Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)
(Applicable from the academic session 2018-2019)

Semester-VIII

Name of the course		DIGITAL SIGNAL PROCESSING	
Course Code: PC-EEE-801		Semester: 8th	
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	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand sampling and reconstruction of signal		
2.	To understand the method of Z-transform and inverse Z- transform of signal and its properties		
3.	To understand Discrete Fourier Transform		
4.	To understand methods of design of Digital filters		
5.	To understand applications of Digital signal processing		
6.	To solve numerical problems on the topics studied		
Pre-Requisite			
1.	Electric circuit theory (PC-EEE-301)		
2.	Control system (PC-EEE-503)		
Unit	Content	Hrs	Marks
1	Discrete-time signals and systems: Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.	06	
2	Z-transform: z-Transform, Region of convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z- transforms.	06	
3	Discrete Fourier Transform : Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.	08	

4	Design of Digital filters: Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Bandstop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing	12	
5	Applications of Digital Signal Processing: Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	06	

Text book:

1. Digital Signal Processing-A computer based approach, S. Mitra, TMH
2. Digital Signal Processing: Principles, Algorithms & Application, J.C. Proakis & M.G. Manslakis, PHI
3. Fundamental of Digital Signal Processing using MATLAB , Robert J. Schilling, S.L. Harris, Cengage Learning.

Reference books

1. Digital Signal Processing-implementation using DSP microprocessors with examples from TMS320C54XX, Avtar Singh & S. Srinivasan, Cengage Learning
2. Digital Signal Processing, Chen, OUP
3. Digital Signal Processing, Johnson, PHI
4. Digital Signal Processing using MATLAB, Ingle, Vikas.
5. Digital Signal Processing, Ifeachor, Pearson Education.
6. Digital Signal Processing, A.V. Oppenhein & R.W. Shaffer, PHI
7. Theory and application of Digital Signal Processing, L.R. Rabiner & B. Gold, PHI
8. Digital Signal Processing, Ashok Ambarder, Cengage Learning.
9. Digital Signal Processing, S. Salivahanan, A. Vallavaris & C. Gnanpruja, TMH.
10. Xilinx FPGA user manual and application notes.

Course Outcome:

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

1. represent signals mathematically in continuous and discrete-time and in the frequency domain.
2. analyse discrete-time systems using z-transform.
3. explain the Discrete-Fourier Transform (DFT) and the FFT algorithms.
4. design digital filters for various applications.
5. apply digital signal processing for the analysis of real-life signals.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Maulana Abul Kalam Azad University of Technology, West Bengal
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Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)
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Name of the course		UTILIZATION OF ELECTRIC POWER	
Course Code: PE-EEE 801A		Semester: 8th	
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	
Objective:			
1.	To understand basic principle of illumination and good lighting practices		
2.	To understand the method of Electric heating, Welding and Electrolytic processes.		
3.	To understand the concepts of Electrical traction systems .		
4.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Electric Machine (PC-EEE-401, PC-EEE-501)		
2.	Control System (PC-EEE-503)		
3.	Power Electronics (PC-EEE-504)		
Unit	Content	Hrs	Marks
1	Electric Traction : Requirement of an ideal traction system, Supply system for electric traction, Train movement (speed time curve, simplified speed time curve, average speed and schedule speed), Mechanism of train movement (energy consumption, tractive effort during acceleration, tractive effort on a gradient, tractive effort for resistance, power & energy output for the driving axles, factors affecting specific energy consumption, coefficient of adhesion). Electric traction motor & their control: Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply, Tractive effort and horse power. Use of AC series motor and Induction motor for traction. Traction motor control: DC series motor control, Multiple unit control, Braking of electric motors, Electrolysis by current through earth, current collection in traction system, Power electronic controllers in traction system.	10	
2	Electric Lighting: Definition of terms; laws of illumination; Luminaries; Lighting requirements; Illumination levels; lamp selection and maintenance; Lighting schemes, calculations & design – Interior lighting – industrial, Factory, residential lighting; Exterior lighting - Flood, street lighting, lighting for displays and signaling - neon signs, LED-LCD displays beacons and lighting for surveillance; Energy Conservation codes for lighting; lighting controls – daylight sensors and occupancy sensors; controller design.	8	

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.

Maulana Abul Kalam Azad University of Technology, West Bengal
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Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)
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Special Remarks (if any)

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course		ADVANCED ELECTRIC DRIVE	
Course Code: PE-EEE 801B		Semester: 8th	
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	
Objective:			
1.	To understand basic principle of operation of Power Converters used for AC drives		
2.	To understand the method for modeling and control of Induction motor and Synchronous motor.		
3.	To understand the method of control of Permanent magnet motor drive, Switched reluctance motor drive.		
4.	To understand the principle of DSP based motion control.		
Pre-Requisite			
1.	Electric Machine (PC-EEE-401, PC-EEE-501)		
2.	Control System (PC-EEE-503)		
3.	Power Electronics (PC-EEE-504)		
Unit	Content	Hrs	Marks
1	Power Converters for AC drives: PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.	8	
2	Induction motor drives: Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC).	8	
3	Synchronous motor drives: Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.	5	
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)

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Maulana Abul Kalam Azad University of Technology, West Bengal
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Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)
(Applicable from the academic session 2018-2019)

Name of the course		POWER SYSTEM DYNAMICS AND CONTROL	
Course Code: PE-EEE 801C		Semester: 8th	
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	
Objective:			
1.	To understand power stability problems and the basic concepts of modeling and analysis of dynamical systems.		
2.	To understand the Modeling of power system components - generators, transmission lines, excitation and prime mover controllers.		
3.	To understand the Stability of single machine and multi-machine systems using digital simulation and small-signal analysis techniques.		
4.	To understand the impact of stability problems on power system planning, and operation.		
Pre-Requisite			
1.	Power System (PC-EEE-502, PC-EEE-601)		
2.	Control System (PC-EEE-503)		
3.	Electric Machine(PC-EEE-401, PC-EEE-501)		
Unit	Content	Hrs	Marks
1	Introduction to Power System Operations: Introduction to power system stability. Power System Operations and Control. Stability problems in Power System. Impact on Power System Operations and control.	3	
2	Analysis of Linear Dynamical System and Numerical Methods : Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability. Modal Analysis of Linear System. Analysis using Numerical Integration Techniques. Issues in Modeling: Slow and Fast Transients, Stiff System.	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)

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course		INDUSTRIAL AUTOMATION AND CONTROL	
Course Code: PE-EEE 801D		Semester: 8th	
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	
Objective:			
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 control system.		
Pre-Requisite			
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.	06	
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)

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course	DIGITAL IMAGE PROCESSING
Course Code: OE-EEE 801A	Semester: 8th
Duration: 6 months	Maximum Marks: 100

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Teaching Scheme	Examination Scheme
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0hr/week	Assignment & Quiz: 10 Marks
Credit Points: 3	Attendance: 05 Marks
	End Semester Exam: 70 Marks

Objective:	
1.	To understand fundamentals and mathematical transforms necessary for image processing.
2.	To understand the image enhancement techniques.
3.	To understand the image restoration procedures.
4.	To understand the image compression procedures.
Pre-Requisite	
1.	Digital Signal Processing (OE-EE 601A)

Unit	Content	Hrs	Marks
1	Introduction: Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.	08	
2	Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.	08	
3	Image Enhancement In Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.	08	
4	Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation-Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.	08	
5	Image Compression: Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.	08	

Text book:

1. Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication, 2017
2. Digital Image Processing, Anil K. Jain, Prentice-Hall, India, 1988.

Reference books:

1. Digital Image Processing, W.K. Pratt , John Wiley & Sons, 1991.
2. Digital Image Processing and Analysis, B. Chanda & D. Dutta Majumder Prentice-Hall India, 2011
3. Image Processing- Theory, Algorithms & Architecture, M. A. Sid-Ahmed, McGraw-Hill, 1994.

Course Outcome:

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

1. explain the fundamental concepts of a digital image processing system.
2. enhance images in the spatial and frequency domain using various transforms.
3. apply different image segmentation techniques.
4. categorize various compression techniques.
5. implement image process and analysis algorithms.
6. apply image processing algorithms in practical applications.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course	BIOMEDICAL INSTRUMENTATION
Course Code: OE-EEE 801B	Semester: 8th
Duration: 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
Credit 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	

1.	Analog Electronics (PC-EEE-302)		
2.	Digital Electronics (PC-EEE-402)		
Unit	Content	Hrs	Marks
1	Fundamentals of Medical Instruments: Fundamentals of medical instrumentation- Sources of biomedical signals, Generalized medical instrumentation block□□□□□ diagram. Medical electrodes - ECG, EEG, EMG, Defibrillator. Medical transducers: Body temperature, Blood pressure, respiration rate. Classification of Medical instruments based on application - (diagnostic, therapeutic, Imaging, analytical).	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, Electro-myograph (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)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course		CRYPTOGRAPHY AND NETWORK SECURITY	
Course Code: OE-EEE 801C		Semester: 8th	
Duration: 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	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand basics of Cryptography and Network Security		
2.	To be able to secure a message over insecure channel by various means		
	To learn about how to maintain the Confidentiality, Integrity and Availability of a data		
	To understand various protocols for network security to protect against the threats in the networks.		
Pre-Requisite			
1.	Computer Network (OE-EEE-701B)		
Unit	Content	Hrs	Marks
1	Attacks on Computers & Computer Security: Introduction, Need for Security, Security approaches, Principles of Security, Types of attack	04	
2	Cryptography: Concepts & Techniques- Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	07	

3	Symmetric Key Algorithm: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.	08	
4	Asymmetric Key Algorithm: Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	08	
5	Internet Security Protocols: User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	05	
6	Electronic Mail Security: Basics of mail security, Pretty Good Privacy, S/MIME.	04	
7	Firewall : Introduction, Types of firewall, Firewall Configurations, DMZ Network	03	

Text book:

1. Cryptography and Network Security, William Stallings, Pearson Education , 2017
2. Cryptography and Network Security, V.K. Jain, Khanna Publishing House, 2013
3. Cryptography & Network Security: Atul Kahate, Mc Graw Hill education, 2017

Reference books:

1. Network Security private communication in a public world, C. Kaufman, R. Perlman and M.Speciner, Prentice Hall, 2002
2. Network Security Essentials: Applications and Standards, William Stallings, Pearson. 1999
3. Designing Network Security , Merike Kaeo, Cisco Press, 2003

Course Outcome:

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

1. describe Symmetrical and Asymmetrical cryptography, Firewall, Web security, Email security, and Malicious software etc.
2. apply the different cryptographic operations of Symmetric and Asymmetric key algorithms,
3. apply security principles to system design
4. identify network security threat
5. analyze network security protocols

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course		SENSORS AND TRANSDUCERS	
Course Code: OE-EEE 801D		Semester: 8th	
Duration: 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	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the principle of operation of Transducers and Sensors		
2.	To understand the application of Transducers and Sensors		
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, synchros, eddy current transducers, LVDT: Construction, material, input-output characteristics. Optical Sensors: LDR, Photo Diode, Stroboscope, IR Sensor.	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)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course	DIGITAL SIGNAL PROCESSING LABORATORY
Course Code: PC-EEE 891	Semester: 8th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	

	Laboratory Experiments:
	Simulation Laboratory using standard Simulator:
1.	Sampled sinusoidal signal, various sequences and different arithmetic operation.
2.	Convolution of two sequences using graphical methods and using commands-verification of the properties of convolution.
3.	Z transform of various sequences-verification of the properties of Z transform.
4.	Twiddle factors-verification of the properties.
5.	DFTs/IDFTs using matrix multiplication and also using commands.

6.	Circular convolution of two sequences using graphical methods and using commands. Differentiation between linear and circular convolutions
7.	Verification of the different algorithms associated with filtering of long data sequences and Overlap add and Overlap-save methods.
8.	Butterworth filter design with different set of parameters.
9.	FIR filter design using rectangular, Hamming and Blackman windows.
	Hardware laboratory using either 5416 or 6713 Processor and Xilinx FPGA:
10.	Writing & execution of small programs related to arithmetic operation and convolution using assembly language of TMS320C5416/6713 processor. Study of MAC instruction.
11.	Writing of small programs in VHDL and downloading onto Xilinx FPGA.
12.	Mapping of some DSP algorithms onto FPGA.

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

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

1. identify appropriate simulator / equipments and instruments for the experiment.
2. test the simulator / instruments for application to the experiment.
3. construct algorithm / circuits with appropriate simulator/ instruments and safety precautions.
4. verify different algorithms and operations in the laboratory.
5. analyse experimental data obtained in the laboratory.
6. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.