P.K.UNIVERSITY, SHIVPURI (MP)
(FACULTY OF ENGINEERING & TECHNOLOGY)

EVALUATION SCHEME & SYLLABUS

FOR

Diploma in Electronics & Instrumentation Engineering

(III Year- VI Semester)

(ON)

CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from the Session: 2025-26]

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN ELECTRONICS &INSTRUMENTATION ENGINEERING

SEMESTER -VI

SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME						Total Marks
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
DPROCEI601	Process Control	4	1	0	5	30	-	30	70	-	70	100
DMICREI602	Micro Controllers & Embedded System	4	0	0	4	30	-	30	70	-	70	100
DBIOMEI603	Bio-Medical Instruments	4	0	0	4	30	-	30	70	-	70	100
DROBOEI604	Robotics	4	0	0	4	30	-	30	70	-	70	100
DPROCEI605	Process Control Lab	0	0	2	1	-	25	25	-	25	25	50
DMICREI606	Micro Controllers & Embedded System Lab	0	0	2	1	-	25	25	-	25	25	50
DBIOMEI607	Bio-Medical Instruments Lab	0	0	2	1	-	25	25	-	25	25	50
DPROJEI608	Project	0	0	12	6	-	100	100	-	100	100	200
Total		16	1	18	26	120	175	395	280	175	455	700

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L	T	P
4	1	0

DPROCEI601: PROCESS CONTROL

1 **INTRODUCTION:**

Basic of process control, Process characteristics, static and dynamic resistance and capacitance of a process, process time delay, dead time, Response of general closed loop process control system.

2 **AUTOMATION CONTROL ACTIONS:**

Types of control actions Two position control- ON-OFF action, Proportional, Proportional plus Derivation action, Proportional plus Integral, Proportional plus Integral plus Derivative action, Control scheme- feed forward.

3 **FINAL CONTROL ELEMENT:**

Introduction, Pneumatic Actuator, Hydraulic Actuator , Electric Actuator, Motor Actuator ,Control Valves . Types of Control Valves, Butterfly ,Globe,Gate, Ball valves, Solenoid valves, Installation and Maintenance of Control Valve , use of final control element.

4 **PNEUMATIC AND HYDRAULIC CONTROLLER**

Flapper-Nozzle system as control element , Characteristic of flapper-nozzle system, Effect of non - linearity of various gain, , I/P Converter & P/I Converter, Direct acting and Reverse acting relay as amplifier in pneumatic system . ON-OFF, P, PI, PD and PID Pneumatic controller, Hydraulic fluids, Jet nozzles control component Comparision between Hydraulic and Pneumatic control system(Concept only)

5 **ELECTRONIC CONTROLLER:**

Op-amp as building block of Electronics controller , ON-OFF, P, PI, PD, PID Electronic Controller.

6 **DIRECT DIGITAL CONTROL SYSTEM:**

Introduction, DDC structure, DDC software basics , Advantage and Disadvantage of DDC

7 **PROGAMMABLE LOGIC CONTROLLER (PLC) ,SCADA,HMI**

Introduction ,Principal of operation, Architecture of PLC, Types of Programming ,Ladder Programming &Boolean Logic, Application, Merits and Demerits of PLC, SCADA/HMI & it's Functional Requirements System Architecture ,configuration , Working, Communication& protocols , Some popular PLC/SCADA/HMI .

8 **DISTRIBUTED CONTROL SYSTEM (DCS):**

Real time computer control system – A Concept , Functional Requirements of DCS, System Architecture, configuration , Working , Communication & Protocols, some popular DCS.

9 **PREVENTIVE MAINTENANCE:**

Objectives of preventive maintenance, elements of preventive maintenance, procedure of preventive maintenance schedules. Simple example of preventive programes and maintenance schedules .

10 VIRTUAL INSTRUMENTATION:

Concept of Data flow techniques , Basic of Data Acquisition and use of Analysis tools

RECOMMENDED BOOKS

1 D.P Eckman, "Automatic Process control" 7th Edition, John Wiley New York 1990

2 Curtis D. Johnson Peocess Control Instrumentation Technology, 8th Edition, Pearson 2006

3 Coughanowr, D.R., "Proces Systems Analysis and Control", McGraw-Hill International Edition,2004

4 Bela G Liptak "Process Contro and Optamization"., InstrumenrEngineers , Handbook volume2, CRC press and ISA, 2005

5 S. K. Singh "Industrial Instrumentation and Control "

6 Surekha Bhanot "Process Control Prinviples& Applications"

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DMICREI602: MICROCONTROLLERS & EMBEDDED SYSTEM

1. **Microcontroller series (MCS)** (14 Periods)

1.1 Architecture of 8051Microcontroller
1.2 Pin details
1.3 I/O Port structure
1.4 Memory Organization
1.5 Special Function Registers (SFRs)
1.6 External Memory

2. Instruction Set for Microcontroller Programming (16 Periods)

2.1 Instruction Set of 8051
2.2 Addressing Modes,
2.3 Types of Instructions
2.4 Timer operation
2.5 Serial Port operation
2.6 Interrupts

3. **Introduction to Embedded System** (08 Periods)
Embedded system, history of embedded systems, embedded system architecture, Functional structure of embedded system

4. **Embedded operating systems** (10 Periods)
Real-time operating system, factors affecting embedded systems, applications of embedded systems, embedded systems characteristics and features,

5. **Introduction of PIC microcontroller** (10 Periods)
Block diagram, function of each block. Introduction of AVR microcontroller, block diagram, function of each block.

6. **Programming concepts of microcontrollers**. (10 Periods)
Basic introduction of Software used in microcontrollers.
How to transfer C or ASM code in microcontrollers.

7. **Input/output interface** (08 Periods)
- Sensors, 7-segment display, LCD, LED and relay

8. **Internet of Things** (08 Periods)
- Introduction to Internet of things
- Application, architecture, protocols
- Functional blocks of IoT, Characteristics of IoT
- Brief idea of Arduino IDE

RECOMMENDED BOOKS:-

1 Fundamentals of Microprocessor and Microcontroller by B. Ram , Dhanpat Rai Publications.

2 Microcotroller and Embedded Systems using Assembly And C by Muhammad Ali Mazidi, RolinMckinlay, Janice GilispieMazidi: Pearson

3 PIC Microcontroller and Embedded Systems : Using assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Danny Causey; Pearson

4 Microcotroller and Embedded Systems using Assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Janice GilispieMazidi, Pearson

5 Embedded Systems - Architecture, Programming, Design, by Kamal, R. Tata McGraw Hill, New Delhi

6 YashavantKanetkar, ShrirangKorde, "21 Internet Of Things (IOT) Experiments" NeerparajRai , "Arduino Projects For Engineers"

7 **E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.**

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DBIOMEI603:BIO-MEDICAL INSTRUMENTATION

1 **INTRODUCTION:**

Basic measurement system, Measurement, Measurand, Accuracy, Precision, Errors in Measurements, Signal and Noise, Calibration, Transduction principles, Classification and Characteristics of Transducers, Transducer parts and electrical design characteristics.

2 **HUMAN PHYSIOLOGY:**

Elementary ideas of cell structure Heart and circulatory system Central nervous System Muscle action Respiratory System Body temperature

3 **BIOPOTENTIAL ELECTRODES:**

Electrode theory: the electrode / Electrolyte interface, Polarizable and nonpolarizable electrodes, Liquid junction potential, Electrode potential, Application of Biopotential electrodes.

ECG electrodes: Surface electrodes, Silver- silver chloride electrodes, stainless steel electrodes, Electrode impedance and Electrode equivalent circuit.

EMG electrodes: Surface electrodes, Needle and Wire electrodes.

EEG electrodes: Micro and suction electrodes- Glass microelectrodes, Metal microelectrodes, Suction electrodes, Microelectrode equivalent circuit.

4 **BIOSENSORS:**

Definition of biosensor, Application and origin of biosensor, Transduction mechanism of biosensor, Blood gas and pH sensors, Bio-Analytical Sensor, Enzymatic biosensors, Optical Biosensors,PO2 and PCO2 sensor, Manufacturing techniques of Biosensors.

5 **BIO-MEDICAL RECORDERS:**

Principle of Physiological pre amplifier and specialized amplifiers. Generalised Block diagram of a Bio-medical reorder.

ECG machine: Block diagram of ECG machine ECG

machine, EEG machine & EEG leads EMG machine

6 **MEDICAL DISPLAY SYSTEM:**

Cardio scope -Cardio scope as sub system Multi channel display system.

CT SCAN, MRI

7 **PATIENT MONITORING SYSTEM**:

Concept, block diagram areworking. Microprocessor application is patient monitoring.

8 **ULTRASOUND INSTRUMENTATION:**

Basic principles of ultra- sonics Doppler principle Fetal Monitor Pulse-echo technique Pulse-echo instrument and imaging Imaging system, scanners.

9 **DEFIBRILLATOR AND PACE MAKERS:**

Block Diagram and principle of DC defibrillator Syrchronis edde fibrillator Pacemakers.

10 PHYSIOTHERAPYS:

Short wave dia-thermy machine Control of output power Application techniques

11 LOW VOLTAGE THERAPY INSTRUMENTS:

Diagnostic stimulators Therapy stimulators

Constant current/constant voltage stimulators.

RECOMMENDED BOOKS

1 R.S. Khandpur, Biomedical Instrumentation Technology and Application, McGraw-Hill Professional, 2004

2 Leslie Cromwell, Fred. J.Weibell and Erich. A.P feiffer. “Biomedical

3 Fundamental of Biomedical instrumentation by Dr.O.N. Pandey

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DROBOEI604:ROBOTICS

1 **FUNDAMENTALS OF ROBOT**

Definition of Robot, Difference between a robot and an automated machine, Advantages and Disadvantages of Robots .Classification -Cartesian, Polar, Cylindrical, Jointed arm, SCARA robot. Basic motions of Robot or degrees of freedom. Factors for Selection of a robot.

2 **ROBOTIC SYSTEMS**

Introduction , Basic components of robotics system ,Mechanical Design of a Robot, Types of Mechanical Joints, Robots Qualities, Robot Specifications, Robot'skinematic Control, types of controller used in robotic system, Non Servo Control , Servo Control –point-to-point and continuous path control, examples.

3 **ROBOT END EFFECTORS**

Definition of End Effectors, Types of End-effectors, Tools, Types of Tools, Characteristics and elements of End-arm tooling, Description of Mechanical grippers –Two & three finger gripper, Vacuum grippers, Magnetic grippers, Adhesive grippers.

4 **ROBOTIC SENSORS**

Definition of Robotic Sensor, Characteristics of a Sensing device, Types of Sensors-External and Internal sensors,Touch or Tactile Sensors - Binary & Analog sensors , Strain Gauge,Position and displacement sensors- Optical encoder-LVDT, Proximity Sensors – Contact & Non-contact proximity sensors, Optical proximity sensor, Ultrasonic sensors, Fibre optic scanning sensors, Scanning laser sensors, Range sensors, Definition of Robotic Vision ,Functions of Robot vision systems, Components of machine vision system ,Advantages of Machine vision, Industrial Applications.

5 **ROBOT PROGRAMMING AND LANGUAGES**

Definition of Robot program. Online and Offline Programming, Programming approaches– Robot oriented programming , Object oriented or Task level programming . Methods to program the Robot work cycle. Robot Programming Languages, Requirement of a Robot programming Language, Types of Robot languages. Example of a robot program.

6 **ROBOT APPLICATIONS**

Applications of Robots, Applications in manufacturing, Examples-Spray Painting, Welding, Material Handling and transfer, Machine loading and unloading applications, Sorting of parts, Inspection of parts, Automatic guided vehicle system. Precautions for Robot, Future of Robots.

RECOMMENDED BOOKS-

1 Industrial Automation and Robotics, A. K. Gupta and S. K. Arora, University Science Press
2 Robotics and Industrial Automation, R. K. Rajput, S. Chand, New Delhi
3 Automation and Robotics, Khushdeep Goyal, Deepak Bhandari, S. K. Kataria& sons
4 Robotics and Controls, R. K. Mittal & I. J. Nagarath, Tata McGraw Hill

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DPROCEI605: PROCESS CONTROL LAB

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0	0	2

LIST OF PRACTICALS

1 To draw characteristic of

A. Quick opening control valve

B. Equal percentage control valve

C. Linear control valve

2 To draw the characteristic of valve

A. Without Positioner

B. With valve Positioner and compare it

3 To study the working of D/P transmitter and plot th I/O characteristic at different range of I/P span

4 To study the working of ON/OFF level controller and draw I/O characteristics.

5 To Draw characteristics of I/P and P/I converter.

6 To verify the logical Expression / Logic Gates using Ladder Logic on PLC Panal.

7 To write and perform simple program using Ladder Logic on PLC panel

8 To Perform Data Read and Write operation using HMI & PLC panel.

9 To study a distributed control system panel and do various experiment task on it.

10 To design a simple control diagram of SCADA software and link it to a given PLC and do various experiment or it.

11 Design a control loop of a typical process using LABVIEW and do various task using virtual instrumentation software

12 To fabricate and install a process instrumentation system.

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DMICREI606: MICROCONTROLLERS & EMBEDDED SYSTEM LAB

LIST OF PRACTICALS

1 Familiarization with Micro-controller Kit and its different sections
2 Programming to interface switches and LEDs
3 Programming and interface of Seven Segment and LCD.
4 Programming for A/D converter, result on LCD.
5 Programming for D/A converter, result on LCD.
6 Programming for serial data transmission from PC to Kit or Vice versa.
7 Programming and interfacing of RELAY and Buzzer
8 Design PIC based Security System
9 Design AVR based Temperature indicator cum controller.
10 Practical using Arduino-interfacing sensors
11 Interfacing Light Emitting Diode(LED)- Blinking LED Interfacing Button and LED – LED blinking when button is pressed
12 Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp Interfacing Relay module to demonstrate Bluetooth/wifi based home automation application. (using Bluetooth/wifi and relay).

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DBIOMEI607:BIO-MEDICAL INSTRUMENTATION LAB

L	T	P
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LIST OF PRACTICALS-

1) To operate and familiarization with- A) B P Apparatus/Sphygmomanometer
   B) Electronic B P meter
2) To operate and familiarization with Ventilator.
3) To measure the Concentration of blood sugar with Glucometer(Fasting, P.P. ,Random)
4) To measure- A) Respiration rate and interface to PC
   B) Pulse Rate
5) Measurement of Heart rate using stethoscope.
6) Measurement of Heart Sound using Phonocardiography machine.
7) To record electrical parameters of the Heart using ECG machine and determine the heart rate, time and amplitude of QRS Complex
8) To measure The EMG signals and interface with PC
9) To measure Human Body temperature using clinical Thermometer and Digital thermometer.
10) To measure pH of a given biological solution (Blood/urine) using pH meter.
11) To detect Blood Group using Antigens.
12) Operation and use of Electro-Physiotherapy.
13) To measure Air Flow using spirometer.
14) Study &Installation of medical equipment's in laboratories of Hospitals precautions to be taken.

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0	0	12

DPROJEI608: PROJECT

Some of the project activities are given below:

- Projects related to designing small electronic equipment / instruments.
- Projects related to increasing productivity in electronic manufacturing areas.
- Projects related to quality assurance.
- Projects connected with repair and maintenance of plant and equipment.
- Projects related to design of PCBs.
- Projects related to suggesting substitutes of electronics components being used.
- Projects related to design of small oscillators and amplifier circuits.
- Projects related to design, fabrication, testing and application of simple digital circuits and components.
- Projects related to microprocessor/microcontroller based circuits/ instruments.

Some of the projects based on above areas are listed below for the benefit of students:

1. Microprocessor/Microcontroller based rolling display/bell and calendar
2. Microprocessor based stepper motor control.
3. Speed control of DC Machines by Microprocessor/Microcontrollers
4. Temperature monitoring using Microprocessor/Microcontroller based systems.
5. Microprocessor/Microcontroller based liquid level indicator and control
6. Fabrication and assembling of digital clock.
7. Fabrication of ON line/OFF line UPS of different ratings and inverters
8. Design, fabrication and testing of different types of experimental boards
9. Repair of oscilloscope, function generator
10. Microprocessor/Microcontroller based solar tracking system
11. GSM based car or home security system
12. Bank token display using microcontroller
13. Microprocessor/Microcontroller Based A/D converter
14. Microprocessor/Microcontroller Based D/A converter
15. Simulation of half wave and full wave rectifiers using Simulation Software
16. Simulation of class A, Class B, Class AB and Class C amplifiers
17. Simulation of different wave forms like sine, square, triangular waves etc. GPS based vehicle tracking system

Calculate BER(Bit Error Rate) of various modulation techniques Electronic Weighing Machines,
Setting up home security system using biometrics and video recording
Making an overhead tank water level controller using a pump and control system
PLC based water level controller/sequential motor starter/bottling plant/traffic light control.