Seventh and Eighth semester syllabus

2018-19 Regulation

(2021-22)

Dr.Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2020-21

B.E Electronics and Instrumentation Engineering

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory **Lecture**	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	MC	18HS71/72	CMEP /OSHA	IM/CV	2	--	--	03	50	50	100	2
2	PC	18EI71	IOT and Wireless Sensor Networks	EI	4	--	--	03	50	50	100	4
3	PC	18EI72	Industrial Data Communication & DCS	EI	4	--	--	03	50	50	100	4
4	PE	18EI73X	Professional Elective -3	EI	3	--	--	03	50	50	100	3
5	PE	18EI74X	Professional Elective -4	EI	3	--	--	03	50	50	100	3
6	OE	18EI75X	Open Elective –C	-	3	--	--	03	50	50	100	3
7	PC	18EIL76	Process Control and Automation Lab	EI	--	--	2	03	50	50	100	1
8	PC	18EI L77	IOT Lab	EI	--	--	2	03	50	50	100	1
9	Project	18EIP78	Project Work Phase – 1	EI	--	--	2	03	50	50	100	2
10	INT	18EII79	Internship	(If not completed after VI semester examinations, it has to be carried out during the intervening vacations of VII and VIII semesters)				--	--	--	--	--
			TOTAL	**19**	--		**6**	**27**	**450**	**450**	**900**	**23**

Note: PC: Professional Core, PE: Professional Elective, OE: Open Elective, INT: Internship, MC: Mandatory Course

Internship: All the students admitted to III year of BE have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters. A SEE examination will be conducted during VIII semester and prescribed credits shall be added to VIII semester. Internship is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the internship will be declared as failed and have to complete during subsequent SEE examination after satisfy the internship requirements.

Electives

Course code	**Professional Electives – 3**
18 EI731	Analytical Instrumentation
18 EI732	Artificial Intelligence in Industrial Automation
18 EI733	Biomedical Signal Processing
18 EI734	Neural Networks & Applications
Course code	**Professional Electives – 4**
18 EI741	Lasers & Optical Instrumentation
18 EI742	Multimedia Communication
18EI743	Adaptive Signal Processing
18EI744	Micro Systems and Nanotechnology
	Open Elective –C
18EI751	Optical Instrumentation & Applications
18EI752	Instrumentation & measurement Techniques

Open Elective –C

Students can select any one of the open electives (Please refer to consolidated list of Dr. AIT for open electives) offered by any Department.

Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Mentor.

CMEP: Cost Management of Engg Projects, OSHA: Occupational Safety and Health Administration

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B.E Electronics and Instrumentation Engineering

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	MC	18XX81	CMEP /OSHA	IM /CV	4	--	--	03	50	50	100	2
2	Project	18EIP84	Project Work Phase – 2		--	--	20	03	50	50	100	10
3	Seminar	18EIS85	Technical Seminar		--	--	2	03	50	50	100	1
4	INT	18EII86	Internship	(Completed during the intervening vacations of VI and VII semesters and /or VII and VIII semesters.)				03	50	50	100	2
				TOTAL	**04**	--	**22**	**12**	**200**	**200**	**400**	**15**

Note: PC: Professional Core, PE: Professional Elective, OE: Open Elective, INT: Internship, MC: Mandatory Course

Electives

Internship: Those, who have not pursued /completed the internship will be declared as failed and have to complete during subsequent SEE examination after they satisfy the internship requirements.

CMEP: Cost Management of Engg Projects, OSHA:Occupational Safety and Health Administration

Subject Title : **IoT and Wireless Sensor Networks**		
Sub Code : **18EI71**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course Objective:

The objective of the course is to:

1. Understanding the need for migrating towards software defined networks and integrating time series data from wireless sensor networks.
2. Know about communication protocols, Hardware platforms and operating systems commonly used in IoT systems.
3. Describe different modules in a wireless sensor node and design of wireless sensor networks for different applications

Unit No	Syllabus	No of Teaching hours
1	**Overview of Internet of Things:** Introduction to Internet of Things Introduction-Definition & Characteristics of IoT , IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT,M2M communication, Difference between IoT and M2M,Examples of IoT, Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management at IoT/M2M Gateway	11 Hours
2	**Architecture and Design Principles for IoT:** Internet connectivity, Internet-based communication, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS, FTP, TELNET and ports. **Data Collection, Storage and Computing using a Cloud Platform:** Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud- based data collection, storage and computing	10 Hours
3	**Prototyping and Designing Software for IoT Applications: prototyping embedded devices and Designing Software for IoT Applications Embedded platforms for prototyping, things always connected to internet /cloud** Prototyping Embedded device software, Programming Embedded Device Arduino Platform using IDE	10 Hours
4	**Overview and Architectures of Wireless Sensor Networks:** Introduction: Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts	10 Hours

5	**Communication Protocols:** MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols (CSMA,PAMAS), Schedule based protocols (LEACH, SMACS, TRAMA). **Applications Of WSN:** WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications **IoT Case study**: smart homes, smart city streetlights control and monitoring.	11 Hours

Course outcome:

After successful completion of the course the student is able to:

1. Analyze various M2M and IoT architectures (Analyze)
2. Apply design concept to IoT solutions (Apply).
3. Designing software and programming embedded devices.
4. Illustrate the concept of WSN node Architecture and Network Architecture
5. Explore MAC and Routing protocols of WSNs

CO-PO MAPPING												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	3	3	1	1							
CO3	2	2	3	2	2							
CO4	2	2	2	1								
CO5	2	2	2	1	-							

Low-1 Medium-2 High-3

Text Books:

1. Raj Kamal, ‖Internet of Things-Architecture and design principles‖, McGraw Hill Education.
2. Holger Kerl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Network”, JohnWiley and Sons, 2005 (ISBN: 978-0-470-09511-9)

Reference Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on Approach)”, 1st Edition, VPT, 2014
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, A press Publications, 2013
4. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
5. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier publications, 2004

Subject Title : **Industrial Data Communication & DCS**		
Sub Code : **18EI72**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course Objective:

The objective of the course is to:

1. Understand the role of standards, protocols and principles of communication standards.
2. Understand the principles of communication systems for industrial applications
3. Provide basic knowledge on architecture and components of DCS
4. Provide knowledge on different algorithms and applications in DCS
5. Provide knowledge on state of arts and future trends in DCS

Unit No	Syllabus	No of Teaching hours
1	**Introduction:** OSI model, Communication principles, communication modes, Asynchronous and synchronous systems. **Serial communication standards**: Balanced and unbalanced transmission lines, RS-232 interface standard functional description, RS-485 standard, GPIB: Physical configuration, electrical and mechanical characteristics and bus structure, USB topology: Host hub, connectors, cables, external hubs, USB devices, Host hub controller with hardware and software driver, Device driver and communication flow.	10 Hours
2	**Industrial protocols:** Protocol: Definition, HART Protocol: HART, Physical layer, Data link Layer, Application Layer, CAN bus, Device Net	10 Hours
3	**Industrial protocols:** Foundation field bus, Ethernet topology **PROFIBUS:** Architecture, OSI-model, PROFIBUS types – PA, DP & FMS and their comparison, Designing PROFIBUS, Network design, Advantages and Applications of PROFIBUS in industries	10 Hours
4	**Distributed computer control System Architecture:** functional levels, data base organization, system implementation concepts, human interface **System Elements** : Field stations, intermediate stations, central computer station, monitoring and command facilities **Software:** Real time operating system, communication software, application software, software configuration and parameterization.	10 Hours
5	**Algorithms :**data acquisition and signal processing algorithms, closed loop and sequential control, optimal and adaptive control, implementation examples, algorithms available within DCCS **Applications:** power plants, chemical plants, DCCS application in cement plants, DCCS application in water industry and water waste treatment, oil and gas fields.	12 Hours

	State-of-the-Art and Future Trends: state of the art in DCCS, state of the art in programmable controllers, factors impacting technology development, artificial intelligence in process control.	

Course outcome:

After successful completion of the course the student is able to:

1. Examine the importance of OSI, serial communication standards.

2. Demonstrate different protocols used in industry

3. Apply the different Ethernet topologies in industries.

4. Identify the components of DCS

5. Apply and Analyse the different algorithms used in DCS

6. Implement different applications and the future trends in DCS

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	1	-	2	1	-	-	1	3	2	2
CO2	2	1	1	-	2	1	-	-	1	3	2	2
CO3	2	1	1	-	1	1	-	-	1	1	2	2
CO4	3	2	3	2	2	1	-	-	2	1	2	2
CO5	3	2	3	2	3	2	-	-	1	1	2	2

Low-1 Medium-2 High-3

Text Books:

1. **Practical Data Communications for Instrumentation and Control.** John Park, Steve Mackay, Edwin Wright 1st Edition 2003
2. **Distributed computer control for industrial automation** popovic and bhatkar Publication by Marcel Dekker, Inc. New York, NY, USA ©1990

Reference Books:

1. **Process software and digital networks** Bela G Liptak, 3rd edition, 2002.
2. **Computer Networks** Andrew S. Tanenbaum, , 4th Edition, PHI/Pearson Education. 2002.
3. **Data Communications and Networking** Behrouz A. Forouzan, , 2nd update Edition, Tata McGraw Hill Publishing Company, New Delhi, 2000.
4. **Understanding Distributed Processor Systems for Control.** Samuel M. Herb ISA Publication, 1999
5. **Computer control of processes** - M.Chidambaram, Narosa publishing, Reprint 2010

Subject Title : **Analytical Instrumentation**		
Sub Code : **18EI731**	No of credits : 3=3:0:0(L:T:P)	No of Lecture hours/week:3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

1. To understand the concept and properties of Electromagnetic radiation **a**nd to provide various techniques and methods of analysis which occur in the various regions of the spectrum.
2. To study the concept on Spectro chemical methods used in analytical instrument application
3. To explain important methods of analysis and uses of infrared Spectroscopy, flame photometry, Mass and NMR spectroscopy
4. To give unique methods of separation of closely similar materials, using the most powerful being gas chromatography.

Unit No	Syllabus	No of Teaching hours
1	**Introduction to Spectro chemical methods:** Properties of electromagnetic radiation, interaction to radiation and matter**.**UV – Visible Spectroscopy: Introduction, Electromagnetic Radiation, Laws relating to absorption radiation, Absorption Instruments, Ultraviolet and visible absorption spectroscopy, Calorimeters, spectrophotometer,	**07 Hours**
2	**Infrared Spectroscopy:** Basic Components of IR Spectrophotometers, Type of Infrared Spectrophotometers, Sample Handling Techniques. **Flame photometers:** principle, constructional details of flame photometers, types of flame photometers, types of flame photometers, clinical flame photometers, accessories for flame photometer, expression for concentration, interferences in flame photometry, procedure for determinations. Atomic spectroscopy:	**08Hours**
3	**Atomic absorption and Emission Spectroscopy:** Principles, sample atomization techniques, atomic absorption instrumentation, interferences in atomic spectroscopy, standard addition and internal standard methods of evaluation. Principles, arc, spark and plasma sources, emission based on plasma sources, emission Spectroscopy based on arc and spark sources	**08 Hours**
4	**Mass & NMR Spectroscopy :** Basic concept, types of mass spectrometer, components of mass spectrometer, resolution and applications. Principle of NMR, constructional details, sensitivity enhancement for analytical NMR spectroscopy. Use of computers with NMR spectrometers.	**08 Hours**

5	**Chromatographic Techniques:** classifications Chromatography behaviour of solutes column efficiency and band broadening column performance gas and liquid chromatography Gas chromatograph- basic concepts, parts of gas chromatograph. Method of peak areas, liquid chromatography- basic concepts, types of liquid chromatography, the liquid chromatography	**08 Hours**

Course Outcomes:

Upon completion of this course the students is able to

1. Understand the concept and properties of Electromagnetic radiation **a**nd to provide various techniques and methods of analysis which occur in the various regions of the spectrum.
2. Explain concept on Spectro chemical methods used in analytical instrument application
3. Describe the important methods of analysis of infrared Spectroscopy & flame photometry.
4. Illustrate the uses of radio chemical methods, Mass and NMR spectroscopy in structure determination.
5. Analyse unique methods of separation of closely similar materials, using the most powerful being gas chromatography.

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**		**1**		**1**						**1**
CO2	**2**	**2**		**2**	**1**	**1**		**1**				**1**
CO3	**3**	**1**	**1**		**2**	**1**				**1**		**1**
CO4	**1**	**2**	**2**	**1**	**2**	**1**		**1**				**1**
CO5	**2**	**2**			**2**	**1**						**1**

Text Books:

1. Hand book of analytical Instruments by R. S. Khandpur, TMH Publications, 2nd edition 2006, New Delhi

Reference Books:

2 Instrumental methods of analysis by H. H. Willard, L. L. Merritt & J. A. Dean, CBS Publications 7th Ed 1988.

3. Principles of Instrumental analysis by S. J. Holler & T. A. Nilman Saunders college Publications 5st Ed 1996

Subject Title: **Artificial Intelligence in Industrial Automation**		
Sub Code : **18EI732**	No of credits : 3=3:0:0	No of hrs/week : 3
Exam duration : 3hrs		

Course Objective:

This course is designed

1. To identify potential areas for automation and justify need for automation
2. Study the concepts of Artificial Intelligence.
3. Learn the methods of solving problems using Artificial Intelligence.
4. Apply the concepts of AI to attain industrial automation.

Unit No	Syllabus	No of Teaching hours
1	Introduction to Industrial Automation - Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations.	**08 Hours**
2	Production Economics - Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in-process.	**07Hours**
3	Introduction to Artificial Intelligence -Introduction-Foundations of AI- History of AI- Intelligent agents: Agents and Environment- Reactive agent-deliberative- goal-driven, utility- driven, and learning agents -Artificial Intelligence programming techniques. Introduction to ML and DL Concepts.	**08 Hours**
4	Knowledge Representation and Reasoning -Ontologies-foundations of knowledge representation and reasoning-representing and reasoning about objects-relations- events- actions- time- and space- predicate logic-situation calculus-description logics-reasoning with defaults,-reasoning about knowledge-sample applications- Representing Knowledge and reasoning in an Uncertain Domain- Bayes rule-bayesian networks-probabilistic inference-sample applications- Planning: planning as search- partial order planning-construction and use of planning graphs.	**08 Hours**
5	Industrial AI applications and Case studies - Applications of Industrial AI in Monitoring, optimization and control.AI applications in Industry Automation using -natural language processing-computer vision-speech recognition-computer vision.	**08 Hours**

Course Outcome:

After the successful completion of the course the student is able to

1. Understand basic AI algorithms.
2. Identify appropriate AI methods to solve a given problem.
3. Apply the knowledge about AI/ ML/DL techniques in Industrial automation.
4. Design appropriate AI methods to solve a given problem.

Text Books

1. Rich and Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill,2014.
2. M.P.Groover,"Automation, Production Systems and Computer Integrated Manufacturing", 5th edition, Pearson Education,2009.

Reference Books

1. Anuradha Srinivasaraghavan, Vincy Joseph "Machine Learning", Wiley,2019
2. Stuart Russell and Peter Norvig, "Artificial Intelligence. A Modern Approach ", 2nd Edition, Prentice Hall,2003.

Rajiv Chopra, "Deep Learning", 1st edition, Khanna PublishingHouse,2018.

Course outcome mapping with Programme outcomes

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3									1
CO2	3	2	3	2								1
CO3		2	3		2						2	
CO4	3		2	3		3						2

Subject Title : **Biomedical Signal Processing**		
Sub Code : **18EI 733**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

1. To understand the basic signals in the field of biomedical.

2. To understand Sources and characteristics of noise and artifacts in bio signals, and to understand use of bio signals in diagnosis, patient monitoring and physiological investigation

3. To explore research domain in biomedical signal processing.

4. To explore application of established engineering methods to complex biomedical signals problems.

Unit No	Syllabus	No of Teaching hours
1	**Introduction to Biomedical Signals:** The nature of biomedical signals, action potential, objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, computer aided diagnosis. **Neurological Signal Processing**: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis	**08 Hours**
2	**Linear Prediction Theory**: The Autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination- the case of epileptic patients, overall performance. **Sleep EEG**: Data acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of sleep-wake transitions, Hypnogram model parameters, Event history analysis for modelling sleep	**08 Hours**
3	**Adaptive Interference/Noise Cancellation** : A review of Wiener filtering problem, Principle of an Adaptive filter, The steepest-descent algorithm, the Widrow-Hoff least mean square adaptive algorithm, Adaptive noise canceller, Cancellation of 60Hz interference in ECG, Cancelling Donor-heart interference in Heart-transplant electrocardiography, Cancellation of ECG signal from the electrical activity of the chest muscles, cancelling of maternal ECG in fetal ECG, Cancellation of High frequency noise in Electro-surgery	**08 Hours**

4	**Cardiological Signal Processing:** Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, The use of multi-scale analysis for parameter estimation of ECG waveforms, Arrhythmia analysis monitoring, long term continuous ECG recording.	**08 Hours**
5	**ECG Data Reduction Techniques:** Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Transformation compression techniques, other data compression techniques, Data compression techniques comparaison.	**07 Hours**

Course Outcomes:

After successful completion the student is able to:

1. Model a biomedical system
2. Explain various methods of acquiring bio signals
3. Analyse physiological signals through digital signal processing techniques
4. Simulate the biomedical models and validate its functionality in real time systems.
5. Demonstrate the concepts to develop new models that suits current trends of Industries and analyse its performance.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3									1
CO2	3	2	3	2								1
CO3		2	3		2						2	
CO4	3		2	3		3						2
CO5	3		2	3		3						2

Text Books:

1. **Biomedical Signal Processing Principles and Techniques**- by D C Reddy, The McGraw-Hill publications 2006.
2. **Biomedical Signal Analysis a case study approaches**- by Rangaraj M. Rangayyan The John Wiley publications 2002.

Reference Book:

1. **Biomedical Digital Signal Processing-**by Willis J. Tompkins, The Prentice Hall of India publications 1995

Subject Title : **Neural Networks & Applications**		
Sub Code : **18EI734**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

1. To understand the biological neural network and to model equivalent neuron models.

2. To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks.

3. Understand the basic neural network architectures and learning algorithms, for applications in pattern recognition, image processing

4. Explore the use of Pattern and Neural Classifiers for classification applications.

Unit No	Syllabus	No of Teaching hours
1	**INTRODUCTION:** What is neural network? Human Brain, Models of a Neuron, Neural Networks viewed as directed graphs, Feedback, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks.	**7 Hours**
2	**LEARNING PROCESSES:** Introduction, Error correction algorithm, Memory based learning, Hebbian Learning, Competitive learning, Boltzmann learning, learning with a teacher, learning without a teacher, Learning tasks, Memory, adaptation.	**8Hours**
3	**SINGLE LAYER PERCEPTIONS:** Introduction, Perceptron, and perception convergence theorem, Examples, Multilayer perceptron, Introduction, Some preliminaries	**8Hours**
4	**BACK PROPAGATION ALGORITHM**: Summary of the Back Propagation Algorithm, XOR Problem, and Heuristics for making the Back propagation algorithm to perform better. **RADIAL BASIS FUNCTION NETWORKS:** Architecture, learning Algorithms, Applications. Hopfield Networks – Architecture, Capacity of Hopfield models, Energy analysis of Hopfield networks	**8Hours**
5	**Applications of Neural Networks** **Applications of ANN:** Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Recognition of handwritten characters, Image segmentation, predictive model, Social media, marketing and sales and Healthcare	**7Hours**

Course Outcomes:

After completion of this course the student is able:

1. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modelling.

2. Understand the concepts and techniques of neural networks through the study of the most important neural network models.

3. Evaluate whether neural networks are appropriate to a particular application.

4. Apply neural networks to particular applications, and to know what steps to take to improve performance.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3									1
CO2	3	2	3	2								1
CO3		2	3		2						2	
CO4	3		2	3		3						2

TEXT BOOKS:

1. Simon Haykin, Neural Networks A comprehensive foundation- McMillan College public company, Newyork 1994.

2. Artificial neural networks-B. Yegnanarayana Prentice Hall of India 1999.

REFERENCE BOOKS:

1. Introduction to Artificial Neural Systems- Jacek M. Zurada JaicoPublishing House,1994

2. Neural Network Fundamentals with Graphs, Algorithms, and applications-N.K. Bose, P.Liang, Tata McGraw Hill Edition.1998

3. Artificial Neural networks-Robert J Schalkoff, McGraw Hill international Edition,1997

4. Neural networks and Fuzzy Systems, A Dynamical systems approach to machine intelligence-Bart Kosko, Prentice Hall of India Publications, 200

Subject Title : **Lasers & Optical Instrumentation**		
Sub Code : **18EI741**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives:

1. To introduce the types of lasers and to study its characteristics.
2. To gain knowledge about various types of optical fiber sensors
3. To understand the working principle of laser Instruments and fiber optic instrumentation.

Unit No	**Syllabus**	**No of Teaching hours**
1	**LASER TYPES AND CHARACTERISTICS:** Principles, classification, construction of Ruby, He-Ne, Nd-YAG, semiconductor, Argon and Carbon dioxide lasers. Characteristics of stabilization, Q-switching and mode locking, frequency stabilization, line shape function, lasing threshold, application of lasers in engineering and medicine, safety with lasers**.**	**10 Hours**
2	**LASER INSTRUMENTS**: laser interferometry, laser strain gauges, velocimetry, pulse echo technique, beam modulation telemetry and holography, application of holography, laser welding, laser machining and laser spectroscopy	**07 Hours**
3	**INTRODUCTION TO OPTICAL FIBERS:** light Modulation schemes, optical fibers, intermodal dispersion, graded index fiber, low dispersive fibers Fiber losses, fiber materials, integrated optics, optical bistability, laser printing, optical multiplexers	**08 Hours**
4	**OPTICAL FIBER SENSORS:** Multimode passive and active fiber sensors, phase modulated sensors, fiber optic gyroscope, Polarization: polarimetric sensors, polarization and rotation sensors	**07 Hours**
5	**FIBER OPTIC INSTRUMENTATION:** Interferometric method of measurement of length - Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain. Fiber optic gyroscope – polarization maintaining fibers – applications	**07 Hours**

Course Outcome:

At the end of the course, the student will be able to

1. To understand the principles, characteristics and construction of various types of Lasers and Optical fibres
2. To apply the basic engineering principles in understanding different type of Laser Instruments.
3. To realize the working of optical fibre sensors and detectors for measurement of various parameters
4. To analyse the use of optic fiber Instrumentation for a given applications of optical fibre

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO 4	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-

Text books:

1. "Optoelectronics", Wilson & Hawkes, Prentice Hall of India,2003.
2. Optoelectronics and Fiber Optics Communication – C.K.Sarkar and D.C. Sarkar, New Age Int. Pub., 2004
3. "Laser principles and applications", Wilson and Hawkes, Prentice Hall of India,1983

Reference books:

1. John and Harry, Industrial Lasers and their Applications, McGraw Hill, 1974.
2. Senior J.M., Optical Fiber Communication Principles and Practice, Prentice Hall, 1985.
3. Keiser G., Optical Fiber Communication, McGraw Hill, 1991

Subject Title : **Multimedia Communication**		
Sub Code : **18EI742**	No of credits : 3 3:0:0	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objective:

The objective of the course is to:

1. To study the different types of Media and their representation in different forms.
2. To understand the different compression techniques for Text and image with examples.
3. To study the different compression techniques for Audio and Video
4. To analyses the network architecture and transport protocols

Unit No	**Syllabus**	**No of Teaching hours**
1	**multimedia communications:** Introduction, multimedia information representation, multimedia networks, multimedia applications, media types, communication modes, network types, multipoint conferencing, network QoS, Application QoS. Digitization Principles,	8 Hours
2	**Text:** unformatted text, formatted text, hyper text**, Image:** Graphics, Digitized documents, **Text and Image Compression:** compression principles, text compression – Arithmetic coding, Lempel-ziv and Welsh coding, Image compression- GIFF, TIFF, Digitized documents and Pictures, JPEG.	7 Hours
3	**Audio compression:** Introduction, audio compression, LPC, Code excited LPC, Perceptual coding, MPEG Audio coders, Dolby Audio coders. **Video compression**: Video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, and MPEG-4.	7 Hours
4	**The Internet**: IP addresses, ARP, RARP, Routing Algorithms- Flooding, Distance vector Routing, Link State & Hierarchical Routing, ICMP, Broadcast Routing, Multicast Routing.	7 Hours
5	**Broadband ATM Networks:** Cell format and Switching principles, Switching architectures, Protocol architectures. **Transport Protocols**: TCP, UDP, RTP and RTCP.	7 Hours

Course outcome:

After successful completion of the course the student is able to:

1. Understand types of Multimedia networks and applications.
2. Illustrate representation of the information of text, images, audio and video.
3. Implement the text and image, Audio and Video compression using different techniques and Standards.
4. Analyse the various Routing algorithms.
5. Evaluate the Broadband Architectures and Transport Protocols.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**1**						**1**		
CO2	**2**	**3**		**1**								
CO3	**2**	**2**	**3**	**2**	**1**	**1**						**1**
CO4	**2**	**1**		**2**								**1**
CO5	**3**	**2**		**1**	**1**	**1**		**1**				**1**

Low-1 Medium-2 High-3

Text Books:

1. Multimedia Communications: Applications, Networks, Protocols, and Standards – Fred Halsall, Pearson Education, Asia, Second Indian reprint 2002.

Reference Books:

1. Multimedia Information Networking –, Nalin K. Sharda, PHI, 2003.
2. Multimedia Fundamentals: Vol 1-Media Coding and Content Processing – RalfSteinmetz, KlaraNarstedt, Pearson Education, 2004.

Subject Title : **Adaptive Signal Processing**		
Sub Code :**18EI743**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives:

The objectives of the course is to:
1. Explain the types of adaptive systems along with its characteristics
2. To understand the concepts of development of Adaptive Filter Theory & Searching the Performance surface.
3. Understand Steepest Descent Algorithms.
4. To develop LMS Algorithm & Applications
5. Introduction to various state Estimators like RLS Algorithm, Statement of Kalman filtering problem, the Innovation Process.

Unit No	Syllabus	No of Teaching hours
1	**Introduction to Adaptive Systems**: Definitions, Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner – Description, Weight Vectors, Desired Response Performance function – Gradient & Mean Square Error.	**8**
2	**Development of Adaptive Filter Theory & Searching the Performance surface**: Introduction to Filtering – Smoothing and Prediction – Linear Optimum Filtering, Problem statement, Principle of Orthogonally – Minimum Mean Square Error, Wiener- Hopf equations, Error Performance – Minimum Mean Square Error, Estimation of phase shift between two narrow band signals using Orthogonal Decomposer.	**8 Hours**
3	**Steepest Descent Algorithms**: Searching the performance surface – Methods & Ideas of Gradient Search methods – Gradient Searching Algorithm & its Solution – Stability & Rate of convergence – Learning Curves Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.	**7 Hours**
4	**LMS Algorithm & Applications**: Overview – LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms – LMS Gradient & Stochastic algorithms – Convergence of LMS algorithm. Applications: Adaptive BFSK, BPSK, ASK demodulators and delay estimation. Adaptive Beam forming, concept of IQ channels, Adaptive filter implementation of Hilbert Transform. Introduction to MUSIC	**8 Hours**
5	**State Estimators**: Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Expression of Kalman Gain, Filtering Example estimation of state from observations of noisy observed narrow band signals. Target tracking using only DOA.	**8 Hours**

Course Outcomes

Successful completion of the course objectives will contribute to the following outcomes:

CO1: To classify various Adaptive Systems.

CO2: To evaluate Adaptive Filter Theory & Searching the Performance surface

CO3: To design and develop Steepest Descent Algorithms and develop LMS Algorithm & Applications

CO4: To analyse RLS Algorithm, Statement of Kalman filtering problem, the Innovation Process.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	-	-	-	1	-	-	-
CO2	1	2	-	1	1	-	-	-	1	-	-	-
CO3	1	2	-	1	1	-	-	-	1	-	-	-
CO4	1	3	1	1	2	-	-	-	1	-	1	1

Low-1 Medium-2 High-3

TEXT BOOK

1. Bernard Widrow, Samuel D.Strearns, "Adaptive Signal Processing", 2005, PE.
2. Simon Haykin, "Adaptive Filter Theory", 4th Edition. 2002, PE Asia.

REFERENCE BOOKS:

1. Kaluri V. Rangarao, Ranjan K. Mallik, "Digital Signal Processing: A Practitioner's Approach", ISBN: 978-0-470-01769-2, 210 pages, November 2006, John Wiley (UK)
2. Sophocles. J. Orfamadis, "Optimum signal processing: An introduction", 2nd Edition, 1988, McGraw-Hill, Newyork
3. S. Thomas Alexander, "Adaptive signal processing-Theory and Applications", 1986, Springer –Verlag.
4. Candy, "Signal analysis", McGraw Hill Int. Student Edition
5. James V. Candy, "Signal Processing: A Modern Approach", McGraw-Hill, International Edition, 1988.

Subject Title : **Micro Systems and Nanotechnology**		
Sub Code : **18EI744**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course objectives:

The objective of this course is to make the students to

1. To impart fundamental knowledge of Microsystems and their manufacturing.
2. To provide knowledge of fabrication process.
3. To know the basics of Nanotechnology and its properties.
4. To impart basic knowledge on various synthesis and characterization techniques involved in Nanotechnology.

Unit No	Syllabus	No of Teaching hours
1	**Overview of MEMS and Microsystems and working principles of microsystems:** MEMS and Microsystems, Typical MEMs and Microsystems products, Evolution of microfabrication, microsystems and microelectronics, Multidisciplinary nature of microsystems design and manufacture, Applications of microsystems in Automotive, Healthcare Aerospace and other industries.	**08Hours**
2	**Micro sensors, Actuator systems: Micro sensors**: Silicon Capacitive Accelerometer, Piezo resistive pressure sensor, Portable blood Analyser **Micro actuation:** using thermal forces, SMA, Piezoelectric crystals, Electrostatic Forces. **MEMS with Micro actuators**- Micro grippers, Micro motors, Micro valves, Micro pumps, Micro accelerometers	**07 Hours**
3	**Miniaturization and Micromachining technologies:** Introduction to scaling, scaling in rigid body dynamics, electrostatic forces, electromagnetic forces, electricity. Silicon as a material for micromachining, Thin film deposition, Lithography, etching, Silicon micromachining- surface, Bulk, LIGA. Advanced process for Microfabrication- Wafer bonding techniques, Special Microfabrication Techniques. Special Materials for Microsystems	**08 Hours**
4	**Introduction to nanotechnology: Nanotechnology**-definition, classification based on the dimension, Effects of the Nano-metre Length Scale, Fabrication methods Top- down processes-Milling, Lithography, Bottom-up processes-Vapour phase deposition methods, Plasma-assisted deposition processes.	**08 Hours**

5	**Methodologies for nanotechnology characterization**: Electron microscopy- Scanning electron microscopy, Transmission electron microscopy, Scanning probe techniques- Scanning tunnelling microscopy , Atomic force microscopy, **Applications of nanotechnology-** electronics and Medical field.	**08 Hours**

Course Outcomes:

At the end of the course the student is able to

CO1: Understand the fundamental knowledge of Microsystems for varied applications
CO2: Understand the working principles of sensors and actuators at micro level
CO3: Integration of various functions into a very small space from sub micro meters to some millimeters and also the fabrication aspects.
CO4: Understand the fundamentals of Nanotechnology.
CO5: Gain knowledge on various synthesis and characterization techniques involved in nano technology.

Text Books:

1. **MEMS and Microsystems**: design and manufacture-Tai-Ran Tsu, Tata McGraw-Hill, 6th reprint 2012
2. **Micro and Smart systems**: G.K Ananhasuresh, K.J.Vinoy, S. Gopalakrishan, K.N Baht, Wiley India Publishers 1st edition 2010.
3. Pradeep, T., Nano: The Essentials, McGraw Hill Publishers, Mumbai, 2007

Reference Books:

1. **MEMS**- Nitaigour Premchand Mahalik, Tata McGraw-Hill, 2007
2. **Nanotechnology**: Principles and practices-SulabhaK. Kulakarani, 3rdedition 2014 Capital Publishing company co-published by Springer.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	-	-	1	-	-	2
CO2	1	2	2	3	1	1	2	-	1	2	-	2
CO3	2	3	3	3	1	2	2	-	1	2	1	2
CO4	3	2	3	1	1	2	-	-	1	2	-	2
CO5	3	2	2	2	1	2	2	-	1	2	1	2

Subject Title : **Process Control and Automation Lab**		
Sub Code : **18EIL76**	No of credits : 1=0:0:1 (L:T:P)	No of Lecture hours/week: 2
Exam Duration: 3 hrs		Total no. of contact hours: 26

Course objectives:

1. To design a suitable signal conditioning circuit for the given physical parameter measured using transducer/sensor
2. Calibrate, configure, and tune various real-world instrumentation and control loops on the physical parameters like pressure, temperature, and level training stations.
3. Design and develop a ladder diagram using PLC for simple automation application

Expt No	Syllabus
1	Closed loop response of flow control loop with and without disturbance.
2	Closed loop response of level control loop with and without disturbance
3	Closed loop response of temperature control loop with and without disturbance.
4	Rig up and test the circuit to display the temperature using RTD with suitable signal conditioning circuit.
5	Rig up a suitable circuit to control the speed of a DC motor/Intensity of a light using PID controller
6	Response of flow, level and temperature control using DCS and SCADA
7	Sequential control using PLC. The logic should be solved using ladder diagram technique
8	Bottle Filling process using PLC The logic should be solved using ladder diagram technique
9	Sequential Control experiments using PLC. The logic should be solved using ladder diagram technique.
10	Elevator using PLC. The logic should be solved using ladder diagram technique
11	Conduct experiment to plot the control valve characteristics
12	Rig up and test the circuit to display the load using load cell with suitable signal conditioning circuits

Course Outcomes:

After completion of this course the student is able to:

1. Design a suitable signal conditioning circuit for the given physical parameter measured using transducer/sensor
2. Calibrate, configure, and tune various real-world instrumentation and control loops on the physical parameters like pressure, temperature, and level training stations.
3. Design and develop a ladder diagram using PLC for simple automation application

CO-PO MAPPING												
CO/ PO	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**P O7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	**1**	**1**	**1**	**1**	**1**	**2**	**-**	**-**	**1**	**1**	**1**	**2**
CO2	**1**	**1**	**2**	**1**	**2**	**-**	**-**	**1**	**1**	**1**	**1**	**2**
CO3	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**1**	**1**	**1**	**1**	**1**

Subject Title : **IOT Lab**		
Sub Code : **18EIL77**	No of credits : 1=0:0:1 (L:T:P)	No of Lecture hours/week: 2
Exam Duration: 3 hrs		Total no. of contact hours: 26

Course Objectives:

1. Develop IoT application using sensing devices, actuation, processing and communication through IoT development kits
2. Illustrate the process of building testing and working f IoT application through prototyping and programming

List of Experiments

Sl. No	Experiment
1.	Introduction to Arduino platform and programming
2.	Interfacing Arduino to Zigbee module
3.	Interfacing Arduino to GSM module
4.	Interfacing Arduino to Bluetooth Module
5.	Introduction to Raspberry PI platform and python programming
6.	Interfacing the given sensor to Raspberry PI
7.	Communicate between Arduino and Raspberry PI using any wireless medium
8.	Setup a cloud platform to log the data
9.	Log Data using Raspberry PI and upload to the cloud platform
10.	ON/OFF Control Based On Light Intensity (Using the light sensors, monitor the surrounding light intensity & automatically turn ON/OFF the high intensity LED's by taking some pre-defined threshold light intensity value.)
11.	Battery Voltage Range Indicator Monitor the voltage level of the battery and indicating the same using multiple LED's (for ex: for 3V battery and 3 led's, turn on 3 led's for 2-3V, 2 led's for 1-2V, 1 led for 0.1-1V & turn off all for 0V)
12.	IoT Based Temperature and Humidity Monitoring over ThingSpeak using Arduino UNO and ESP8266

Course Outcomes:

The students will be able to:

1. Use microcontroller based embedded platforms in IOT
2. Use wireless peripherals for exchange of data.
3. Make use of Cloud platform to upload and analyze any sensor data
4. Use of Devices, Gateways and Data Management in IoT.

5. Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.

CO-PO MAPPING												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1								
CO2	3	2	2	1	1					2		
CO3	2	2	2	2	2					2		
CO4	3	2	2	2	2							
CO5	3	2	2	2	2							

Low-1 Medium-2 High-3