Semester-VIII

Name of the course UTILIZATION OF ELECTRIC POWER			ER	
Course Code: PC-EE 801 Sen		Semester: 8 th		
Durat	Duration: 6 months Maximum Marks: 100			
Teach	ing Scheme	Examination Scheme		
Theor	ry: 3 hrs/week	Mid Semester Exam: 1	15 Marks	
Tutori	ial: 0 hr/week	Assignment & Quiz:	10 Marks	
Practi	cal: 0 hrs/week	Attendance: (05 Marks	
Credit	t Points: 3	End Semester Exam:	70 Marks	
Objec	tive:			
1.	To understand basic principle of illuminati	on and good lighting p	ractices	
2.	To understand the method of Electric heating	ng, Welding and Electr	rolytic processe	es.
3.	To understand the concepts of Electrical	traction systems.		
4.	To solve numerical problems on the topics stu	ıdied.		
Pre-R	equisite			
1.	Electric Machine (PC-EE-401, PC-EE-501)			
2.	Control System (PC-EE-503)			
3.	Power Electronics (PC-EE-504)			
Unit	Content		Hrs	Marks
1	Electric Traction: Requirement of an ideal of system for electric traction, Train movement simplified speed time curve, average speed and Mechanism of train movement (energy considuring acceleration, tractive effort on a grading resistance, power & energy output for the affecting specific energy consumption, coeffic Electric traction motor & their control: Paral of Series and Shunt motor with equal and uneffect of sudden change of in supply voltage, of supply, Tractive effort and horse power. Use of AC series motor and Induction motor traction motor control: DC series motor control, Braking of electric motors, Electroly earth, current collection in traction system.	nt (speed time curve, and schedule speed), umption, tractive effort dient, tractive effort for driving axles, factors cient of adhesion). lel and series operation nequal wheel diameter, Temporary interruption for traction. control, Multiple unit ysis by current through	10	
2	Electric Lighting: Definition of terms; Luminaries; Lighting requirements; Illun selection and maintenance; Lighting schemes – Interior lighting – industrial, Factory, resid lighting - Flood, street lighting, lighting for one neon signs, LED-LCD displays beacons and lighting in the contract of the con	nination levels; lamp s, calculations & design ential lighting; Exterior displays and signaling -	8	

	Energy Conservation codes for lighting; lighting controls – daylight sensors and occupancy sensors; controller design.		
3	Electric Heating: Advantages of electrical heating, Heating methods, Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating	08	
	appliances and thermostat control circuit ,Induction heating; principle of core type and coreless induction furnace , Electric arc heating, direct and indirect arc heating, construction, working and applications of arc furnace, Dielectric heating, applications in various industrial fields, Infra-red heating and its applications, Microwave heating, Simple design problems of resistance heating element.		
4	Electric Welding: Advantages of electric welding, Welding methods, Principles of resistance welding, types –spot, projection seam and butt, welding and welding equipment used, Principle of arc production, electric arc welding, characteristics of arc, carbon arc, metal arc, hydrogen arc welding and their applications, Power supply required, Advantages of using coated electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminum and copper, Introduction to TIG, MIG welding	08	
5	Electrolytic processes: Need of electro-deposition, Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing, Equipment and accessories for electroplating, Factors affecting electro-deposition, Principle of galvanizing and its applications, Principle of anodising and its applications, Electroplating on non-conducting materials, Manufacture of chemicals by electrolytic process and electrolysis process.	06	

Text books:

- 1. Generation Distribution and Utilization of Electrical Energy, C.L. Wadhawa, New Age International Publishers, 2015
- 2. Art and Science of Utilization of Electrical Energy, H. Partab, Dhanpat Rai & co, 2017 3. Utilisation of Electric Energy, E.Openahaw Taylor, Universities press, 1981

Reference books:

- 1. Generation and Utilization of Electrical Energy by S. Sivanagaruju, Pearson, 2010.
- 2. Utilization of Electrical Energy by J. B. Gupta, Rajeev Manglik, Rohit Manglik, Kataria Publications, 2012.

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

- 1. explain the fundamentals of illumination and different lighting schemes.
- 2. explain the fundamental of Electrolytic processes, Electric heating and Welding.
- 3. able to select appropriate lighting, heating and welding techniques for specific applications.
- 4. apply different electrolysis process for different applications.
- 5. explain the principle of different aspect of Electric traction and control of traction motor.

Special Remarks (if any)

Name	ne of the course LINE COMMUTATED AND ACTIVE PWM RECTIFIERS			E PWM
Cours	e Code: PE-EE 801A	Semester: 8 th		
Durat	ion: 6 months	Maximum Marks: 100		
Teach	Teaching Scheme Examination Scheme			
Theor	y: 3 hrs/week	Mid Semester Exam: 1	15 Marks	
Tutori	al: 0 hr/week	Assignment & Quiz:	10 Marks	
Practi	cal: 0 hrs/week	Attendance:	05 Marks	
Credit	Points: 3	End Semester Exam:	70 Marks	
Objective:				
1.	To understand the principle of operation of o	different converter circui	ts and filters	
2.	To understand the method of steady state ana	lysis of converters.		
3.	To understand the different control techniques of the converters.			
4.	To understand the application of different converters			
Pre-R	equisite			
1.	Control System (PC-EE-503)			
2.	Power Electronics (PC-EE-504)			
Unit	Content		Hrs	Marks
1	Diode rectifiers with passive filtering:			
	Half-wave diode rectifier with RL and RC loads; 1-phase full-wave			
	diode rectifier with L, C and LC filter; 3-phase diode rectifier with L,		5	
	C and LC filter; continuous and discontinuous conduction, input			
	current wave shape, effect of source inc			
	overlap.			

2	Thyristor rectifiers with passive filtering: Half-wave thyristor rectifier with RL and RC loads; 1-phase thyristor rectifier with L and LC filter; 3- phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current waveshape	5	
3	Multi-Pulse converter: Review of transformer phase shifting, generation of 6-phase ac voltage from 3-phase ac, 6-pulse converter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation.	6	
4	Single-phase ac-dc single-switch boost converter: Review of dc-dc boost converter, power circuit of single-switch acdc converter, steady state analysis, unity power factor operation, closed-loop control structure.	6	
5	Ac-dc bidirectional boost converter: Review of 1-phase inverter and 3-phase inverter, power circuits of 1phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. Phasor diagrams, closed-loop control structure.	6	
6	Isolated single-phase ac-dc fly back converter: Dc-dc fly back converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of ac-dc fly back	08	
	converter, steady state analysis, unity power factor operation, closed loop control structure		

Text books:

- 1. Power Electronics: Converters, Applications and Design, N. Mohan and T. M. Undeland, John Wiley & Sons, 2007.
- 2. Power Electronics: Essentials and Applications, L. Umanand, Wiley India, 2009
- 3. Principles of Power Electronics, J.G. Kassakian, M. F. Schlecht and G. C. Verghese, Addison-Wesley, 1991.

Reference books:

1. Fundamentals of Power Electronics, R. W. Erickson and D. Maksimovic, Springer Science & Business Media, 2001.

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

- 1. explain the principle of operation of different converters.
- 2. suggest the application of different filters.
- 3. apply converters for different applications.
- 4. analyze converter circuits.
- 5. develop appropriate scheme for control of different converters.

6. solve numerical problems relating to different converters.

Special Remarks (if any)

Name	of the course POWER SYSTEM DYNAMICS AND CONTROL		D	
Cours	se Code: PE-EE 801B	Semester: 8 th		
Durat	ion: 6 months	6 months Maximum Marks: 100		
Teach	ning Scheme	Examination Scheme		
Theor	ry: 3 hrs/week	Mid Semester Exam: 1	15 Marks	
Tutor	ial: 0 hr/week	Assignment & Quiz:	10 Marks	
Practi	cal: 0 hrs/week	Attendance:	05 Marks	
Credi	t Points: 3	End Semester Exam:	70 Marks	
Objec	etive:			
1.	To understand power stability problems and the basic concepts of modeling and analysis of dynamical systems.			d analysis of
2.	To understand the Modeling of power system components - generators, transmission lines, excitation and prime mover controllers.			nes, excitation
3.	To understand the Stability of single machine a and small-signal analysis techniques.	and multi-machine syste	ems using digita	l simulation
4.	To understand the impact of stability problems	s on power system plann	ning, and operati	ion.
Pre-R	equisite			
1.	Power System (PC-EE-502, PC-EE-601)			
2.	Control System (PC-EE-503)			
3.	Electric Machine(PC-EE-401, PC-EE501)			
Unit	Content		Hrs	Marks
1	Introduction to Power System Operations: I system stability. Power System Operations problems in Power System. Impact on Power Scontrol.	and Control. Stability	3	
2	Analysis of Linear Dynamical System and Analysis of dynamical System, Concept of E Large Disturbance Stability. Modal Analysi Analysis using Numerical Integration Techniq Modeling: Slow and Fast Transients, Stiff Syst	Equilibrium, Small and its of Linear System. ues. Issues in	5	

3	Modeling of Synchronous Machines and Associated Controllers: Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. D-Q Transformation. Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine. Synchronization of Synchronous Machine to an Infinite Bus. Modeling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control. Automatic Voltage Regulator. Prime Mover Control Systems. Speed Governors.	10	
4	Modeling of other Power System Components: Modeling of Transmission Lines and Loads. Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency and Voltage Dependence of Loads. Other Subsystems – HVDC and FACTS	08	
	controllers, Wind Energy Systems.		
5	Stability Analysis: Angular stability analysis in Single Machine Infinite Bus System. Angular Stability in multi-machine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre of Inertia Motion. Load Sharing: Governor droop. Single Machine Load Bus System: Voltage Stability. Introduction to Tensional Oscillations and the SSR phenomenon. Stability Analysis Tools: Transient Stability Programs, Small Signal Analysis Programs	10	
6	Enhancing System Stability: Planning Measures. Stabilizing Controllers (Power System Stabilizers). Operational Measures- Preventive Control. Emergency Control.	4	

Text books:

- 1. Power System Dynamics, Stability and Control, K.R. Padiyar. B. S. Publications, 2002.
- 2. Power System Stability and Control, Prabha Kundur. McGraw Hill, 2006.
- 3. Power System Dynamics and Stability, P. W. Sauer and M. A. Pai . Pearson, 1997.

Reference books:

- 1. The Essentials of Power System Dynamics and Control, Hemanshu Roy Pota, Springer, 2018
- 2. Power System Dynamics and Control, H.G. Kwanty and K.M.Miller, Birkhauser. 2016

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

- 1. explain the model of power system components
- 2. select the appropriate model for required analysis.
- 3. analyze the performance of the system with small signal analysis.
- 4. evaluate the stability of the single and multi machine systems. .
- 5. develop measures for enhancing the stability of the system.

6. Solve numerical problems of linear dynamical system, modeling of different components and stability.

Special Remarks (if any)

	of the course	ADVANCED ELECT	RIC DRIVE		
Cours	Course Code: PE-EE 801C Semester: 8 th				
Duration: 6 months Maximum Marks: 100		Maximum Marks: 100			
Teach	Teaching Scheme Examination Scheme				
Theor	y: 3 hrs/week	Mid Semester Exam:	15 Marks		
Tutori	ial: 0 hr/week	Assignment & Quiz:	10 Marks		
Practi	cal: 0 hrs/week	Attendance:	05 Marks		
Credit	t Points: 3	End Semester Exam:	70 Marks		
Objec	tive:				
1.	To understand basic principle of operation o	f Power Converters used	l for AC drives		
2.	To understand the method for modeling and c	control of Induction motor	or and Synchron	ous motor.	
3.	To understand the method of control of Permanent magnet motor drive, Switched reluctance motor drive.			ictance motor	
4.	To understand the principle of DSP based mo	tion control.			
Pre-Re	equisite				
1.	Electric Machine (PC-EE-401, PC-EE-501)				
2.	Control System (PC-EE-503)				
3.	Power Electronics (PC-EE-504)				
Unit	Content		Hrs	Marks	
1	Power Converters for AC drives: PWM cont		8		
	harmonic elimination, space vector modulat				
	VSI, three level inverter, Different topolog inverter, Diode rectifier with boost chopper,				
	side rectifier, current fed inverters with sel				
	Control of CSI, H bridge as a 4-Q drive.				
2	Induction motor drives: Different transformations and reference 8				
	frame theory, modeling of induction machines, voltage fed inverter				
	control-v/f control, vector control, dire	ect torque and flux			
2	control(DTC).	hanners and al-1	5		
3	Synchronous motor drives: Modeling of synch loop v/f control, vector control, direct to	_	3		
	synchronous motor drives.	ique comion, est teu			
			<u> </u>		

4	Permanent magnet motor drives: Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.	5	
5	Switched reluctance motor drives: Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.	5	
6	DSP based motion control: Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.	5	

Text books:

- 1. Modern Power Electronics and AC Drives, B. K. Bose, PHI, 2005
- 2. Permanent Magnet Synchronous and Brushless DC motor Drives, R. Krishnan, CRC Press, 2009
- 3. DSP based Electromechanical Motion Control, H. A. Taliyat and S. G. Campbell, CRC Press, 2003.

Reference books:

1. Analysis of Electric Machinery and Drive Systems, P.C. Krause, O. Wasynczuk and S.D. Sudhoff, Wiley, 2013.

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

- 1. explain the principle of operation of converters for AC drives.
- 2. model Induction and Synchronous motor by reference frame theory.
- 3. apply different control methods to control speed and torque of Induction and Synchronous motor.
- 4. explain the configurations and method of speed control of BLDC, PMSM and SRM.
- 5. realize basic blocks for DSP based motion control.
- 6. develop appropriate scheme for speed control of Induction and Synchronous motor.

Special Remarks (if any)

Name of the course	INDUSTRIAL AUTOMATION AND CONTROL	
Course Code: PE-EE 801D	Semester: 8 th	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	Examination Scheme	
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week	Attendance: 05 Marks	
Credit Points: 3	End Semester Exam: 70 Marks	

Objec	ctive:		
1.	To understand Industrial automation and control.		
2.	To understand the different control modes.		
3.	To understand advance industrial control strategies.		
4.	To understand the Programmable Logic Controller and distributed con	trol system.	
Pre-R	equisite		
1.	Control System (PC-EEE-503)		
Unit	Content	Hrs	Marks
1	Introduction to Industrial Automation and Control: Architecture of Industrial Automation Systems. General review of process, Process control & automation, Servo and regulatory control, Characteristic parameter of a process: Process quality, Process potential, Process resistance, Process capacitance, Process lag, Self regulation.	08	
2	Different control modes and Implementation: On-off control, Multistep, Time proportional, Proportional, Proportional-integral, Proportional -derivative, Proportionalintegral- derivative, integral windup, bump less transfer, Inverse derivative control, controller tuning techniques and selection guideline. Implementation of PID Controllers.	08	
3	Advance Industrial control strategies (Brief analysis): Feedforward control, Cascade control, Ratio control, Selective Control, Split Range Control, Adaptive control.	06	
4	Actuators and final control elements: Classification of Actuators: pneumatic, hydraulic, electropneumatic, and stepper motor operated actuators. Pumps and motors, proportional and servo valves.	06	
5	Programmable Logic Controller: Block diagram, Classification, Basic Architecture and Functions; Input-Output Modules, power supply. PLC Programming: Relay logic and ladder logic, PLC ladder diagram realization, PLC Timer, PLC Counter, advance instructions. PLC programming examples for Industrial maintenance and control.		
6	Distributed Control System (DCS): Basic concept and overview of DCS, DCS System Architecture, configuration, operation and features. HMI and SCADA, OSI Communication Standard and Fieldbus.	06	

Text books:

- 1. Industrial Instrumentation and Control, S. K. Singh, Tata-McGraw , 2010
- 2. Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A. K.

Deb, Jaico Publishing House, 2012.

- 3. Process Control, K. Krishnaswamy, New Age International Publishers, 2009
- 4. Programmable Logic Controllers with Control Logix, Jon Stenerson, Delmar Cengage learning, 2009

Reference books:

- 1. Automatic Process Control, D.P. Eckman, John Wiley and sons, 1958
- 2. Process control instrumentation technology, C.D. Johnson, PHI, 2005
- 3. Instrument Engineers Handbook, B.G. Liptak, CRC Press, 2003

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

- 1. explain the basic structure of industrial automation and control
- 2. classify different types of control actions of controllers.
- 3. analyze control strategies of different processes of industry.
- 4. illustrate the construction and use of different types of actuators and control valves.
- 5. use PLC, DCS and SCADA in advanced industrial control.

Special Remarks (if any)

Name	of the course SOFT COMPUTING TECHNIQUES			
Cours	rse Code: OE-EE 801A Semester: 8th			
Durati	ion: 6 months	Maximum Marks: 100		
Teach	ing Scheme	Examination Scheme		
Theor	y: 3 hrs/week	Mid Semester Exam: 1	5 Marks	
Tutori	torial: 0hr/week Assignment & Quiz: 10 Marks			
Credit	redit Points: 3 Attendance: 05 Marks			
		End Semester Exam:	70 Marks	
Objec	tive:			
1.	To understand the theory of Neural network	k, Fuzzy logic and Genet	ic Algorithm.	
2.	To Introduce neural networks, Genetic Algorithm and Fuzzy logic from an engineering perspective.			
Pre-Requisite				
1.	Programming for problem solving (ES-CS 201)			
Unit	Content		Hrs	Marks

1	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm.	05	
2	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations: Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership functions: Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting Fuzzy Control, Convention control systems, Fuzzy logic control vs. PID control.	12	
3	Neural Network: Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron. Learning Methods: Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Back propagation and multi layer networks. Competitive learning networks: Kohonen self organizing networks, Hebbian learning; Hopfield Networks. Neuo-Fuzzy modelling: Applications of Neural Networks: Pattern Recognition and classification:	10	
4	Genetic Algorithms: Simple GA, crossover and mutation, Multi-		
	objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition.	08	
5	Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	05	

Text book:

- 1. Fuzzy logic with engineering applications, Timothy J. Ross, Wiley ,2011
- 2. Neural Networks Fuxxy Logic and Genetic Algorithm: Synthesis and Application, S. Rajashekharan and G.A. Vijaylakshmi Pai, PHI,2013
- 3. Principles of Soft Computing, S N Sivanandam, S.N. Deepa, Wiley , 2011.

Reference books:

- 1. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Addison Wesley, 1989.
- 2. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, Pearson, 1996.
- 3. Neural Networks: A Classroom Approach, Satish Kumar, McGraw Hill, 2017.
- 4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
- 5. Introduction to Soft Computing-Neuro Fuzzy and Genetic Algorithm, Samir Roy & Udit Chakraborty, Pearson, 2013.

Course Outcome:

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

- 1. explain soft computing techniques and their roles in building intelligent machines
- anlyse the feasibility of application of soft computing techniques for a particular problem
 effectively use existing software tools to solve real problems using a soft computing approach
- 4. evaluate solutions by various soft computing approaches for a given problem.
- 5. apply different soft computing techniques to solve Engineering problems.

Special Remarks (if any)

Name of the course		BIOMEDICAL INSTRUMENTATION		
Course Code: OE-EE 801B		Semester: 8th		
Durat	tion: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme		
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks		
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks		
Credi	it Points: 3	Attendance: 05 Marks		
		End Semester Exam: 70 Marks		
Objective:				
1.	To understand the fundamental of Medical Instruments			
2.	To understand Biomedical recorders, Medical Imaging equipments, Surgical, Therapeutic			
	Instruments and Medical Laboratory equipments.			
Pre-Requisite Pre-Requisite				
1.	Analog Electronics (PC-EE-302)			

Maulana Abul Kalam Azad University of Technology, West Bengal (Formerly West Bengal University of Technology) Syllabus for B. Tech in Electrical Engineering

(Applicable from the academic session 2018-2019)

2.	Digital Electronics (PC-EE-402)		
Unit	Content	Hrs	Marks
1	Fundamentals of Medical Instruments: Fundamentals of medical instrumentation- Sources of biomedical signals, Generalized medical instrumentation block \(\precedit \	08	
2	Biomedical Recorders: Electrocardiograph (ECG) machine -ECG block diagram, Bipolar and unipolar □ leads, Phono-cardiograph. Electroencephalograph (EEG). 10-20 electrode placement system, EEG readout device, Electromyograph (EMG) machine. Bio-feedback Instrumentation. Pulse Oximeter.	08	
3	Medical Imaging Equipments: X-ray machine, CT-Scan machine, MRI Scan machine, Properties of ultrasound, Ultrasonic foetal monitors. Echoencephalography. Echocardiograph. Colour Doppler ultrasound machine.	08	
4	Surgical & Therapeutic Instruments: Electro-surgery machine (cautery), Hemo-dialysis machine Muscle stimulators, Defibrilator Machine	06	
5	Medical Laboratory Instruments: Types of test- Blood cell, Bio chemistry, Blood Cell Counter, Bio chemistry analyze, Auto analyzer, Blood gas analyzer.	06	

Text book:

- 1. Handbook of Biomedical instrumentation, R. S. Khandpur, Tata McGraw Hill, New Delhi, 2003
- 2. Introduction to Biomedical equipment technology, Joseph J. Carr and J.M. Brown , Pearson education, New Delhi, 2000
- 3. Biomedical instrumentation measurements, Lesli P Cromwell, Fred J. Weibell, Erich A. Pfeiffer, PHI Learning, New Delhi, 2018

Reference books:

- 1. Medical instrumentation application & design, John G. Webster, Editor, John Wiley and Sons, New Delhi, 2009
- 2. Introduction to Biomedical Instrumentation, Mandeep Singh, PHI, 2010

Course Outcome:

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

- 1. describe the principle of medical transducers for temperature, pressure and respiration rate.
- 2. explain the principle of operation of Biomedical recorders, Medical Imaging equipments Surgical & Therapeutic Instruments and Medical Laboratory Instruments.
- 3. use different Medical laboratory equipments for different tests.
- 4. analyze any measurement application and suggest suitable measurement methods.
- 5. suggest suitable imaging methodology for a specific ailment.

Special Remarks (if any)

Name of the course		INTRODUCTION TO MACHINE LEARNING		
Course Code: OE-EE 801C		Semester: 8th		
Durat	ion: 6 months	Maximum Marks: 100		
Teach	ing Scheme	Examination Scheme		
Theor	y: 3 hrs/week	Mid Semester Exam: 15 Marks		
Tutor	ial: 0hr/week	Assignment & Quiz: 10 Marks		
Credi	Points: 3	Attendance: (05 Marks	
		End Semester Exam:	70 Marks	
Objec	tive:			
1.	To understand fundamental concepts of Mac	hine Learning		
2.	2. To apply Machine Learning in real life applications.			
Pre-R	equisite			
1.	Programming for problem solving (ES-CS 20	1)		1
Unit	t Content		Hrs	Marks
1	Basics of Machine Learning and Python: Review of Linear Algebra, Definition of learning systems; Designing a learning system, Goals and applications of machine learning; Classification of learning system, Basic concepts in Machine Learning. Python Basics – string, number, list, tuple, Dictionary, functions, conditional statement, Loop statements, Numpy, Matplotlib, simple programming exercises using python.		12	
2	Supervised Learning: Linear regression with one variable, Linear regression with multiple variables, Logistic regression; Linear Methods for Classification; Linear Methods for Regression; Decision trees, overfitting.		07	
3	Support Vector Machines: Introduction, Classification, Mathematics behind Maximum Maximum Margin linear separators, non-lin learning non-linear functions.	Margin Classification,	07	

4	Unsupervised Learning: Learning from unclassified data, Clustering - Hierarchical Agglomerative Clustering, K-means partitional clustering, Expectation maximization (EM) for soft clustering; Dimensionality reduction — Principal Component Analysis, factor Analysis, Multidimensional scaling, Linear Discriminant Analysis.	07	
5	Applications of Machine Learning: Strategies, guidelines for good design, performance measurement, Reading Data, PreProcessing Data, handwriting recognition, object detection, face detection.	07	

Text book:

- 1. Machine Learning, Dr. Rajjiv Chopra, Khanna Publishing, 2020
- 2. Introduction to Machine Learning, EthemAlpaydi, PHII, 2015
- 3. Building Machine Learning Systems with Python, Richert& Coelho, Packt publishing, 2013 Reference books:
- 1. The Elements Of Statistical Learning: Data mining, Infarence and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2017.
- 2. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press 2012.

Course Outcome:

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

- 1. explain the basics concepts and classification of Machine Learning.
- 2. write simple programs using python.
- 3. describe Supervised Learning concepts.
- 4. explain the concept of Support Vector Machine.
- 5. describe unsupervised learning concepts and dimensionality reduction techniques.
- 6. apply Machine Learning in a range of real-world applications.

Special Remarks (if any)

Name of the course S		SENSORS AND TRANSDUCERS			
Course Code: OE-EE 801D		Semester: 8th			
Durat	ion: 6 months	Maximum Marks: 100			
Teach	ing Scheme	Examination Scheme			
Theor	ry: 3 hrs/week	Mid Semester Exam: 15 Marks			
Tutor	ial: 0hr/week	Assignment & Quiz: 10 Marks			
Credi	t Points: 3	Attendance: 05 Marks			
		End Semester Exam: 70 Marks			
Objec	tive:	L			
1.	To understand the principle of operation of Transducers and Sensors				
2.	To understand the application of Transducers and Sensors				
Pre-R	Pre-Requisite Pre-Requisite				
1.	Electric Circuit Theory (PC-EEE-301)				
2.	Electromagnetic Field Theory (PC-EEE-303)				
Unit	Content		Hrs	Marks	
1	Introduction: Definition, significance of measurement and instruments. Principle of sensing & transduction, transducer classification, Transducer characteristics, emerging fields of sensor technologies.		05		
2	Resistive transducers: Potentiometers: types, loading error, metal and semiconductor strain gauges, types, resistance measuring methods, strain gauge applications: Load and torque measurement.		05		
3	Inductive transducers: Transformer type, s transducers, LVDT: Construction, m characteristics. Optical Sensors: LDR, Photo Diode, Strobosc	naterial, input-output	08		

4	Capacitive transducers: Variable distance-parallel plate type, variable area- parallel plate type, cylindrical type, differential type, variable dielectric constant type, calculation of sensitivity. Capacitive microphone, fluid level measurement. Piezoelectric transducers: piezoelectric effects, Materials, natural and synthetic types – their comparison, Charge and voltage coefficient, Force and stress sensing, displacement measurement. Magnetic Transducer: Hall effect sensors, Magnetostrictive transducers: principle, positive and negative magnetostriction.	10	
5	Thermal sensors: Resistance temperature detector (RTD): principle, materials and types; Thermistor: principle, materials and types; Thermocouple, Thermoelectric effects, laws of thermocouple, thermocouple types, construction. IC temperature sensor, PTAT type sensor. Radiation sensors: types, characteristics and comparison. Pyroelectric type.	06	
6	Micro-sensors and smart sensors: Construction, characteristics and applications. Standards for smart sensor interface. Recent Trends in Sensor Technologies: Introduction; Film sensors (Thick film sensors, thin film sensor)	04	

Text book:

- 1. Transducers and Instrumentation, D.V.S. Murthy, Prentice Hall, 2008
- 2. Sensors and Transducers, D. Patranabis, Prentice Hall India, 2003
- 3. Measurement Systems Application and Design, E.O. Doebelin, McGraw-Hill, 2008

Reference books:

- 1. Instrument Transducers An Introduction to their Performance and Design", H.K.P. Neubert, Oxford University Press, 1999.
- 2. Measurement Systems and Sensors, WaldemarNawrocki Artech House, 2016.
- 3. Semiconductor sensors", S.M. Sze, Wiley Interscience, 1994
- 4. Instrumentation Measurement and Analysis", B. C. Nakara&Chaudhry TATA McGraw-Hill, 2009
- 5. Smart Sensors and Sensing Technology, Daniel E. Suarez, Nova Science Publishers, 2011

Course Outcome:

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

- 1. explain the basic principle of operation of Transducers and Sensors.
- 2. distinguish different sensors and transducers.
- 3. identify suitable transducer by comparing different industrial standards and procedures for measurement of physical parameters
- 4. estimate the performance of different transducers.
- 5. design real life electronics and instrumentation measurement systems.
- 6. apply smart sensors, bio-sensors, PLC and Internet of Things to different applications.

Special Remarks (if any)