, S. Chand & Company Private Limited.
5. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall.

Reference Books:

1. Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.).
2. Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education.
3. Nadim Mulaf and Kirt Williams, "An Introduction to Microelectromechanical systems Engineering", Artech House.
4. Stanley Wolf and Richard Tauber, "Silicon Processing for the VLSI era Volume -1 Technology", Lattice press.
5. Vijay K. Varadan, K.J.Vinoy and S. Gopalkrishnan, "Smart Material Systems and MEMS: Design and Development Methodologies", John Wiley and sons Ltd.

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV · DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

PLC and SCADA Laboratory

MT706	PCC	PLC and SCADA Laboratory	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hours/week/batch	Continuous Assessment –I :15 Marks Continuous Assessment –II :15 Marks End Semester Exam: 20 Marks

Pre-Requisites:

Course Outcomes: At the end of the course students will be able to -

CO1	Explain PLC hardware and software
CO2	Develop the ladder diagrams for using PLC ladder instructions
CO3	Utilize the HMI/SCADA System for various applications

List of Experiments:

At least minimum 10 experiments should be performed from the following list

1. Study hardware and software used in PLC.
2. Implementation of logic functions and De Morgan's theorems using Ladder Diagram
3. Implementation of arithmetic instructions using Ladder Diagram
4. Implement ladder diagram using timers and counters.
5. Logic implementation of switching of lights
6. Logic implementation of Door Bell operation
7. Logic implementation of traffic light control
8. Logic implementation of bottle filling application
9. HMI implementation for any one application
10. SCADA implementation for any one application

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING YADRAV · DEPT. OF MECHATRONICS ENGINEERING · sit

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Text Books:

1."ProgrammableLogicController–
PrinciplesandApplications",5/e,J.W.Webb,R.A.Reis;PrenticeHallof IndiaLtd.ISBN81-203-2308-4.
2."Programmable Logic Controller–Principles and Applications, by NIIT; Prentice Hall Publications Pvt. Ltd. India, ISBN81-203-2525-7.
."ProgrammableLogicController –Programming methods and Applications", Hackworth JohnR. And Hackworth Frederick D.J.; Pearson Education LCE, ISBN81-297-0340

Reference Books:

1. Introduction to PLC–Gary Dumming –Delmar Pub.
2. Various PLC manufacturers catalogue.
3. Programmable Logic Controller–FESTO Pneumatics, -Bangalore
4. SCADA, Stuart A. Boyer (ISA Publi.) ISBN1-55617-660-0.
5. Practical SCADA for industry, David Bailey, (Elsevier Publi.) ISBN 0-7506-5805-3.

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

MT707	PCC	Simulation Laboratory	0-0-2	1 Credits

Simulation Laboratory

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hours/week/batch	Continuous Assessment –I :15 Marks Continuous Assessment –II :15 Marks End Semester Exam: 20 Marks

Pre-Requisites: CAD/CAM/CAE

Course Outcomes: At the end of the course students will be able to -

CO1	Make use of MATLAB and VHDL environment.
CO2	Utilize the functionality of simulation tools.
CO3	Develop program for basics functions using MATLAB.

List of Experiments:

MATLAB (Any Two)

1. Introduction to MAT LAB
2. Solving mathematical expressions using MAT LAB.
3. Introduction to plotting graphs using MAT LAB.
4. Function and operations using variables and arrays to learn arithmetic operation using MAT LAB

MATLAB SIMULINK (Any Five)

1. Introduction to MATLAB SIMULINK.
2. Simulation of Spring-mass system using MAT LAB SIMULINK
3. Simulation of Mechatronics system using MATLAB SIMULINK
4. Simulation of single-phase inverter using MAT LAB SIMULINK
5. Simulation of single-phase inverter using MAT LAB SIMULINK
6. Introduction of PID controller using MAT LAB SIMULINK
7. Introduction to Fuzzy logic library in MAT LAB SIMULINK.

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING YADRAV DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

VHDL Simulation (Any One)

1 Introduction to VHDL

2.Write VHDL code for basic gates

3.Write a VHDL code to describe the functions of Half adder & Full Adder

Text Books:

1. Ibrahim Zeid, "CAD/CAM Theory and Practice", Tata McGraw Hill Publication,
2. M. P. Grover, Zimmer, "CAD/CAM/CIM", Prentice Hall India.
3. Bryan Mealy, Fabrizio Tappero" Free Range VHDL" Prentice Hall India.

Reference Books:

1. Rogers D. F. and Adams A., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989.
2. Faux I. D. and Pratt M. J., Computational Geometry for Design and Manufacture, John Wiley & sons, NY, 1979
3. Mortenson M. E., Geometric Modeling, John Wiley &sons, NY, 1985
4. Choi B.K., Surface Modeling for CAD/CAM/CAE, John Wiley & Sons, NY, 1991.
5. Mikell P. Grover, Automation, Production System and Computer Integrated Manufacturing, Prentice Hall of India Pvt Ltd, 1995.
6. C. Ray Astaihe, Robots of Manufacturing automation, John Wiley and Sons, New York

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

MT 708	PCC	**Robotics Laboratory**	0-0-2	1 Credits

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hours/week/batch	Continuous Assessment –I :15 Marks Continuous Assessment –II :15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Industrial Automation and Robotics
Course Outcomes: At the end of the course students will be able to -

CO1	Demonstrate the kinematics & dynamic analysis of robot manipulators.
CO2	Illustrate the functionality and limitations of robot actuators.
CO3	Develop a program a robot to perform a specified task in a target environment and solve problems in areas such as robot control and navigation.

List of Experiments:

At least minimum of Eight experiments should be performed from the following list

1. Demonstration of various robotic configurations using an industrial robot
2. Determination of the maximum and minimum position of links.
3. Verification of transformation (Position and orientation) with respect to the gripper and world coordinate system
4. Estimation of accuracy, repeatability, and resolution.
5. Robot programming and simulation for any industrial process (Packaging, Assembly)
6. Demonstration components of a real robot and its DH parameters.
7. One Industrial visit for Industrial robotic application
8. Case study for industrial robotics.
9. Virtual modeling for kinematic and dynamic verification (Any one robotic structure using suitable software)
10. Robot Teaching Using VAL (Versatile Assembly Language) Programming

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Text Books:

1. Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, Industrial Robotics, Technology, Programming & Applications, Tata McGraw Hill Education Pvt. Ltd. New Delhi
2. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.
3. Groover M.P.-Automation, production systems and computer integrated manufacturing-Prentice Hall of India.

Reference Books:

1. S B Niku, Introduction to Robotics, Analysis, Control, Applications, 2nd Edition, Wiley Publication, 2015.
2. Mikell P. Groover, Automation, Production Systems & Computer Integrated Manufacturing, PHI Learning Pvt. Ltd., New Delhi, ISBN:987-81-203-3418-2, 2012
3. John Craig, Introduction to Robotics, Mechanics and Control, 3rd Edition, Pearson Education, 2009
4. R K Mittal & I. J. Nagrath, Robotics and Control, McGraw Hill Publication, 2015.
5. Mike Wilson, Implementation of Robotic Systems, ISBN: 978-0-124-04733-4

Head
Dept. of Mechatronics Engineering
SIT COE, Yadrav

Mega Project Phase-II

PRJ06	PROJ	**Mega Project Phase-II**	0-0-8	4 Credits

Teaching Scheme:	Examination Scheme:
Practical: 2 hours/week/batch	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks End Semester Examination: 50 Marks

Pre-Requisites: All courses

Course Outcomes: At the end of the course, students will be able to:

CO1	Identify real life problem and feasibility of solution to the problem.
CO2	Analyze and optimize solutions to real life problems with individual and team work through modern tool usage
CO3	Improve professional ethics and communication skill and engage with environment

The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The completion of work and the submission of the report and assessment should be done at the end of VII Sem. The project work should consist of any of the following or an appropriate combination:

1. A comprehensive and up-to-date survey of literature related to the study of a phenomenon or product.
2. Design of any equipment and/or its fabrication and testing.
3. Critical Analysis of any design or process for optimizing the same.
4. Experimental verification of principles used in applications related to various specializations related to Mechatronics Engineering.
5. Software development for particular applications.
6. A combination of the above.

The objective is to prepare the students to examine any design or process or phenomenon from all angles, to encourage the process of independent thinking and working, and to expose them to industry. The students may preferably select the project works from their opted elective subjects. The students should submit the report in a prescribed format, before the end of the VIIth semester. The report shall be comprehensive and presented typed on A_4 size sheets and bound. The number of copies to be submitted is the number of students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING YADRAV DEPT. OF MECHATRONICS ENGINEERING SIT

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Project Report:

Project report should be of 50 to 60 pages (typed on A4 size sheets).
For standardization of the project reports the following format should be strictly followed.
1. Page Size: Trimmed A4
2. Top Margin: 1.00 Inch
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inch
6. Para Text: Times New Roman 12 Point. Font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right Aligned at Footer. Font 12 Point Times New Roman
9. Headings: Times New Roman, 14 Point Bold face
10. Certificate: All students should attach standard format of Certificate as described by the department. Certificate should be awarded to batch and not to individual student. Certificate should have signatures of Guide, Head of Department and Principal /Director
11. Index of Report:
    i) Title Sheet ii) Certificate iii) Acknowledgement iv) Table of Contents. v) List of Figures vi) List of Tables
    1. Introduction
    2. Literature Survey/ Theory
    3. Design/ Fabrication/ Production/ Actual work carried out for the same and Experimentation.
    4. Observation Results
    5. Discussion on Result and Conclusion
12. References:
References should have the following format
For Books: "Title of Book", Authors, Publisher, Edition
For Papers: "Title of Paper, Authors, Journal/Conference Details, Year
13. The Project report shall be signed by each student in the group, approved by the guide and endorsed by the Head of the Department
14. Presentation: The group has to make a presentation in front of the faculty of department at the end of semester.

Seminar

DEPT. OF MECHATRONICS ENGINEERING, YADRAV ★ SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE, Yadrav

PRJ07	PROJ	**Seminar**	0-0-2	1 Credits

Teaching Scheme:	Examination Scheme:
Practical: 2 hours/week/batch	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Pre-Requisites: All courses

Course Outcomes: At the end of the course, students will be able to:

CO1	Identify the topic of the seminar related to recent trends and technology.
CO2	Survey literature related to topic and prepare report.
CO3	Improve effective written and verbal communication.

Course Contents:
Before the end of Semester VII, each student will have to deliver a seminar on a subject mutually decided by candidate and his/her guide. The student should select the topic for his/her seminar which is latest and relevant. The student, as a part of the term work, should submit the write-up of the seminar topic in duplicate, typed on A4size sheets in a prescribed format and bound at the end of semester. The performance of the student will be evaluated on the basis of the contents, the presentation and discussion during the delivery of seminar before the evaluation committee appointed by the Department.

Head
Dept. of Mechatronics Engineering
SIT COE, Yadrav

Values and Ethics

HMS09	HSMC	Values and Ethics	1-0-0	Audit

Teaching Scheme:	Examination Scheme:
Lecture: -2 hrs./week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks

Pre-Requisites:

Course Outcomes: At the end of the course, students will be able to:

CO1	Relate the Ethics & Human interface
CO2	Improve Attitude, Morals, Aptitude, Integrity towards Society
CO3	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO4	Explain the significance of value inputs in a classroom and start applying them in their life and profession
CO5	Develop Publication ethics
CO6	Develop Business ethics in professional careers

Course Contents:

Unit 1 Ethics and Human Interface: Ethics and Human Interface, Essence, determinants and consequences of ethics in human actions; Dimensions of ethics; ethics in private and public relationships Human Values – lessons from the lives and teachings of great leaders, reformers and administrators, Role of family, society in inculcating values, role of educational institutions in inculcating values.	**[2]**
Unit 2: Attitude, Morals, Aptitude, Integrity towards Society Attitude: content, structure, function, Attitude and its influence and relation with thought and behavior, Aptitude and foundational values towards society, integrity, impartiality and non-partisanship, empathy, tolerance and compassion intelligence-concepts.	**[2]**
Unit 3: Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body', Understanding the Body as an	**[2]**

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Programs to ensure Sanyam and Swasthya,	
Unit 4: Value Education: Need, Guidelines, content and process for Value Education, Self-Exploration–; Natural Acceptance and Experiential Validation, Continuous Happiness and Prosperity, Relationship and Physical Facilities, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	[2]
Unit 5: Publication Ethics Publication Ethics: Introduction, Scope & importance, best practices/standards initiatives & Guidelines: COPE, WAME etc., Conflict of Interest, Publication Misconduct: definition, concept, problems that lead to unethical behavior & vice versa, complaints & appeals.	[2]
Unit 6: Business Ethics Ethics - Meaning, Importance, & Types of Ethics, Nature and Relevance to Business ethics, Values and Attitudes of Professional Engineers, Seven Principles of Public Life, Ethics in Business: Features, Principles, Need & Importance, Improving ethical behavior in Business	[2]

Text Books

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
3. Neeraj Kumar, "Lexicon for Ethics, Integrity & Aptitude", Chronicle Publication, 2016.
4. Santosh Ajmera, Nand Kishor Reddi, "Ethics - Integrity and Aptitude", Tata Mc Graw Hill Publication, 2014.

M. Karthikeyan"Ethics, Integrity and Aptitude", Tata Mc Graw Hill Publication, 2015.

Reference Books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
2. A N Tripathy, 2003, Human Values, New Age International Publishers.
3. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
4. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
5. B L Baipai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING YADRAV DEPT. OF MECHATRONICS ENGINEERING sit

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Open Elective III:
Microelectromechanical Systems

OECXXX	OEC	Microelectromechanical systems (MEMS)	3-0-0	3 Credits

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Nil

Course Outcomes: At the end of the course, students will be able to:

CO1	Classify and compare MEMS for various applications
CO2	Summarize various materials used for MEMS and microsystems
CO3	Explain the working principle of MEMS and microsystems
CO4	Interpret various processing techniques for fabrication of MEMS
CO5	Demonstrate the working principles of transducers
CO6	Illustrate the importance of MEMS packaging and reliability

Course Contents:

Unit 1: Introduction to MEMS and microsystems: History of MEMS development, Scaling of micromechanical devices, intrinsic characteristics of MEMS, Applications of MEMS in various industries, multidisciplinary nature of microsystem design and manufacture, Microsystems and microelectronics	[7]

Head
Dept. of Mechatronics Engineering
SIT COE, Yadrav

Unit 2: Materials for MEMS and microsystems: Silicon compatible material systems, Piezoelectric crystals, Polymers, Shape memory alloys, Packaging materials, Important material properties and physical effects	[7]
Unit 3: Microsystems and their working principles: Microsensors, Micro actuation, MEMS with micro actuators, Microfluidics	[8]
Unit 4: Microfabrication: Photolithography, Physical vapor deposition, Chemical vapor deposition, Bulk micromanufacturing, Surface micromachining, LIGA process	[6]
Unit 5: Transducers: Electrostatic sensing and actuation, Thermal sensing and actuation, Piezoresistive sensors, Piezoelectric sensing and actuation, Magnetic actuation	[6]
Unit 6: MEMS packaging and reliability: Key design and packaging considerations, Types of packaging solutions, Quality control and reliability	[6]

Text Books:

1. Tai-Ran Hsu, "MEMS and microsystems-Design and Manufacture," 1st edition, Tata McGraw-Hill, 2002
2. Nadim Maluf, Kirt Williams, "An Introduction to Microelectromechanical Systems Engineering," 2nd edition, Artech House Inc. 2004
3. Chang Liu, "Foundations of MEMS," 2nd edition, Pearson Education Inc., 2012

Reference Books:

1. The MEMS Handbook – Introduction and Fundamentals, 2nd edition, CRC Press, 2006
2. The MEMS Handbook – Design and Fabrication, 2nd edition, CRC Press, 2006
3. Thomas M. Adams, Richard A, Layton, Introductory MEMS – Fabrication and Applications, Springer, 2010

COLLEGE OF ENGINEERING, YADRAV
DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE Yadrav