Final

DIPLOMA CURRICULUM OF MECHATRONICS ENGINEERING (SECOND YEAR) (4th Semester)

(To be implemented from 2025-26)

Prepared by;

National Institute of Technical Teachers' Training & Research Kolkata
Block – FC, Sector – III, Salt Lake City, Kolkata – 700106

Vetted by:
Domain experts from Polytechnics of Odisha

State Council for Technical Education & Vocational Training
Near Raj Bhawan, Unit-VIII, Bhubaneswar, Odisha

Table of Contents

PROGRAMME TITLE: MECHATRONICS ENGINEERING

SEMESTER - IV

SL. No	Category of Course	Code No	Course Title	Study Scheme				Evaluation Scheme				Total Marks	Credits
				Pre-requisite	Contact Hours/ week			Theory		Practical			
					L	T	P	End Exam	Progressive Assessment	End Exam	Progressive Assessment		
1	Programme core	MEPC202 TH:1	Mechatronic System Design		3	0	0	70	30	-	-	100	3
2		MEPC204 TH:2	Electrical, Electronic Sensors and Actuators		3	0	0	70	30	-	-	100	3
3		MEPC206 TH:3	Microprocessor and Micro Controller		3	0	0	70	30	-	-	100	3
4		MEPC208 PR:1	Mechatronics System LAB		0	0	4	-	-	15	35	50	2
5		MEPC210 PR:2	Sensor and Actuators LAB		0	0	4	-	-	15	35	50	2
6		MEPC212 PR:3	Microprocessor and Micro Controller LAB		0	0	4	-	-	15	35	50	2
7	Programme elective	MEPE202 (Any one) TH:4	(A). Industrial Internet of Things (IOT) (B). Data Communication and Computer Network (C). Signal Conditioning and Data Acquisition System		3	0	0	70	30	–		100	3
8		MEPE204 (Any one) TH:5	(A). Automotive Electronics (B). Solar Power Technologies (C). Wind Power Technologies		3	0	0	70	30	–		100	3
9	**Minor Project**	PR202 PR:4	MINOR PROJECT		0	0	4	-	-	30	70	100	2
10	**Mandatory**	AU202	Essence of Indian knowledge and tradition		**2**	**0**	**0**	**-**	**-**	**0**	**0**	**0**	**0**
TOTAL					**17**	**0**	**16**	**350**	**150**	**75**	**175**	**750**	**23**

The best of 2 IA conducted in a subject out of 20 marks to be considered. Assignment/ quiz etc. of 10 marks to be treated as part of IA. Besides this, Monthly Test to be conducted for each subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester. Club/Innovation/ Idea Tinkering Activities etc. shall be encouraged to be performed by students beyond the above stipulated hours

Annexure - I

List of Open Elective Courses [OE]

S. No.	Code No.	Course Title	Hours per week			Semester	Cred-its
			L	T	P		
1	OE	Economic Policies in India	3	0	0	V / VI	3
2	OE	Project Management	3	0	0	V / VI	3
3	OE	Renewable Energy Technologies	3	0	0	V / VI	3
4	OE	Energy Conservation & Audit	3	0	0	V / VI	3
5	OE	Engineering Economics & Accountancy	3	0	0	V / VI	3
6	OE	Operations Research	3	0	0	V / VI	3
7	OE	Energy Efficiency and Audit	3	0	0	V / VI	3
8	OE	Disaster Management	3	0	0	V / VI	3
9	OE	Product Design	3	0	0	V / VI	3
10	OE	VLSI Technology	3	0	0	V / VI	3
11	OE	Digital Image Processing and Machine Vision	3	0	0	V / VI	3
12	OE	Computer Programming	3	0	0	V / VI	3
13	OE	Artificial Intelligence	3	0	0	V / VI	3
14	OE	Wireless Communications	3	0	0	V / VI	3

4TH SEMESTER

Code: MEPC202

TH:1- MECHATRONIC SYSTEM DESIGN					
L	T	P	Total Marks: 100	Code: MEPC202	
3	0	0			
Total Contact Hours		: 45Hrs		Theory Assessment	
Theory		: 45Hrs		End Term Exam	: 70
Credit		: 3		Progressive Assessment	: 30

RATIONALE:

Mechatronics is a multidisciplinary engineering course that combines mechanical, electronic, and computer science engineering to create systems that can process and communicate information. Here are some reasons why mechatronics is important: A diploma in mechatronics can lead to careers in automation, robotics, and smart systems. Mechatronics is changing the way people approach technology and how they learn new skills.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- State different types of mechatronics systems
- Explain electrical systems and their application in mechatronics
- Discuss mechanical systems and their application in mechatronics
- Explain fluid and thermal systems and their applications
- Design of mechanical and hydraulic system

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**Electrical Systems:** Mathematical modeling of Electromechanical Systems, RLC Circuits, active and passive electrical circuits, PMDC Motor, Stepper motor, three phase squirrel cage induction motor, three phase permanent magnet synchronous motor, servo motor	08
Unit 2	**Mechanical Systems:**	10

	Introduction to various systems of units, mathematical modeling of mechanical systems, Newton's laws, moment of inertia, forced response and natural response, rotational systems, spring mass system, free vibration, spring mass damper system, mechanical systems with dry friction, work energy and power, passive elements and active elements an energy method for deriving equations of motion, energy and power transformers.	
Unit 3	**Fluid and Thermal systems:** Mathematical modeling of liquid level system: Resistance and capacitance of liquid level systems with interaction. Mathematical modeling of pneumatic systems: Resistance and capacitance of pneumatic systems, mathematical modeling of a pneumatic systems, liberalization of non-linear systems. Mathematical modeling of hydraulic systems: Hydraulic circuits, hydraulic servo-meter and mathematical model of hydraulic servo motor dashpots. Mathematical modeling of thermal systems: Thermal resistance and thermal capacitance mathematical modeling of thermal systems.	10
Unit 4	**Design of Mechanical Elements:** The phases of design, Design considerations, codes and standards, optimum design process, design variables, cost functions, design constraints, optimum design. Springs, rolling contact bearing, journal bearing, Spur and helical gear, bevel and worm gears, shafts, axes and spindles, Flexible Mechanical Elements, Belts, timing belts, chain and sprocket, flexible shafts, brakes, clutches, cams, four bar mechanism.	12
Unit 5	**Design of Hydraulic System:** Hydraulic circuit design, Actuator design, selection of pumps, selection of valves, design of control circuits.	05

REFERENCE:

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. A Textbook of Mechatronics, R. K. Rajput, S. Chand & Company Private Limited.
4. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall.
5. Mahalik, Principles, concepts and applications Mechatronics", TMH.
6. Ramesh Gaonkar, "Introduction to 8085-PENRAM", International Publishing.
7. Muzumdar, "Pneumatics" –Tata McGraw-Hill Education.
8. Introduction to Mechatronics and Measurement Systems" by David G Alciatore and Michel Bi-Histand
9. Mechatronics: Integrated Mechanical Electronic Systems by K P Ramachandran

10. Mechatronics: Principles, Concepts and Applications by W Bolton
11. Mechatronics by Singh M D
12. Mechatronics by Tilak Thakur
13. Mechatronics by Ganesh S Hegde
14. Introduction to Mechatronics" by Dr K K Appukuttan

Code: MEPC204

<table>
<tr><th colspan="6">TH:2- ELECTRICAL, ELECTRONIC SENSORS AND ACTUATORS</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td rowspan="4">Total Marks: 100</td><td colspan="2" rowspan="2">Code: MEPC204</td></tr>
<tr><td>3</td><td>0</td><td>0</td></tr>
<tr><td colspan="2">Total Contact Hours</td><td>: 45Hrs</td><td colspan="2">Theory Assessment</td></tr>
<tr><td colspan="2">Theory</td><td>: 45Hrs</td><td>End Term Exam</td><td>: 70</td></tr>
<tr><td colspan="2">Credit</td><td>: 3</td><td>Progressive Assessment</td><td>: 30</td></tr>
</table>

RATIONALE:

The objective of this course is to understand the basics of sensors, actuators and their operating principles. Also, this course is to provide information about interfacing of sensors and signal conditioning circuits to establish any control system or monitoring system. The course will also provide knowledge about simulation and characterization of different sensors and finally the students will be able to evaluate sensor performance.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Explain fundamental physical and technical base of sensors and actuators,
- Describe basic laws and phenomena that define behavior of sensors and actuators,
- Set up testing strategies to evaluate performance characteristics of different types of sensors
- Explain the advantages of Smart sensors and IoT application
- Apply different actuators for real world automation

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**Overview of measurement systems:** Measurement devices; Difference between sensor, transmitter and transducer; Smart device. **Primary measuring element selection and characteristics:** Range; Response time; Accuracy; Precision; Sensitivity; Dead band; Dead time; Costs; Installation Problems. **Signal transmission:** Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Standard signal ranges: Electronic transmitter adjusted range; Pneumatic	03

	transmitter adjusted range; Transmission system dynamics; transmission Lag; Transmitter Gain; Smart transmitters.	
Unit 2	**Principles of Sensors:** Classification of sensors. Characteristics and calibration of different sensors.	03
Unit 3	**Displacement, position and motion sensors:** Principles of variable resistance, variable inductance, variable reluctance, variable capacitance type sensors. Position and Motion sensors: Limit switches; Proximity sensors: Pneumatic Proximity sensor; Optical Proximity sensor; Inductive Proximity sensor; Capacitive Proximity sensor; Ultrasonic Proximity sensor. **LVDT:** construction; Working principle; signal conditioning; use of LVDT. The Tacho-generator: DC tachogenerator; Digital Tachogenerator; Optical type and magnetic type. Synchro and resolver. Encoders: types of encoders; Hall sensors: Working principle; Hall effect gear tooth sensors. Distance sensors. **Light Sensor:** Photovoltaic; Photoconductive (Photo resistors). **Accelerometer:** Definition; General Construction; Working Principle; Types of Accelerometers.	06
Unit 4	**Force, Torque, Tactile** Different types of load cells and their application, Piezoelectric transducer, Torque measurement: Tactile sensors: Types, construction and working principle of Tactile sensors. magnetic, Piezoelectric, Photoelectric, capacitive and ultrasonic methods, Manometer, elastic elements.	05
Unit 5	**Strain Gauges:** Working principle; construction; poisson's ratio; Gauge factor, Piezo resistance Co- efficient; strain sensing alloys; characteristics; gauges length, rosettes. Types of Strain Gauge: Bonded; Unbonded; Metallic; Semiconductor. **Strain Gauge Measurement:** Wheatstone bridge measurement; Advantage between full bridge, half bridge and quarter bridge; ppm; disadvantage of. bridge circuit; linearity error; lead error, bridge constant; temperature compensation; practical implementation of strain gauge (Installation method).	06
Unit 6	**Pressure sensor:** Few Definitions on pressure; static, head, dynamic pressure. Classification of pressure; Pressure Measurement method: Manometric: U Tube manometer, well type; inclined tube manometer; dead weight; electric strain method. **Mechanical pressure measuring elements**: Bourden tube: Types – C Type; Spiral; Helical; Twisted; Bellows; Diaphragm. Design and construction of different types of pressure sensing elements. Application of Diaphragm: Capacitance Type, Reluctance Type, Strain Gauge Type and Inductive Type. Application of Bellows.	05
Unit 7	**Temperature sensor:** Mechanical and Resistance type temperature sensors, Thermocouples, Thermistor, Optical pyrometer.	04
Unit 8	**Smart Sensor:** Methods of internal compensation, information coding, integrated sensor	03

	principles, present trends.	
Unit 9	**Sensors in Robotics:** Potentiometers, Synchro and Resolvers, Optical encoders, Tactile and Proximity sensors, non-contact ranging sensors, Ultrasonic transducers, Opto-electric sensors, Geomagnetic sensors, Gyroscopes.	04
Unit 10	**Actuators:** Definition of Actuators: Example; selection; Types of Actuators; linear; Rotary; Logical and Continuous Actuators. **Electrical actuating systems:** Solid-state switches, Solenoids, Voice Coil; Electric Motors; D.C. motors, Classifications; Application; Brass less DC Motor; Working principle and its application; AC motors, Single phase Motor; 3 Phase Motor; Induction Motor; Synchronous Motor; Stepper motors; half stepper; full stepper; linear motor, Piezoelectric actuator.	06

REFERENCE:

1. Doeblin, E.O. – Measurement Systems: Application and Design, Mc Graw Hill International.
2. Patranabis, D – Sensors and Transducers, Wheeler Pub., New Delhi.
3. Murthy, D.V.S., Transducers and Instrumentation, PHI, New Delhi.
4. Swobada, G. – Telecontrol: Methods and Applications of Telemetry and Remote Control. Van Nostrand.
5. Newbert, H. K. – Instrument Transducers, Oxford University
6. Numerical Simulation of Mechatronic Sensors and Actuators by Manfred Kaltenbacher
7. Advanced Materials and Technologies for Micro/Nano-Devices, Sensors and Actuators by Evgeni Gusev and Eric Garfunkel
8. Electromechanical Sensors and Actuators by Ilene J Busch-Vishniac
9. Ultrasonic Transducers: Materials and Design for Sensors, Actuators and Medical Applications" by Nakamura K
10. Analog Circuit Design: RF Analog-to-Digital Converters; Sensor and Actuator Interfaces; Low-Noise Oscillators, PLLs and Synthesizers" by Rudy J van de Plassche and Johan Huijsin
11. Wireless Sensor and Actuator Networks: Technologies, Analysis and Design" by Roberto Verdone Professor and Davide Dardari

Code: MEPC206

TH:3- MICROPROCESSOR AND MICRO CONTROLLER					
L	T	P	Total Marks: 100	Code: MEPC206	
3	0	0			
Total Contact Hours		: 45Hrs		Theory Assessment	
Theory		: 45Hrs		End Term Exam	: 70
Credit		: 3		Progressive Assessment	: 30

RATIONALE:

Microcontrollers are optimized to perform a dedicated low-power application, ideal for embedded systems while microprocessors are more useful for general computing applications that require more complex and versatile computing operations. Advanced Microcontroller is an open-source and standard architecture. It has an on-chip interconnection structure for connection of functional blocks on specific designs. It has advanced BUS architecture, which facilitates multi-processor designs.

LEARNING OUTCOMES:

After the completion of the course, the student shall be able to

- Understand Interfacing of 8085/8086/8051
- Apply 8085/8086/8051 in real world
- Learn architecture and programming with 8O51 and PIC microcontroller
- Study the basic concepts of Arduino Uno and Raspberry Pi.
- Develop skill in simple applications development with programming 8051, PIC, Arudino Uno and Raspberry Pi.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**Introduction to Microprocessor:** 8085 Microprocessor Architecture and Its Operations, Memory, Input/Output (I/O), Microcomputer System, Interfacing Devices, Basic Instructions, Programming Techniques with Additional Instructions, Counter and Timing	06

	Delays, Stack and Subroutines, Code Conversion, BCD Arithmetic and 16-Bit, Data Operations, Software Development Systems and Assemblers.	
Unit 2	**8086 Microprocessor Architecture:** 8086 CPU Pins and Signals, Operating Modes, Minimum Mode, Maximum Mode, System Interrupt Configurations, Bus Timing Diagrams, Minimum Mode, and Maximum Mode.	06
Unit 3	**8086 Assembly Language Instruction and Programming:** Instruction Set, Registers and Flags, General Purpose Registers, Pointer Registers, Index Registers, Segment Registers, Flags Register, How Instructions Affect the Flags Register, Addressing Modes, Program Memory Addressing Modes, Data Memory Addressing Modes, Addressing Mode Byte, Segment Override, Memory Addressing Tables, Instruction Set Mnemonics, Assemblers. Dependent Mnemonics, 8086 Instruction Groups & Programming.	06
Unit 4	**8051 Microcontroller:** 8051 microcontroller Architecture, Instruction sets with examples, Assembly language Programs, Timers & Counters, Interrupts, Serial port programming, and how to interface external memory devices with 8051 microcontrollers. Application	06
Unit 5	**8085 / 8086 / 8051 Interfacing:** Interfacing Peripherals (I/O'S) & Applications, Parallel Input/output and Interfacing Applications, Keyboard & display Interface, Interrupts Interfacing Data Converters, Programmable Interface Devices, General Purpose Programmable Peripheral Devices, Serial I/O & Data Communication Microprocessor Applications.	07
Unit 6	**Arduino:** Introduction to the Arduino, creating an Arduino programming Environment, Arduino IDE, creating an Arduino program, Arduino Libraries, Analog and Digital Interfacing, Adding Interrupts, communicating with devices and sensors.	07
Unit 7	**Raspberry Pi:** Introduction to the Raspberry Pi, basic functionality of the Raspberry Pi board and its processor, setting and configuring the board, programming on Raspberry Pi, python programming environment, python expressions, general purpose IO pins, Protocol pins, RPi, GPIO library, communicating with devices and sensors.	07

REFERENCE:

1. Microprocessors and Microcontrollers (Second Edition) by R S Kaler
2. Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096 by Kant K
3. Microprocessors and Microcontrollers by A Nagoor Kani
4. Microprocessors and Microcontrollers by Jeevanathan and Saravanan
5. Microprocessors and Microcontrollers for VTU by A P Godse and Dr D A Godse
6. Fundamentals of Microprocessor and Microcontrollers by B Ram

7. Microprocessors and Microcontrollers by B P Singh
8. The x86 Microprocessors: 8086 to Pentium, Multicores, Atom and the 8051 Microcontroller: Architecture, Programming and Interfacing, 2e" by Lyla B Das.
9. Douglas V. Hall, Microprocessor and Interfacing, Tata McGraw-Hill Education.
10. Barry B. Bray, The Intel Microprocessors Architecture, Programming and Interfacing, Pearson Publications.
11. "Arduino Cookbook", Michael Margolis, O'Reilly Media, Inc., 1st Edition.
12. "Arduino for beginners: Essential Skills Every Maker Needs", John Baichtal, Person Education, Inc., 1st Edition.
13. "Raspberry Pi User Guide", Eben Upton and Gareth Halfacree, August 2016, 4th Edition, John Wiley & Sons.
14. "Programming with Raspberry Pi: Getting Started with Python", Simon Monk, January 2012, McGraw Hill Professional.

Code: MEPC208

PR:1- MECHATRONICS SYSTEM LAB					
L	T	P	Total Marks: 50	Code: MEPC208	
0	0	4			
Total Contact Hours		: 60Hrs		Laboratory Assessment	
Practical		: 60Hrs		Practical Exam	: 15
Credit		: 2		Progressive Assessment	: 35

RATIONALE:

The Course aims to give students professional knowledge and skills to conduct and lead mechanical engineering projects integrating smart ICT, electrical and control systems with a wide range of fields including energy, mechanics, electronics, automation. The design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

LEARNING OUTCOMES:

After completion of the Lab the students will be able to

- Measuring physical quantity such as displacement, force and temperature and also the operation of signal conditioning circuits
- Applying a suitable sensor and image processing technique for Mechatronics systems.
- Design appropriate circuits to automate and control the hydraulic, pneumatic and electric actuators.
- Apply microcontroller as a control unit Mechatronics system. 5. Developing a model of pneumatic and hydraulic circuits by using simulation software.
- Provide a focused laboratory environment to the engineering students to apply and absorb Mechatronics concepts.

DETAILED COURSE CONTENTS

Sl No	List of Experiments
1	Design and testing of fluid power circuits to control(i) Velocity (ii) direction and (iii) force of single and double acting actuators

2	Stepper motor interfacing with 8051 Micro controller(i) Full step resolution (ii) half step resolution
3	Traffic light interface.
4	Study of hydraulic, pneumatic and electro-pneumatic circuits.
5	Study of image processing technique.
6	Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
7	Servo controller interfacing for DC motor
8	Speed Control of AC & DC drives
9	Design of circuits with logical sequence using Electro pneumatic System
10	Computerized data logging system with control for process variables like pressure flow and temperature.

Code: MEPC210

PR:2- SENSORS AND ACTUATORS LAB					
L	T	P	Total Marks: 50	Code: MEPC210	
0	0	4			
Total Contact Hours		: 60Hrs		Laboratory Assessment	
Practical		: 60Hrs		Practical Exam	: 15
Credit		: 2		Progressive Assessment	: 35

RATIONALE:

Knowledge of sensors are needed for self-realization of a system and actuators, as they are the way through which the control systems act upon the system. The objective of this lab is to impart practical knowledge and hands-on training to students on the characterization, calibration and applications of sensors and actuators.

LEARNING OUTCOMES:

After completion of the Lab the students will be able to

- Set up testing strategies of different types of sensors and transducers
- Evaluate performance characteristics of sensors
- Show professional skills in applying the knowledge of sensors in the real world
- Design a real-life Industrial instrumentation system.

DETAILED COURSE CONTENTS

Sl No	List of Experiments
1	Study of the characteristics of Capacitor Level Sensor for Level Measurement of a Liquid in a Tank.
2	Study of the characteristics of a Piezo Resistive Sensor for Pressure Measurement of a Liquid in a Tank.
3	Study of the characteristics of Resistance Temperature Detector (RTD)

4	Study of the characteristics of a Thermistor
5	Study of the characteristics of a Thermocouple
6	Study of the characteristics of a Magnetic Proximity sensor for Speed Measurement
7	Study of the characteristics and operation of Magnetic Sensor.
8	Study of the operation and characteristics of optical sensors
9	Study of the characteristics of encoder fitted with PMDC/Brushless motor
10	Study of the operation of Synchro
11	Study of the characteristics of Pneumatic and Electrically operated control valves
12	Experiment on pneumatic cylinder and direction control valve
13	Study of the characteristics of servo motor and stepper motor

Code: MEPC212

PR:3- MICROPROCESSOR AND MICRO CONTROLLER LAB					
L	T	P	Total Marks: 50	Code: MEPC212	
0	0	4			
Total Contact Hours		: 60Hrs		Laboratory Assessment	
Practical		: 60Hrs		Practical Exam	: 15
Credit		: 2		Progressive Assessment	: 35

RATIONALE:

Design and coding knowledge on 80x86 family is necessary to provide practical exposure to the students on microprocessors. This course will give knowledge and practical exposure on connectivity and executing interfacing devices with 8086 and 8051 kit like LED displays, Keyboards, DAC/ADC, and various other devices.

LEARNING OUTCOMES:

After completion of the Lab the students will be able to

- Develop Assembly Language Programming of microprocessors and microcontrollers.
- Apply the basic knowledge of microprocessor interfacing, delay generation, and waveform generation.
- Design and implement programs on 8086 microprocessors.
- Apply the concepts of Interfacing to connect external devices with the 8085 and 8051
- Implement microcontrollers based on simple real time applications.

DETAILED COURSE CONTENTS

Sl No	List of Experiments
	Experiments on assembly language programming
1	Write a program to convert decimal numbers to hexadecimal.
2	Write a program to add a number n, m number of times.
3	Write a program to find the largest from a set of n numbers.

4	Write a program for sorting the given set of numbers.
5	Write a program to transfer a block of data from internal memory to external memory.
6	Experiments On 8051 Interfacing
7	Write an assembly language program for generating a triangular wave.
8	Write a program to find the largest from a set of ten numbers and display it using LEDs.
9	Write a program to display the decimal numbers in 7 Segment display.
10	Write a program to read the DIP switches for displaying the reading using 7 Segment display
11	Write a program to rotate the given motor in a clockwise direction.
12	Write a program to rotate the given motor in an anticlockwise direction.
13	Write a program to generate a square wave.
14	Write a program to display a message in LCD display
15	Familiarization with Arduino/Raspberry Pi and perform necessary software
16	Connection of an Arduino board with ESP8266 Wi-Fi module
17	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
18	To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
19	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
20	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON the motor when push button is pressed.

Code: MEPE202A

TH:4(A)- INDUSTRIAL INTERNET OF THINGS (IOT)					
L	T	P	Total Marks: 100	Code: MEPE202A	
3	0	0			
Total Contact Hours		: 45Hrs		Theory Assessment	
Theory		: 45Hrs		End Term Exam	: 70
Credit		: 3		Progressive Assessment	: 30

RATIONALE:

The Internet of Things (IoT) is a revolutionary technology that refers to the collective network of connected devices and the technology that facilitates communication between devices and the cloud, as well as between the devices themselves. It has many applications that can improve the quality of life for people and businesses. IoT devices can collect and analyze data in real time, which can help businesses make better decisions. IoT devices can monitor equipment performance and detect potential issues before they cause downtime. The study of IoT and its applications will make the students to achieve the skills on modern technology.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Explain fundamental concepts of IoT
- Describe roles of sensors in IoT
- Explain different protocols used for IoT design
- Handle data and analytics tools in IoT
- Explain various applications of IoT and APIs to connect IoT related technologies.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**Fundamentals of IoT**: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks.	07

Unit 2	**Sensors Networks:** Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, the node, Connecting nodes, Networking Nodes, WSN and IoT.	10
Unit 3	**Wireless Technologies for IoT:** WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus. IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT. Edge connectivity and protocols.	08
Unit 4	**Data Handling& Analytics:** Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications	10
Unit 5	**Applications for IoT:** Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.	10

REFERENCES:

1. Soldatos, John –Editor, Building blocks for IoT analytics internet-of-things analytics, River publishers, 2017.
2. Perry Lea, Internet of Things for Architects: Architecting IoT solutions by implementing, Packt Publishing Limited, 2018.
3. Raj Kamal, Internet of Things, McGraw Hill Education, 2017
4. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks: Architectures and Protocols, Prentice Hall PTR, New Jersey, May 2004.
5. B. S. Manoj, "Internet of Things," bsmp, Trivandrum, 2022.
6. Relevant research publications.

Code: MEPE202B

<table>
<tr><th colspan="6">TH:4(B)- DATA COMMUNICATION AND COMPUTER NETWORK</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td rowspan="4">Total Marks: 100</td><td colspan="2" rowspan="2">Code: MEPE202B</td></tr>
<tr><td>3</td><td>0</td><td>0</td></tr>
<tr><td colspan="2">Total Contact Hours</td><td>: 45Hrs</td><td colspan="2">Theory Assessment</td></tr>
<tr><td colspan="2">Theory</td><td>: 45Hrs</td><td>End Term Exam</td><td>: 70</td></tr>
<tr><td colspan="2">Credit</td><td>: 3</td><td>Progressive Assessment</td><td>: 30</td></tr>
</table>

RATIONALE:

Now a days the growth of data communication technology has become very fast in development of various application areas. This subject will expose the learner to have an idea about the architecture of computer networks and different protocols to be followed to communicate. Further they will have an idea about different modes of communication.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Know the concepts of Data Communication, networking, protocols, and networking models
- Understand the concepts of switching and various Error detection and correction methods
- Know about data flow, error control and data link control
- Learn the concepts of wired LANs and Ethernet
- Know the concepts of network layer, logical addressing, IP, Forwarding and routing
- Understand brief concept on TCP/IP

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**Network& Protocol:** Data Communication, Networks, Protocol & Architecture, Standards, OSI, TCP/IP.	05
Unit 2	**Data Transmission & Media:** Data transmission Concepts and Terminology, Analog and Digital Data transmission, Transmission impairments, Channel capacity, Transmission media, Guided Transmission, Wireless Transmission	06

Unit 3	**Data Encoding:** Data encoding, Digital data digital signals, Digital data analog signals, Analog data digital signals, Analog data analog signals.	06
Unit 4	**Data Communication & Data link control:** Asynchronous and Synchronous Transmission, Error Detection, Line configuration, Flow Control, Error Control, Multiplexing, FDM synchronous TDM, Statistical TDM.	06
Unit-5	**Switching & Routing:** Circuit Switching networks, Packet Switching principles, Routing in Packet switching, Congestion, Effects of congestion, congestion control, Traffic Management, Congestion Control in Packet Switching Network.	08
Unit-6	**LAN Technology:** Topology and Transmission Media, LAN protocol architecture, Medium Access control, Bridges, Hub, Switch, Ethernet (CSMA/CD), Fiber Channel, Wireless LAN Technology.	07
Unit-7	**TCP/IP:** TCP/IP Protocol Suite, Basic Protocol functions, Principles of Internetworking, Internet Protocol operations.	07

REFERENCES:

1. W.Stallings, Data Communication & Computer Networks, PHI
2. M.Bhatia, Introduction to Comp. Network, Unv. S. Press
3. Forouzen, Data Communication & Network, TMH

Code: MEPE202C

TH:4(C)- SIGNAL CONDITIONING AND DATA ACQUISITION SYSTEM					
L	T	P	Total Marks: 100	Code: MEPE202C	
3	0	0			
Total Contact Hours		: 45Hrs		Theory Assessment	
Theory		: 45Hrs		End Term Exam	: 70
Credit		: 3		Progressive Assessment	: 30

RATIONALE:

Knowledge of signal conditioning of sensors output is needed for self-realization of a complete system and actuators, as they are the way through which the control systems act upon the system. The objective of this lab is to impart practical knowledge and hands-on training to students on the characterization, calibration and applications of various signal conditioning circuits after sensors so that it can be used by the controllers.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- State different types of signal conditioning
- Explain analog signal conditioning and its application in mechatronics
- Discuss digital signal conditioning and its application
- Describe operation of data acquisition system

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**Analog Signal Conditioning** Introduction, Principles of Analog Signal Conditioning, Signal-Level Changing, Linearization, Conversions, Zero adjustment, Span adjustment, Filtering and Impedance Matching, Passive Circuits, Divider Circuit, Bridge Circuits, RC Filters, Operational Amplifiers, Characteristics, Op Amp Circuits in Instrumentation, Voltage Follower, Differential Amplifier, Instrumentation Amplifier, Active Filters, Voltage-to-Current Converter, Current-to-Voltage Converter, Linearization, Special Integrated Circuits (ICs), Industrial Electronics, Silicon-Controlled Rectifier (SCR), TRIAC.	15

Unit 2	**Digital Signal Conditioning** Review of Digital Fundamentals, Busses and Tri-State Buffers, Converters, Comparators, Digital-to-Analog Converters (DAC), Analog-lo-Digital Converters (ADCs), Sample and Hold, Multiplexer and De-multiplexer, decoder and encoder, Pulse modulations, Digital recorder, Programmable Logic Controller	15
Unit 3	**Data Acquisition System** Introduction, Analog and Digital Data Acquisition Systems, Block diagram, Components, CPU, Memory, Input / Output, Sensors, ADC, DAC, Sample and Hold, Multiplexing, De-Multiplexing, Modulation, Display, Recording, Alarm, Programming, Voltage, Current, Frequency, Temperature, Displacement, Pressure measurement using Data Acquisition System (DAS), Application of Data Acquisition System in Power plant, Process control plant and Automation, Data Logger.	15

REFERENCES:

1. Signal Conditioning and PC-Based Data Acquisition Handbook by Steve Lekas
2. Practical Data Acquisition for Instrumentation and Control Systems by John Park and Steve Mackay
3. Resistive, Capacitive, Inductive, and Magnetic Sensor Technologies by Winncy Y Du
4. Electrical Measurement and Control by S K Bhattacharya and S Bhattacharya
5. Signal Conditioning Handbook by IO tech Inc
6. Transducer Interfacing: Signal Conditioning for Process Control by Robert G Seippel
7. Signal Conditioning in Raman Spectroscopy Signals by Peter Knief

Code: MEPE204A

TH:5(A)- AUTOMOTIVE ELECTRONICS					
L	T	P	Total Marks: 100	Code: MEPE204A	
3	0	0			
Total Contact Hours		: 45Hrs		Theory Assessment	
Theory		: 45Hrs		End Term Exam	: 70
Credit		: 3		Progressive Assessment	: 30

RATIONALE:

Auto Electronics is introduced with the aim of providing necessary knowledge on automobiles that may help the students get employed in automobile Industries.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Understand the basic concepts and components
- Explore different ignition systems
- Explain about the lead acid battery, testing and lighting system
- Describe the sensor based electronic engine management and control devices
- Study about advance Future Trends in Automobile Techniques

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**Automobile fundamentals**	09
	The engine-components- engine block, cylinder, crank shaft, piston, cam shaft, valves, intake system, ignition, exhaust, cooling system- Lubrication system-fuel feed system ignition system- spark plug- high voltage circuit and distribution- compression ignition system -steering system, Ackerman steering mechanism. Suspension systems. Fuel injection and Ignition system - Fuel injection-types-throttle body versus port injection- Fuel injectors- different types; High pressure diesel fuel injection- Introduction to Electronic ignition system.	

Unit 2	**Storage Battery, Charging and Lighting System:** Principle of lead acid cells, plates and their characteristics, construction, electrolyte, effect of temperature on electrolyte, specific gravity, capacity and efficiency, methods of charging from D.C. mains, defects and remedies of batteries, care of idle and new batteries. **Recycling Process** - Recent developments. D. C. Generators, Alternators -their Characteristics. Control, cutout, Electrical, Electro-mechanical and electronic regulators. Procedure for charging., details of head light and side light, LED lighting system, head light dazzling and preventive methods. Static and Dynamic Bending lights.	09
Unit 3	**Sensors and Engine Management Systems:** Introduction to sensors and transducers-Types-Air flow rate sensor, Engine crankshaft angular position senor, Engine speed sensor, Timing sensor, Throttle angle sensor, Pressure sensor, Temperature sensors, Pressure sensor- Flow sensor, Exhaust gas oxygen sensors, Knock Sensor, Engine torque sensors, Automotive engine control actuators, Exhaust gas recirculation actuator. Electronic Engine Management System, Brake actuation warning system, flash system, oil pressure warning system, engine overheat warning system, air pressure warning system, speed warning system, door lock indicators, neutral gear indicator, horn design, permanent magnet horn, air & music horns. Wind shield wiper. Window washer, electronic instruments, dashboard illumination and MIL.	09
Unit 4	**Automotive control systems and control components:** Engine Control Objectives, Engine control functions, Fuel delivery systems, Electronic fuel Ignition Systems– Emission control, Automotive Transmission Control Systems - Cruise control system, Antilock braking system(ABS), Tire-slip control, Active suspension, Traction control, Electronic Suspension system, Steering control, Stability control, Integrated engine control. Central locking, Air bags and seat belt tensioners. Voice warning system, Travel information system, GPS. Introduction to micro chip –micro controller – block diagram – architecture –Introduction to AVR family IC – features, block diagram, architecture. Basics of embedded control and software.	09
Unit 5	**Recent trends in automobile technology:** Electrical and Hybrid Vehicles, Introduction-Electric Vehicle development- system layout- basic system components- Electric battery solar cells- Rapid charging system-Motor drive system-fuel cell Electric vehicle- Hybrid vehicles- Parallel Hybrid Vehicle-CNG Electric hybrid vehicle. Vehicle Intelligence: Introduction – Base structure- Vision based autonomous road vehicles- Architecture for vision system-Features applications –image processing – Intelligent robot vehicles - obstacle detection, collision warning and avoidance system.	09

REFERENCE:

1. Automobile engineering vol- 1, vol – 2, Kirpal singh, Standard publishers distributors New Delhi.
2. Automobile Engineering, G.B.S. Narang, Khanna Publishers, New Delhi.
3. Understanding Automotive Electronics, William B. Ribben, 6th edition Elsevier Science-2003
4. Vehicle and Engine technology. Vol. I, Heinz Heisler, , ELBS

5. Automobile Engineering, R.B.Gupta, Satya Prakashan, New Delhi
6. Understanding Automotive Electronics, Fourth Edition, William B. Ribbens
7. Sensor and Transducers, Ronald K.Jurgen, SAE-2003
8. Electric and Hybrid-electric vehicles, Ronald K. Jurgen, SAE 2002

Code: MEPE204B

TH:5(B)- SOLAR POWER TECHNOLOGIES					
L	T	P	Total Marks: 100	Code: MEPE204B	
3	0	0			
Total Contact Hours		: 45Hrs		Theory Assessment	
Theory		: 45Hrs		End Term Exam	: 70
Credit		: 3		Progressive Assessment	: 30

RATIONALE:

Solar power is a renewable energy source that can help reduce greenhouse gas emissions and mitigate climate change. It's also a reliable and cost-effective energy source because sunlight is free and won't run out like fossil fuels. A student needs to know the atomic structure of silicon, energy band formation in semiconductor, and the principles for electron-hole pair generation by photon absorption. It also covers solar cell characteristics, materials for photovoltaic cells, etc.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Identify different types of solar cell, its components & materials.
- Use solar cell in PV system applications.
- Test solar cell characteristic parameters.
- Fabricate photovoltaic array, module, and panel components.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**Solar cell fundamentals:** Current conduction in semiconductors. Atomic structure of silicon, Energy band formation in semiconductor, P-Type and N-type material with silicon, Formation of P-N junction of semiconductor. Principles for Electron-Hole Pair generation by Photon absorption, Photoelectric effect, Photo-conductive effect and Photovoltaic effect. Materials for Opto-Electronic applications. Concept of solar cell, Main elements of silicon solar cell.	7
Unit 2	**Solar cell characteristics:** Current-Voltage (I-V) characteristics of a Photovoltaic cell. Power-Voltage (P-V) characteristics of a Photovoltaic cell. Equivalent circuit of a solar cell, Maximum power point (MPP). Design considerations of Solar cells – Short circuit current (Isc), Open circuit voltage (Voc), Fill factor (FF), Energy losses & factors for loss, Efficiency. Factors limiting the efficiency of solar cells. Impact of external parameters on solar cell performances – (i) Radiation, (ii) Temperature, (iii) Wind velocity.	10
Unit 3	**Materials for Photovoltaic Cells:** Classification of solar cells, Cell size. Single crystalline silicon cell, Polycrystalline silicon cell. Thin film solar cell – Amorphous Silicon, Gallium Arsenide, Cadmium Telluride, Copper Indium Galium Diselenide. Multi-junction solar cell. Other non-silicon materials for photovoltaic cell fabrications. Production technology of Gallium Arsenide and Amorphous Solar Cell. Materials required for solar panel and formation of solar panel.	08
Unit 4	**Technologies for Photovoltaic Cells Fabrication:** Dye-sensitised Solar Cell (DSSC) technology, Organic solar cell technology, Quantum Dot Solar cell technology. Concept of PV module, PV panel, PV array and its formation. Silicon Group and non-Silicon Group, PV cell, PV module, PV panel and PV array fabrication. Application of Nanotechnology in Solar Cell. Technical data sheet of solar PV panel. 4.6 Basic control diagram of PV system and its components. Power distribution layout of PV system.	07
Unit 5	**Active solar energy in systems:** How large-scale deployment of active solar energy is possible in Sweden and globally. Buying and selling heat and electric energy. Grid aspects of large-scale deployment of solar cells as well as environmental and socioeconomic aspects.	5
Unit 6	**Testing and Evaluation of Photovoltaic Cells:** Solar Simulator and its application. Current-voltage analysis of solar cells, Power analysis. Light soaking and temperature cycling analysis.	03

Unit 7	**Hybrid systems: Combinations** of solar thermal and solar cell systems. Overview of different applications. District heating with solar thermal components. Introduction to microchip –micro controller – block diagram – architecture –Introduction to AVR family IC – features, block diagram, architecture. Basics of embedded control and software.	05

REFERENCE:

1. Renewable Energy Technologies, Solanki, Chetan S., PHI Learning, New Delhi, 2011
2. Renewable Energy Sources for Sustainable Development, N.S. Rathore and N. L. Panwar, New India Publishing Agency, New Delhi
3. Renewable Energy Resources, J. Twidell and T. Weir, E & F N Spon Ltd, London, 1999
4. Non-Conventional Energy Resources B. H. Khan, The McGraw Hill Publications.
5. Non-Conventional Energy Sources G.D. Rai Khanna Publications
6. Solar Energy – Principles of Thermal Collection and Storage S. P. Sukhatme, J.K. Nayak Tata McGraw-Hill, New Delhi
7. Solar Energy, Fundamentals and Applications Garg, Prakash Tata McGraw Hill.
8. Non-Conventional Energy Resources Shobh Nath Singh Pearson
9. Introduction to NonConventional Energy P.Raja Scitech Publications(India) Pvt.
10. Non-Conventional Energy Resources S.H.Saeed, D.K.Sharma S.K.Kataria& Sons
11. Solar energy A.M. Rehman Scitech Publications (India) Pvt. Ltd
12. Introduction to solar principles Thomas E. Kissell Pearson

Code: MEPE204C

TH:5(C)- WIND POWER TECHNOLOGIES					
L	T	P	Total Marks: 100	Code: MEPE204C	
3	0	0			
Total Contact Hours		: 45Hrs		Theory Assessment	
Theory		: 45Hrs		End Term Exam	: 70
Credit		: 3		Progressive Assessment	: 30

RATIONALE:

Wind power is a renewable energy source that can help reduce greenhouse gas emissions and mitigate climate change. It's also a reliable and cost-effective energy source because wind power is free and won't run out like fossil fuels. A student needs to know qualitatively how the terrain influences the wind resource, calculate and analyze wind resource and energy production for a wind turbine from wind speed distribution, wind shear and power curve by and large. It also covers to describe and motivate the design of typical wind turbines, differences between horizontal and vertical axis wind turbines, calculations for wind turbines and describe typical control methods for wind turbines, as well as control problems.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- State the different types of Windmills, Explain the Need, importance and scope of Wind Energy resources.
- Describe the working System components and their functions. Calculating output and dimensioning of Wind Mill systems. Explain Examples of DFIG - systems globally.
- Explore the working of Prepare economic analysis for Commercial/ Industrial/ Residential wind energy conservation systems
- Acquire knowledge about How large-scale deployment of active wind energy is possible in India and globally.

DETAILED COURSE CONTENTS

Unit	Topic/Subtopic	Hours
Unit 1	**History:** early wind power, technical development, influence of society and science **Winds:** physical background, energy content, variation in time and in space, geographical resource distribution, influence of terrain, measurement methods, statistical analysis	09
Unit 2	**Turbines:** free flow, principles of drag and lift, aerodynamics, design of turbine blades, horizontal and vertical axis wind turbines, Betz' and Glauert's turbine theories, the BEM **method Mechanics:** static and dynamic loads (oscillations), rotor dynamics, solid mechanics, mechanical modelling, aeroelasticity	11
Unit 3	**Electric generation:** synchronous/ asynchronous generators, winding/ permanent magnetized generators, constant/ variable speed, transformers, power electronics, power converters **Design:** horizontal and vertical axis wind turbines, blades, control mechanisms, drive train, tower, nacelle, foundation, choice of materials, manufacture, adaptation to different climates	10
Unit 4	**Control:** control targets, system modelling, control strategies (pitch and stall regulation), hardware **Systems:** wind power parks, transports, erection, grid connection, operation, maintenance	08
Unit 5	**Economy:** financing, investment, costs during the life time of a wind turbine, value of wind energy, business and market overview **Society:** environmental issues, law, forms of government support, technical aspects of environment Small scale wind power: technology, economy, paths of 8 20 development	07

REFERENCE:

1. A Textbook of Power System Engineering, A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, Dhanpat Rai Publication
2. Renewable Energy Technologies, Solanki, Chetan S., PHI Learning, New Delhi, 2011
3. Renewable Energy Sources for Sustainable Development, N.S. Rathore and N. L. Panwar, New India Publishing Agency, New Delhi

4. Renewable Energy Resources, J. Twidell and T. Weir, E & F N Spon Ltd, London, 1999
5. Electric Power Generation: Transmission and Distribution, S. N. Singh, PHI Learning, New
6. Electrical Power, Dr. S.L. Uppal
7. Electrical Power System, Mehta, V.K. S. Chand and Company Bew Delhi, 2011.

Code: PR202

<table>
<tr><th colspan="6">PR:4- MINOR PROJECT</th></tr>
<tr><td>L</td><td>T</td><td>P</td><td rowspan="4">Total Marks: 100</td><td colspan="2" rowspan="2">Code: PR202</td></tr>
<tr><td>0</td><td>0</td><td>4</td></tr>
<tr><td colspan="2">Total Contact Hours</td><td>: 60Hrs</td><td colspan="2">Project Assessment</td></tr>
<tr><td colspan="2">Practical</td><td>: 60Hrs</td><td>Practical Exam</td><td>: 30</td></tr>
<tr><td colspan="2">Credit</td><td>: 2</td><td>Progressive Assessment</td><td>: 70</td></tr>
</table>

RATIONALE:

Mini-projects help students in different ways like the formation of groups, understanding group behavior, improving communication skills, learning in-depth with minimum time, interaction with the guide and outside agencies, thinking about final year projects, etc. it is observed that students are always excited to work on "something new topic in Engineering" because of their interest in learning in the implementation of knowledge in actual fields rather than classes. It will be appreciated if students involve some experimental works, case studies, site visits, and industrial projects, if possible.

The procedure of Evaluation: Normally, evaluation of mini-projects is done through presentations by a group of students in front of two or more faculty, and assessment of the individual student is done by faculty and the average of marks is worked out.

LEARNING OUTCOMES:

After completion of the course the students will be able to

- Integrate their knowledge and skills to develop prototype models in their field.
- Develop professional values and ethical standards.
- Handle real life challenges by making effective decisions to complete project work.
- Show skills in developing real world applications

STUDENTS' ACTIVITY

Students will do their project work as per guidance from their guide (faculty member).

Code: AU202

ESSENCE OF INDIAN KNOWLEDGE AND TRADITION

L	T	P	Total Marks: NIL	Course Code: AU202	
2	0	0			
Total Contact Hours				Theory Assessment	
Theory		: 30Hrs		End Term Exam	0
				Progressive Assessment*	0
Pre-Requisite		: Nil			
Credit		0		Category of Course: Mandatory	

RATIONALE:

Considering the need of protecting Indian knowledge and tradition, the diploma level students of Automobile Engineering should be facilitated the concepts Indian traditional knowledge and to make them understand the importance of roots of knowledge system and methods of application in today's life and how to protect traditional knowledge system. Interpretation of the concepts of Intellectual property to protect the traditional knowledge as well as importance of Traditional knowledge in Agriculture and Medicine must be known.

LEARNING OUTCOME:

On successful completion of the course, students will be able to:

- Discuss the concepts of traditional Indian knowledge and roots of knowledge system and indigenous knowledge system
- Explain the technique of protection of traditional Indian knowledge
- Discuss legal frameworks of traditional knowledge
- State intellectual property rights
- State traditional knowledge in Different Sectors

DETAILED COURSE CONTENTS

UNIT	TOPIC/SUB-TOPIC	Allotted HRS.
1	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge (Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge of Odisha	07
2	Protection of traditional knowledge (TK): The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	07
3	Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.	06
4	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Geographical Indications (GI).	04
5	Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	06

REFERENCE BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor.
3. Madhya Himalayi Sanskriti mein Gyan, Vigyan evam Paravigyan by Prof PC Pandey.

Suggested Online Link:

Web Links:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/12110600/

*****Progressive Assessment to be conducted for ensuring learning of students.