Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

THIRD YEAR 6TH SEMESTER SYLLABUS

Course Code: PC - EI 601	**Category: Professional Core Course**
Course Name: Process Control	**Semester: Sixth**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 44	
Pre-Requisite: Control System	

Objectives:

1. To study the operation of different types of industrial processes.
2. To study the different control strategies used in industrial applications.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	General review of process, Process control & automation, Servo and regulatory control, Basic process control loop block diagram. Characteristic parameter of a process: Process quality, Process potential, Process resistance, Process capacitance, Process lag, Self regulation.	8
2	Different control modes: On-off control, Multistep , Time proportional, Proportional, Offset-why it appears and how it is eliminated-mathematical analysis, Proportional-integral, Proportional -derivative, Proportional-integral-derivative, integral windup, bump less transfer, Inverse derivative control, controller selection guideline. Effect of disturbances and variation in set point in process control.	8
3	Tuning of controllers: Controller performance indices, Concept of good control, close loop and open loop tuning methods, comparison of tuning methods. Electronic P, PI, PD, PID controller design Pneumatic Controllers - brief analysis	8
4	Different control strategies - schemes, brief analysis and uses (i) Feedforward control (ii) Cascade control (iii) Ratio control (iv) Override control (v) Adaptive control (Programmed or scheduled and self adaptive control) (vi) Continuous control and Batch control.	6
5	Final control elements: Classification. Actuators: self-operated, pneumatic, electro-pneumatic, and stepper motor operated actuators. Valve positioner. Classification of control valves, performance and application of different control valves, valve type and construction, Single & Double Seated Valves, valve sizing, valve characteristics, Cavitation, Flashing, valve	8

	selection guidelines. Control Valve Accessories – Air Filter Regulator, I/P Converter.	
6	Programmable Logic Controller: Block diagram, Classification, Basic Architecture and Functions; Input-Output Modules. PLC Programming: PLC function block timers, function block counters, arithmetic function blocks, real time LADDER diagram; programming examples for maintenance and control. DCS: Computer based control, History and overviewof DCS, Concept of centralized and distributed control systems, system architecture, brief view on operator station, engineering station, field control station.	6

Course Outcome:

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

1. Construct the block diagram of feedback control loop and demonstrate its various components.
2. Analyze the different process characteristics with suitable examples.
3. Classify different types of controllers according to their feature and use.
4. Apply the concept of controller tuning in practical processes.
5. Illustrate the construction and use of different types of control valves.
6. Differentiate between different control schemes such as feedforward control, cascade control, ratio control, etc.
7. Construct LADDER program to operate batch processes.

Learning Resources

Text books:

1. Process Control-Principles and application, S. Bhanot, Oxford University press.
2. Principle of Process control, D. Patranabis, TMH.
3. Automatic Process Control, D.P. Eckman, John Wiley.
4. Instrumentation and Process Control, D.C. Sikdar, Khanna Publishing House.

Reference books:

1. Process control, P. Harriott, McGraw Hill.
2. Chemical process control, G. Stephanpoulos, PHI.
3. Process control instrumentation technology, C.D. Johnson, PHI
4. Process Control, S.K. Singh, PHI.
5. Instrument Engineers Handbook, B.G. Liptak, Chilton Book Co. Philadelphia
6. Elements of Chemical Process Technology, O.P. Gupta, Khanna Publishing House

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Course Code : PC-EI 602	**Category: Professional Core Course**
Course Name: Biomedical Instrumentation	**Semester: Sixth**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 40	
Pre-Requisites: No -prerequisites	

Objectives:

1. To introduce students information about biomedical instrumentation and its application.

2. To familiarize students about different types bio-signals like ECG, EEG, EMG.

Course Content:

Module No.	Description	Contact Hours
1	**BASIC PHYSIOLOGY AND TRANSDUCERS** Introduction to the physiology of cardiac, nervous and muscular and respiratory systems. Transducers- Different types of transducers and their selection criteria for biomedical applications.	6
2	**BIOPOTENTIAL & BIOELECTRODES** Action and resting potential .Electrode theory-different types of electrodes -Hydrogen Calomel, Ag-AgCI, pH, PO_2 and Pco_2 electrode and selection criteria of electrodes.	6
3	**ELECTRO – PHYSIOLOGICAL MEASUREMENTS:**Electrocardiography,Measurement of Electrical Activities in Muscles and Brain: Eectromyography, Electroencephalography and their interpretation.	6
4	**NON-ELECTRICAL PARAMETER MEASUREMENTS** Measurement of Blood Pressure and Blood flow. Cardiac output and Cardiac rate.	8
5	**MEDICAL IMAGING** Ultrasound and IR Imaging X-ray machine - Radio graphic and fluoroscopic techniques, Computer tomography . MRI – Ultrasonography	8
6	**BIOTELEMETRY**	6

	Transmission and Reception aspects of Biological signals via long distance.Application of biotelemetry in patient care.	

Course Outcomes:

At the end of the course, a student will be able to:
1. Inspect common biomedical signals.
2.Describe the origin of various bio-potentials and explain the role of bio-potential electrodes.
3. Explain the measurement principles for blood flow, blood pressure.
4. Indentify various imaging techquines.
5. Illustrate the application of biotelemetry system.

Learning Resources

Text Books:

1. Cromwell – Biomedical Instrumentation and Measurement, PHI
2. Webster J S – Medical Instrumentation – Application and Design
3. Khandpur R S – Handbook of Biomedical Instrumentation, TMH,

Reference Books:

1. Carr – Introduction to Biomedical Equipment Technology 4/e – Pearson
2. Chatterjee Miller – Biomedical Instrumentation, Cengage Learning
3. Astor B R – Introduction to Biomedical Instrumentation and Measurement, McMillan.

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Course Code: OE - EI 601	**Category: Open Elective Courses -II**
Course Name: Internet of Things (IoT)	**Semester: Sixth**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 44	
Pre-Requisite: Sensors & Actuators, Microcontrollers, Basic programming knowledge	

Objectives:

1.Able to understand the application areas of IOT

2. Able to understand building blocks of Internet of Things and characteristics

3. Able to realize the revolution of Internet in Mobile Devices & Sensor Networks

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to IoT, Concept of Smart sensors and actuators	6
2	Basic of IoT networking Internet Communications: An Overview MQTT, CoAP, REST Api and gRPC, Different Communication protocols :(RFID, IEEE 802.15.4, Zigbee, 6LoWPAN, Bluetooth), LoRa, Machine-to-Machine (M2M) Communications, MQTT Broker	4
3	Introduction to Python programming with IoT modules i.e. Paho MQTT, Web modules: urllib2, Flask, Flask-RESTful	12
4	Introduction to Arduino Programming, integration of Sensors having analog and i2c. Connecting Arduino with ESP8266 WiFi module	10
5	Introduction to Python Raspberry Pi, Implementation of IoT with Raspberry Pi.	10
6	IoT application: Smart Cities and Smart Homes	2

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

1. Understand the application areas of IOT.
2. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3. Understand building blocks of Internet of Things and characteristics.
4. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
5. Building state of the art architecture in IoT.

Learning Resources

Text books:

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wileypublication, 1st Edition, November 2013.
2. Jeeva Jose, Internet of Things, Khanna Publishing House, New Delhi (AICTE Recommended – 2018)
3. Michale Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", PearsonEducation
4. Hanes David ,Salgueiro Gonzalo, Grossetete Patrick, Barton Rob ,"IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things" , PearsonEducation
5. RMD SundaramShriram, K Vasudevan, Abhishek S Nagarajan,"Internet of Things" ,Wiley publication,

Reference books:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems,Springer International Publishing

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Course Code: OE–EI 602	**Category: Open Elective Course - 1I**
Course Name: Artificial Intelligence (AI)	**Semester: Sixth**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 45	
Pre-Requisite: Algorithmic approach of Problem Solving, Discrete Mathematics and Statistics.	

Objectives:

1. Problem Solving using knowledge of AI techniques.

2. Data Analysis and Forecasting using AI Tools.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Overview – Overview of AI, Turing Test, Problems of AI, Intelligent Agent, Environment and Types of agents. State Space search problem, Production Systems explanation using standard problems like water-jug, wolf-goat-cabbage, missionary cannibals, 8-puzzle etc.	6
2	Search Techniques – BFS, DFS, Iterative deepening and broadening, bidirectional and Comparisons among the techniques. Heuristics based searches, Greedy, Uniform Cost and A* techniques.	7
3	Hill Climbing, AND-OR search, Constraint Satisfaction Problems. Adversarial Search- Min-max search and alpha-beta pruning	8
4	Knowledge Representation – Propositional Logic and proof by contradiction, FOPL, Resolution, Unification Algorithm Basic Knowledge of Programming in Prolog and Python.	8
5	Probabilistic Reasoning – Bayesian Learning, Belief Network, Fuzzy Logic and Sets, NLP, Expert Systems	8
6	Machine Learning – Types of learning (Supervised, Unsupervised, Reinforcement), Classification Model and Learning Steps, Common Classification Algorithms (kNN, Decision Tree, Random Forest, SVM)	8

Course Outcome:

1. Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.

2. Explain how Artificial Intelligence enables capabilities that are beyond conventionaltechnology, for example,chess-playing computers, self-driving cars, robotic vacuum cleaners.

3. Use classical Artificial Intelligence techniques, such as search algorithms, minimax algorithm.

4. Ability to apply Artificial Intelligence techniques for problem solving.

Learning Resources

Text books:

1. Artificial Intelligence, Ritch and Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Artificial Intelligence and Soft Computing, Amit Konar.
4. A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Publishing House

Reference books:

1. Machine Learning, Saikat Dutta, Subramanian Chandramouli, Amit Kumar Das, Pearson.
2. Introduction to Machine Learning, Jeeva Jose, Khanna Publishing House

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Course Code: OE- EI 603	**Category: Open Elective Courses-III**
Course Name: Digital Signal Processing	**Semester: Sixth**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 42	
Pre-Requisite: No-prerequisite	

Objectives:

1. To provide students a brief concept of signals and systems related to signal processing.
2. To acquire knowledge of different types of signal processing methods.
3. To familiar with the importance of Fourier Transformation in signal processing and its different methods.
4. To realize the importance of filter and their various designing techniques.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	**Discrete-time signals:** Concept of signals and systems, Advantages and application of digital signal processing, Analog signal to digital signal conversion, Sampling theorem, Reconstruction of signal, Concept of Discrete –time signal, Representation of discrete time sequences, Classifications of discrete time sequences with example, Mathematical operations on sequences. **Discrete-time System** Classifications of Discrete time systems, LTI systems, Representation of Discrete time signal using Impulse response, Concept and properties of linear convolution, Methods of convolution process between two signals by both graphical and tabular form procedure, De-convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems .	3 5
2	**Z-Transform:** Defination, Relationship between Laplace Transform and Fourier Transform, Mapping between s-plane and z-plane, concept of unit circle (Fourier transformation from z transformation, stability of a system using z transformation, concept of ROC, Z-transformation of finite and infinite sequences and their ROC, z-transformation of standard sequences, properties of z-transform **Inverse Z-transform :** Direct evaluation of inverse Z-transform -Residue theorem, partial fraction method, Long division or power series expansion method, convolution process	3 3

3	**Discrete Time Fourier Transform (DTFT):** Concept of Fourier series of discrete time signals, difference between continuous time and discrete time Fourier series, frequency spectrum of periodic discrete time signals, properties of discrete time Fourier series and its example, definition of DTFT, frequency spectrum of discrete time signal, properties of DTFT, DTFT of periodic discrete time signals,analysis of discrete time system using DTFT and its frequency response. **Discrete Fourier Transform:** Concept of DFT/IDFT, relation between DFT and IDFT, Properties of DFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as lineartransformations and computation of DFT in matrix form, multiplication of DFTs or concept of circular convolution,computation of circular convolution by graphical and matrix form, relationship between linear convolution and circular convolution, computation of linear convolution from circular convolution, , linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods .	4 5
4	**Fast Fourier Transform (FFT):** Complexity analysis of direct computation of DFT, Concept of FastFourier transformation, Radix-2 computation of FFT using decimation-in-time and decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations of FFT in one place using both algorithms, bitreversal process, examples for DIT & DIF FFT Butterfly computations .	5
5	**FIR Filter Design:** Basic concepts of IIR and FIR filters, Gibbs Phenomenon, design of linear phase FIR filters, no. of taps, concept of window technique to design FIR filter,Fourier series method of FIR filter designing, different types of window sequences and their spectrum-rectangular, Bartlett, Hamming, Hanning, Blackman and Kaiser windows, Design of FIR filter using window techniques.	6
6	**IIR Filter Design:** Concept of IIR digital filter, recursive and nonrecursive system, analog to digital domain transformation- impulse invariant method and bilinear transformation and their properties, limitations of bilinear transformation, warping and prewarping, methods to find out the order of IIR filter, mapping of poles and zeroes of filter in analog domain, computation of filter transfer function in analog domain, digital filter realization techniques, procedure to design Butterworth digital IIR filters.	8

Course Outcome:

1. Distinguish different types of signals, can acquire a brief idea about analog and digital signals and their conversion techniques , criterion for stability of a system.
2. To evaluate different types of mathematical operation on signals.
3. Learn a good idea about Z-transform and importance of analog to digital domain transformation technique.
4. Appropriately distinguish between Fourier series and Fourier transformation, properly compute it,
5. Know different types of filters, distinguish between analog and digital filter, methods to transform from one type to another types of filter.
6. Acquire a clear idea of different filter designing techniques and their realization methods.

Learning Resources

Text books:

1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis&D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.

Reference books:

1. Digital Signal Processing, A. NagoorKani, TMH Education
2. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
3. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.

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Course Code: OE-EI 604	**Category: Open Elective Courses -III**
Course Name: Soft Computing Techniques	**Semester: Sixth**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 45	
Pre-Requisite:	

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to Soft-computing, Its Constituent components, Fuzzy Sets, General Idea and importance in practical life, definition,	7
2	Basic Operators, T- Norms, S- Norms, other aggregation operators, Fuzzy relations, implications, extensions, projections and compositions	6
3	Approximate reasoning, compositional rule of inference, rule based systems, term set, Fuzzification, reasoning, defuzzification	7
4	Different Fuzzy models (MA/TS), Applications of Fuzzy rule based systems	6
5	Basics of Genetic Algorithm, its adaptation for computing, Application	10
6	Studies of some Fuzzy-neural, Neuro-fuzzy and Fuzzy-GA systems	9

Learning Resources

Text books:

1. Dirankov and Hellendrom Fuzzy logic control, Narosa
2. Rajsekhar and Pai, Neural Networks, Fuzzy logic and Genetic Algorithm: Synthetic and Applications, Pearson Education
3. Goldberg - Genetic algorithm, Pearson 2003
4. Freeman - Neural Networks, Pearson 2003
5. Jang - Neuro-fuzzy and soft Computing, Pearson 2003

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Course Code: HM- HU 601	**Category: Humanities & Social Sciences including Management Courses**
Course Name: Economics for Engineers	**Semester: Sixth**
L-T-P: 2-0-0	**Credit: 2**
Total Lectures: 45	
Pre-Requisite: No-prerequisite	

Objectives:

1. To provide students the basic concepts of Economic theories related to Engineering so that they can analyse the economic viability of any engineering course of action.

2. To provide students the basic concepts of Finance and the methods of Accounting so that they can use such methods and concepts in order to analyse the economic viability of the engineering or any other courses of action related to any project.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	6
2	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal& Effective Interest. 4. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return,	9
3	5. Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, 6. Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks. .	6

4	7.Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. 8. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Riskvs Return, Simulation, Real Options.	9
5	9. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives 10.Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, DepreciationCalculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining BalanceDepreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances	6
6	11. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. 12. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	9

Course Outcome:

1.Understand the Principles of Engineering Economy and the Engineering Decision-making process. Apply the appropriate type of Estimating Model to determine Engineering Cost.

2.Understand the basic concept of Time value of money and apply such formulas to analyze Situations of both Single cash flow and multiple cash flow. Apply such knowledge toEvaluate financial feasibility of different types of investment situations in Engineering Projects.

3. Understand the causes and Effect of Inflation & Deflation and Use the Price Indexes in Engineering Economic Analysis.

4. Understand the basic concept of Probability and expected value and of Depreciation and Obsolescence. Also apply the Fundamental methods of calculation of depreciation.

5.Understand Replacement Analysis Replacement Map and determine Minimum Cost Life of aNew Asset.

6.Understand Accounting Function, Balance Sheet ,Income Statement and apply suchknowledge in calculation of Financial Ratios and apply Cost Accounting Principles for Direct and Indirect Cost Allocation.

Learning Resources:

Text books:

1. R. PaneerSeelvan: Engineering Economics, PHI
2. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House
3. BhabatoshBanerjee : Cost Accounting ,The World Press Private Ltd.
4. BhabatoshBanerjee : Cost & Management Accounting ,The World Press Private Ltd.
5. Amit Kumar De &SamironMkherjee: Economics for Engineers, Matrix Educare Pvt. Ltd.
6. Financial Accounting I : Soumya Mukherjee &Abhik Kr. Mukherjee ,Oxford University Press

Reference books:

1. Sullivan and Wicks: Engineering Economy, Pearson
2. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e ,Tata McGraw-Hill
3. Cost & Management Accounting I :J.K.Mitra , Oxford University Press

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Course Code: MC-ES 601	**Category: Mandatory Course**
Course Name: Indian Constitution and Cultures	**Semester: Sixth**
L-T-P: 1-0-0	**Credit: 0**
Total Lectures: 40	
Pre-Requisite: No pre-requisite	

Objectives:

1. To provide basic knowledge about the Indian Constitution.

2. To have working idea about the functioning of the Executive, Legislative and Judiciary bodies in our country.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	**Indian Constitution** Sources of Constitutional history, Preamble and its Salient Features, Citizenship, Fundamental Rights and Duties, Directive Principles of State Policy	5
2	**Union Government and its administration.** Structure of the Indian Union. Legislative bodies: LokSabha and the RajyaSabha, The Speaker and the Chairperson of the RajyaSabha. Executive Bodies. The President and the Vice-President - Role, Power and the method of Election and Amenities and Removal Procedure The Prime Minister and the Council of Ministers. Central Secretariat	10
3	**State Government/s and its administration.** Federalism. Centre-State relationship The Governor – Role and Function The Chief Minister and the State Council of Ministers State Secretariat	5
4	**The Judiciary** The Supreme Court – Organization, Procedure, Jurisdiction and Power Chief Justice and other Judges High Court/s - Organization, Procedure, Jurisdiction and Power Chief Justice and other Judges Subordinate Courts – Structure, Jurisdiction and Procedure LokAdalats	10

	PIL – Scope, Principle and Features	
5	**Local Administration – Urban** Municipalities, Municipal Corporations, Town Area, Notified Area Mayor – Role and Function	5
6	**Local Administration – Rural** ZillaParishad, AanchalParishad and Gram Panchayats Powers, Functions and Key Functionaries **Grassroot Empowerment**	5

Course Outcome:

After the completion of this course learners will be able to:

1. Identify the authority to redress the problems in their profession or society

2. Describe:

The features of Indian Constitution

Workings of the various Legislative, Executive and Judicial bodies in the country

Appreciate the democratic workings at the grassroots level

Understand the jurisdiction and procedures of our courts

Learning Resources

Text books:

1. Indian Polity, M Laxminath, Mcgraw Hill Publications, 5th Edition.

Reference books:

1. Introduction to the Constitution of India, D DBasu, Lexis Nexis Publications of India, 21st Edition.

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Course Code: PC - EI 691	**Category: Professional Core Courses**
Course Name: Process Control Lab	**Semester: Sixth**
L-T-P: 0-0-3	**Credit: 1.5**

Laboratory Experiments :	
1	Study of flow, level, pressure processes and construction of the PI diagrams in accordance with ISA guidelines / standards.
2	Study of a typical Temperature Control Loop having Furnace, suitable final control element, Temperature transmitter, conventional PID controller.
3	Study of a typical Pressure Control Loop having Pressure source, Pressure Transmitter, Motorized/Pneumatic control valve, and conventional PID controller.
4	Study of a typical Flow Control Loop having suitable Flow meter, Motorized/ Pneumatic control valve, and conventional PID controller.
5	Study of a typical Level Control Loop having Level Transmitter, Motorized/ Pneumatic control valve, and conventional PID controller.
6	Study of a typical Air Duct Flow Monitoring and Control.
7	Study the performance of DCS for controlling multiple processes from remote end.
8	Familiarization with PLC & LADDER Programs

Course Outcome:

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

1. Analyze the operation of different types of control action.
2. Apply the concept of controller tuning in practical processes.

Course Code: PC - EI 692	**Category: Professional Core Courses**
Course Name: Instrumentation System Design Lab	**Semester: Sixth**
L-T-P: 0-0-3	**Credit: 1.5**

Guidelines:

1. Design of sensors for measurement of process parameters.
2. Design of appropriate signal conditioning circuit for different sensors.
3. Design of process control loop.
4. Design of PC based instrumentation system.
5. Electronic system design employing microcontrollers.
6. Electronic circuit design using PCB layout with suitable software .

Course Outcome:

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

1. Learn the issues related to practical implementation of applications using electronic circuits.
2. Design sensors and suitable signal conditioning circuit.

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Course Code: OE-EI691	**Category: Open Elective -II**
Course Name: Internet of Things Lab (IoT)	**Semester: Sixth**
L-T-P: 0-0-3	**Credit: 1.5**

Laboratory Experiments :

1	Familiarization with Python and writing programs in PyCharm IDE using Anaconda Framework.
2	Program to implement Paho MQTT client in Python.
3	Program simple web server in Python using Flask framework.
4	Familiarization with Arduino IDE and writing a program using Arduino IDE for LED blinking.
5	Study of LM35/DHT-11 temperature sensors and write programs to monitor them with Arduino with Thing Speak.
6	Setup Raspbian on the Raspberry Pi and write a program to blink an LED using Python.
7	Interfacing digital sensors and relay boards with Raspberry Pi
8	Familiarization with Python and writing programs in PyCharm IDE using Anaconda Framework.

Course Outcome:

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

1. Gather engineering knowledge related to IoT.
2. Students can analysisthe problem and able to design/develop the solutions

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Course Code : OE-EI692	**Category: Open Elective- II**
Corse Name : Artificial Intelligence Lab(AI)	**Semester : 6th**
L-T-P :0-0-3	**Credit: 1.5**

Laboratory Experiments : Solve the problems Using Prolog/LISP	
1	**Concepts on number**: Factorial, GCD,LCM, Digit count.
2	**Concept on list**: Maximum, Minimum, Palindrome Searching, Union, Intersection
3	**Sorting of list**: Selection sort, Quick sort,
4	**Knowledge Base**: Create KB and apply rules.
5	**Graph Searching algorithms**: DFS,BFS
6	**Implement Puzzle**: Wolf Goat cabbage, Monkey Banana Problem.

Course Outcome:

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

1. Apply Artificial Intelligence techniques for problem solving.