JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in ELECTRONICS AND INSTRUMENTATION ENGINEERING
COURSE STRUCTURE & SYLLABUS (R18)

Applicable From 2018-19 Admitted Batch

I YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA101BS	Mathematics - I	3	1	0	4
2	AP102BS	Applied Physics	3	1	0	4
3	CS103ES	Programming for Problem Solving	3	1	0	4
4	ME104ES	Engineering Graphics	1	0	4	3
5	AP105BS	Applied Physics Lab	0	0	3	1.5
6	CS106ES	Programming for Problem Solving Lab	0	0	3	1.5
7	*MC109ES	Environmental Science	3	0	0	0
		Induction Programme				
		Total Credits	**13**	**3**	**10**	**18**

I YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA201BS	Mathematics - II	3	1	0	4
2	CH202BS	Chemistry	3	1	0	4
3	EE203ES	Basic Electrical Engineering	3	0	0	3
4	ME205ES	Engineering Workshop	1	0	3	2.5
5	EN205HS	English	2	0	0	2
6	CH206BS	Engineering Chemistry Lab	0	0	3	1.5
7	EN207HS	English Language and Communication Skills Lab	0	0	2	1
8	EE208ES	Basic Electrical Engineering Lab	0	0	2	1
		Total Credits	**12**	**2**	**10**	**19**

II YEAR I SEMESTER

S. No.	Course Code	Subject	L	T	P	Credits
1	EC301PC	Electronic Devices and Circuits	3	1	0	4
2	EI302ES	Network Theory	3	0	0	3
3	PEI303C	Transducers Engineering	3	1	0	4
4	EI304PC	Electronic Measurements	3	0	0	3
5	EC304PC	Signals and Systems	3	1	0	4
6	EC306PC	Electronic Devices and Circuits Lab	0	0	2	1
7	EC308PC	Basic Simulation Lab	0	0	2	1
8	EI307PC	Transducers and Measurements Lab	0	0	2	1
9	*MC309	Constitution of India	3	0	0	0
		Total Credits	**18**	**3**	**6**	**21**

II YEAR II SEMESTER

S. No.	Course Code	Subject	L	T	P	Credits
1	MA401BS	Laplace Transforms, Numerical Methods & Complex Variables	3	1	0	4

2	EI402PC	Industrial Instrumentation	3	0	0	3
3	EC404PC	Linear IC Applications	3	0	0	3
4	EC405PC	Electronic Circuit Analysis	3	0	0	3
5	EI403PC	Digital System Design	3	1	0	4
6	EC407PC	IC Applications Lab	0	0	3	1.5
7	EI406PC	Industrial Instrumentation Lab	0	0	3	1.5
8	EC408PC	Electronic Circuit Analysis Lab	0	0	2	1
9	*MC409	Gender Sensitization Lab	0	0	2	0
		Total Credits	**15**	**2**	**10**	**21**

III YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	EC501PC	Microprocessor & Microcontrollers	3	1	0	4
2	EI502PC	Process Dynamics and Control	3	1	0	4
3	EC503PC	Control Systems	3	1	0	4
4	SM504MS	Business Economics & Financial Analysis	3	0	0	3
5		Professional Elective - I	3	0	0	3
6	EC505PC	Microprocessor & Microcontrollers Lab	0	0	3	1.5
7	EI506PC	Process Control Lab	0	0	3	1.5
8	EN508HS	Advanced Communication Skills Lab	0	0	2	1
9	*MC510	Intellectual Property Rights	3	0	0	0
		Total Credits	**18**	**3**	**8**	**22**

III YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	EI601PC	Industrial Automation	3	1	0	4
2	EC602PC	Digital Signal Processing	3	1	0	4
3	EI603PC	Object Oriented Programming through Java	3	1	0	4
4		Professional Elective - II	3	0	0	3
5		Open Elective - I	3	0	0	3
6	EC604PC	Digital Signal Processing Lab	0	0	3	1.5
7	EI605PC	Industrial Automation Lab	0	0	3	1.5
8	EI606PC	Object Oriented Programming through Java Lab	0	0	2	1
9	*MC609	Environmental Science	3	0	0	0
		Total Credits	**18**	**3**	**8**	**22**

IV YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	EI701PC	Analytical Instrumentation	3	0	0	3
2		Professional Elective - III	3	0	0	3
3		Professional Elective - IV	3	0	0	3
4		Open Elective - II	3	0	0	3
5	SM702MS	Professional Practice, Law & Ethics	2	0	0	2
6	EI703PC	Analytical Instrumentation Lab	0	0	2	1
7	EI704PC	Industrial Oriented Mini Project/ Summer Internship	0	0	0	2*

8	EI705PC	Seminar	0	0	2	1
9	EI706PC	Project Stage - I	0	0	6	3
		Total Credits	**14**	**0**	**10**	**21**

IV YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1		Professional Elective - V	3	0	0	3
2		Professional Elective - VI	3	0	0	3
3		Open Elective - III	3	0	0	3
4	EI801PC	Project Stage – II	0	0	14	7
		Total Credits	**9**	**0**	**14**	**16**

Professional Elective – I

EI511PE	Instrumentation Practices in Industries
EI512PE	Operating Systems
EI513PE	Robotics and Automation

Professional Elective - II

EI611PE	Optoelectronics and Laser Instrumentation
EI612PE	Industrial Data Communications
EI613PE	Embedded Systems

Professional Elective – III

EI711PE	Pharmaceutical Instrumentation
EI712PE	Virtual Instrumentation
EI713PE	MEMS and its applications

Professional Elective – IV

EC721PE	Biomedical Instrumentation
EI722PE	Computer Networks
EI723PE	Artificial Neural Networks

Professional Elective – V

EI811PE	Telemetry and Telecontrol
EI812PE	Digital Image Processing
EI813PE	VLSI Design

Professional Elective – VI

EI821PE	Power Plant Instrumentation
EI822PE	Machine Learning
EI823PE	Fundamentals of Internet of Things

***MC - Environmental Science – Should be Registered by Lateral Entry Students Only.**
***MC – Satisfactory/Unsatisfactory**

Note: Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

EI701PC: ANALYTICAL INSTRUMENTATION

B.Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Course Objectives: Student will be able to

- Students will be introduced to a whole array of modern analytical instrumentation with the goal of providing them with the tools with which they can further their applied research.
- The emphasis will be a "hands-on" approach with sample preparation, theory, application, method development, data analysis and interpretation being key elements.
- **Interpret** data derived from any of the above-mentioned spectroscopic instruments
- **Appreciate** the basic concept, principles and terms of chromatography

Course Outcomes: After completion of the course the student is able to:

- **Understand** the principles, procedures and applications of Analytical Instrument and analytical techniques
- **Use** statistical method for evaluating and interpreting data
- **Appreciate** the basic principles of spectroscopy and chromatography techniques.
- **Integrate** different analytical techniques to solve analytical and bio-analytical problems

UNIT - I

Electrochemical Instruments: Basic concepts of Analytical Instrumentation, Electro chemical instruments- pH meter, Conductivity meter, Dissolved oxygen analyzers, sodium analyzers, silica analyzers

UNIT - II

Spectrophotometers-I (Absorption): Concepts of Spectrometry, Beer- Lambert's law-Derivation of Beer Lamberts Law- Problems associated with the Law. UV, VIS spectrophotometers – single beam and double beam instruments – Instrumentation associated with the above spectrophotometers – sources and detectors.

IR Spectrometers – sources and detector, Instrumentation associated with the above spectrophotometers, FTIR. Interpretation and Analysis.

Spectrophotometers-II (Emission): Flame emission and Atomic emission spectrophotometers – Sources for Flame Photometers, Online calorific value measurements**.**

UNIT - III

Gas and Liquid Chromatographs: Chromatography – types- Basic principles of gas chromatography, liquid chromatography (HPLC) ---- different types of columns, detectors, recorders and associated equipment for Gas and Liquid Chromatographs and their applications, Interpretation and Analysis.

Principles of Nuclear Magnetic Resonance: Instrumentation associated with NMR spectrophotometer – Introduction to mass spectrophotometers, Introduction and Working Principle of Electron Spin Resonance (ESR), Interpretation and Analysis.

UNIT - IV

Gas Analyzers- I: Analysis using Thermal conductivity principle, Katharometer – oxygen analyzers using paramagnetic principle, H_2S analyzer system.

Gas Analyzers- II: CO monitors, NO_x analyzers, Industrial analyzer circuits, Pollution Monitoring systems

UNIT - V

Thermal Analyzers: Differential Scanning Calorimetry (DSC), Derivative Thermo Gravimetric Analyzers (DTGA).

Nuclear Radiation Detectors: Gas filled Detectors- GM counters, Scintillation counter, Ionization chamber, Proportional counter, solid state detector.

TEXT BOOKS:

1. Handbook of Analytical Instrumentation, R.S. Khandpur, TMH.
2. Instrumental Method of Analysis- by Willard. H.H, Merrit L.L, Dean, D.Van Nostrand, CBS publishing and Distributors, 6/e, 1995.

REFERENCE BOOKS:

1. Process Measurement and Analysis- by B.G. Liptak, CRC Press
2. Principles of Instrumental Analysis- by Skoog D.A and West D.M, Holt Sounder publication, Philadelphia, 1985
3. Instrument Technology- by Jones B.E, Butterworth Scientific Publications, London, 1987.

EI711PE: PHARMACEUTICAL INSTRUMENTATION (PE – III)

B.Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Course Objectives: Student will be able to

- **Understand** the working pharmaceutical industry
- **Understand** the necessity of a instrumentation engineer pharmaceutical industry
- **Understand** different components and their control in pharmaceutical industry.

Course Outcomes: After completion of the course the student is able to:

- Appreciate the concept of analytical instrumentation learned during previous semester.
- Appreciate the necessity of homogenization of mixture and size reduction.
- Appreciate evaporation process involved in pharma industries.
- Appreciate distillation and filtration process involved in pharma industries.

UNIT - I

Introduction: Pharma Industries Basic Processors and Instrumentation Techniques, Process Analysis Technology (PAT).

Filtration: Classification of Filtration, Mechanism of Filtration, Filter media, Filter Aids, Pretreatment of materials, small scale filtration methods, filtration equipment, filter presses, Leaf filters, stacked disc filters, meta filters, Rotary continuous filters, other methods, ceramic filters, seitz filters, sintered (fritted) Glass filters, Membrane filters, factors affecting the rate of filtration, filter operation, theory of filtration, Limitations of filter theory.

Centrifugation: General principles, theoretical aspects, classification, Laboratory equipment, Large scale equipment, Semi continuous centrifuge, equipment with non-perforated basket, de laval clarifier, vertical solid bowl centrifuges, continuous centrifuges.

Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum cleaning cycle in batch filters. Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimeters.

UNIT - II

Crystallization: Introduction, Crystal forms and crystal Habit, classification of crystallizers, tank crystallizers, agitated batch crystallizers, Swenson Walker Crystallizer, others, Krystal Crystallizer, Vacuum Crystallizer without External Classifying seed Bed, theoretical aspects of Crystallization, Calculation of yields, theory of Crystallization. The miers super saturation theory, limitations of themiers theory, rate of crystal growth, Caking of crystals.

Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields, Material and heat balances around Swenson Walker Crystallizer. Super saturation theory and its limitations, Nucleation mechanisms, crystal growth. Study of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizers. Caking of crystals and its prevention. Numerical problems on yields.

UNIT - III

Humidity control and Refrigeration: Basic concepts and definition, wet bulb temperature, adiabatic cooling lines, use of Humidity chart, determination of humidity, air conditioning, humidification and humidifying equipment, dehumidifiers. Introduction, refrigeration equipment, coefficient of performance and refrigerants, Brine systems, refrigeration load, absorption systems.

Evaporation and Distillation Heat Processes: Factors affecting evaporation, study of evaporating stills and evaporating pans, heat transferring evaporators, vapor compression evaporators and evaporation under reduced pressure. Distillation: Importance of distillation in Pharmacy, methods of distillation. Brief introduction to freeze drying, sublimation, desiccation and exsiccation, efflorescence and its importance.

UNIT - IV

Size Reduction and Separation: Introduction, mechanism and principles of size reduction, classification of size reduction equipment, law of size reduction, large equipment, mills using impact force for size reduction, cage mills, pin mills, fluid energy or jet mills, attrition and grinding mills tumbling mills. Ball mills and tube mills, practical size classifiers used with grinding mills, wet classifiers, nonrotary

ball and bead mills, dry vs wet grinding, end runner mill, edge runner mills, disc attrition mills, dispersion and colloid mills, roller mills, size reduction combined with other operations, factors influencing choice of size reduction machinery, changes resulting in the material due to size reduction.
size separation sieving, Screening equipment, sedimentation, screen analysis Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of a mill, types of mills including ball mill, hammer mill, fluid energy mill etc. Various methods and equipments employed for size separation, centrifugal elutriation, microscopic methods.

UNIT - V

Mixing and Homogenization: Introduction, equipment for4 mixing of miscible liquids, mixing of a soluble solid with a low viscon liquid etc., mixing solids with solids, equipment, consideration while choosing solids mixing equipment, theory of mixing, mixing solids with liquids, mixing miscible liquids, mixing viscous masses, mixing of immiscible liquids, equipment for emulsification.
Theory of mixing, solid solid, solid liquid and liquid liquid mixing equipment, double cone, twin-shell, silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and turbine mixer.Semi solid mixing, Triple roller mill.

TEXT BOOKS:

1. Pharmaceutical Engineering. K. Samba Murthy
2. Pharmaceutical Engineering CVS Subhramanyam.

REFERENCE BOOKS:

1. Tutorial Pharmacy, S.J. Carter, Cooper and Gunn‘s, 6th ed., CBS publisher, Delhi. Perry‘s Handbook of Chemical Engineering.
2. Unit Operations by Mc Cabe & Smith.

EI712PE: VIRTUAL INSTRUMENTATION (PE – III)

B.Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Course Objectives: Student will be able to

- **Develop** virtual instruments for specific application using Lab VIEW software.
- Ease the programming required to make computer interact with real world.
- To **acquire**, **analyze** and **display** the throughput of any compatible system.
- Knowledge to **connect** with third party software and hardware

Course Outcomes: After completion of the course the student is able to:

- Create Virtual Instrument using Lab VIEW software for Control system, Signal Processing and Image processing applications.
- Create effective Virtual Instrument that shall use minimum memory space and work effectively with any processor.
- Interface the computer with DAQ to monitor, process and control real world applications
- Analyze the throughput using the tools in Lab VIEW software

UNIT - I

Virtual Instrumentation: An Introduction, Historical perspective, advantages, blocks diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT - II

VI Programming Techniques: VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O, Instrument Drivers, mathscript.

UNIT - III

VI Interface Requirements: Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, Firewire. PXI system controllers, Ethernet control of PXI, VISA and IVI, Data Acquisition Hardware

UNIT - IV

Application of Virtual Instrumentation: Application of Virtual Instrumentation: Instrument Control using RS-232C and IEEE488, Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, Active X programming, Publishing measurement data in the web.

UNIT - V

VI toolsets: Distributed I/O modules, Control Design and Simulation, Digital Signal processing tool kit, Image acquisition and processing, Motion control

TEXT BOOKS:

1. LabVIEW Graphical Programming, Gary Johnson, Second edition, McGraw Hill, New York, 1997.
2. LabVIEW for everyone, Lisa K. wells & Jeffrey Travis Prentice Hall, New Jersey, 1997.

REFERENCE BOOKS:

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2000.
2. Rick Bitter, LabVIEW advanced programming technique, 2nd Edition, CRC Press, 2005
3. Jovitha Jerome, Virtual Instrumentation using LabVIEW, 1st Edition, PHI, 2001.

EI713PE: MEMS AND ITS APPLICATIONS (PE – III)

B.Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Course Objectives: The course is intended for students to:

- **Acquire** knowledge about MEMS devices and their applications in various domains.
- **Understand** the techniques to fabricate MEMS devices.
- **Learn** the design considerations for MEMS devices and Microsystems.
- **Learning** to characterize Microsystems using optical and electron microscopy and other techniques.

Course Outcomes: After completion of the course the student is able to:

- **Apply** fundamental knowledge of physics and chemistry to design microsystems for various applications.
- **Select** appropriate tools and techniques considering particular practical need for a microsystem application.
- **Realize** the need for advancement of technology towards microsystems for better living in the society.
- **Understand** the need to keep oneself updated constantly to understand the ease of use of emerging technologies.

UNIT - I

Fundamentals of MEMS: Overview of MEMS and Microsystems; Evolution of microfabrication; Applications of MEMS in optical devices (Micro-Opto-Electro-Mechanical Systems or MOEMS), healthcare and biomedicine (including Bio-MEMS and Bio-MOEMS), aerospace, telecommunications, consumer products, automotive, and industrial products; Working principles of microsystems: Microsensors – acoustic wave, bio-, chemical, optical, pressure, thermal; Microactuation – thermal, shape-memory alloys, piezoelectric, electrostatic; MEMS devices – Microgrippers; Micromotors; Microfluidics – Micropumps, Microvalves; Micro accelerometers

UNIT - II

Materials for MEMS and Microsystems: Substrates and Wafers; Silicon as a Substrate, Silicon Compounds, Silicon piezoresistors, Non-silicon-based materials: Gallium Arsenide, Gallium Nitride, Quartz, Piezeoelectric Crystals, Polymers.

UNIT - III

Basics of Micromanufacturing: Photolithography; Cleanroom Environment; Deposition techniques: Ion implantation, Diffusion, Vapour Deposition (PVD, CVD, PECVD), Oxidation, Epitaxial growth; Etching techniques: Chemical (Wet) Etching, Plasma (Dry) Etching
Design considerations; Process Design; Photomask layout using CAD; Mechanical design overview

UNIT - IV

Fabrication of MEMS: Bulk micromachining, Surface micromachining, LIGA Process, Deep X-Ray Lithography (DXRL)

UNIT - V

Characterization of MEMS: Characterization techniques: Principle of working and operation of: Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Atomic Force Microscope (AFM), X-Ray Diffraction (XRD), Optical microscope

TEXT BOOKS:

1. Tai-Ran Hsu, ―MEMS and Microsystems Design and Manufacture‖, *Tata McGrawHill*, 2002 (ISBN: 978-0070487093)
2. N. Mahalik, ―MEMS‖, *McGraw-Hill Education (India) Pvt. Ltd.*, 2007 (ISBN: 9780070634459)

REFERENCE BOOKS

1. Marc J. Madou, ―Fundamentals of Microfabrication: The Science of Miniaturization‖, *CRC Press*, 2002 (ISBN: 978-0849308260)
2. Stephen D. Senturia, ―Microsystem Design‖, *Springer*, 2004 (ISBN: 9788181285461)
3. Ville Kaajakari, ―Practical MEMS‖, *Small Gear Publishing*, 2009 (ISBN: 9780982299104)

EC721PE: BIOMEDICAL INSTRUMENTATION (PE – IV)

B.Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Course Objectives:

- **Identify** significant biological variables at cellular level and ways to acquire different bio-signals.
- **Elucidate** the methods to monitor the activity of the heart,brain, eyes and muscles.
- **Introduce** therapeutic equipment for intensive and critical care.
- **Outline** medical imaging techniques and equipment for certain diagnosis and therapies.

Course Outcomes: After completion of the course the student is able to:

- **Understand** bio systems and medical systems from an engineering perspective.
- **Identify** the techniques to acquire record and primarily understand physiological activity of the human body through cell potential, ECG, EEG, BP and blood flow measurement and EMG.
- **Understand** the working of various medical instruments and critical care equipment.
- **Know** the imaging techniques including CT,PET, SPECT and MRI used in diagnosis of various medical conditions.

UNIT - I:

Bio-Potential Signals and Electrodes

Bio-signals and their characteristics, Organization of cell, Nernst equation of membrane, Resting and Action potentials.

Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems.

Bio-potential electrodes – Body surface recording electrodes, Internal electrodes, micro electrodes.

Bio-chemical transducers – reference electrode, the pH electrodes, Blood gas electrodes.

UNIT - II:

Cardiovascular Instrumentation: Heart and cardiovascular system Heart electrical activity, blood pressure and heart sounds. Cardiovascular measurements electro cardiography – electrocardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

UNIT - III:

Neurological Instrumentation: Neuronal communication, electro encephalogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, preamplifiers and amplifiers. EMG block diagram and Stimulators

UNIT - IV:

Equipment for Critical Care: Therapeutic equipment - Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators.

UNIT - V:

Principles of Medical Imaging: Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography, Introduction to Telemedicine.

TEXT BOOKS

1. Hand-book of Biomedical Instrumentation – by R.S. Khandpur, McGraw-Hill, 2003.
2. Medical Instrumentation, Application and Design – by John G. Webster, John Wiley.

REFERENCE BOOKS

1. Biomedical Instrumentation and Measurements – by Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, PHI.
2. Principles of Applied Biomedical Instrumentation – by L.A. Geoddes and L.E. Baker, John Wiley and Sons.
3. Introduction to Biomedical equipment technology-by Joseph Carr and Brown.

EI722PE: COMPUTER NETWORKS (PE – IV)

B.Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Prerequisites:
1. A course on "Programming for problem solving"
2. A course on "Data Structures"

Course Objectives:
- The objective of the course is to equip the students with a general overview of the concepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.

Course Outcomes:
- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
- Obtain the skills of subnetting and routing mechanisms.
- Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.

UNIT - I
Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.
Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

UNIT - II
Data link layer: Design issues, framing, Error detection and correction.
Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel.
Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols.
Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, Data link layer switching.

UNIT - III
Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

UNIT - IV
Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

UNIT - V
Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

TEXT BOOK:
1. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI

REFERENCE BOOKS:
1. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education
2. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

EC711PE/EI723PE: ARTIFICIAL NEURAL NETWORKS (PE – IV)

B.Tech. IV Year I Semester

L	T	P	C
3	0	0	3

Prerequisite: Nil

Course Objectives:

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, learning algorithms
- To know the issues of various feed forward and feedback neural networks.
- To explore the Neuro dynamic models for various problems.

Course Outcomes: Upon completing this course, the student will be able to

- Understand the similarity of Biological networks and Neural networks
- Perform the training of neural networks using various learning rules.
- Understanding the concepts of forward and backward propagations.
- Understand and Construct the Hopfield models.

UNIT-I:

Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT-II:

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT-III:

Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT-IV:

Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT-V:

Neuro Dynamics: Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm

Hopfield Models – Hopfield Models, restricted boltzmen machine.

TEXT BOOKS:

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.,.
2. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.

REFERENCE BOOKS:

1. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
2. Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
3. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005

SM702MS: PROFESSIONAL PRACTICE, LAW AND ETHICS

B.Tech. IV Year I Semester

L	T	P	C
2	0	0	2

Course Objective:

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession.

Course Outcome: The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen

UNIT - I

Professional Practice and Ethics: Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

UNIT - II

Law of Contract: Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

UNIT - III

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT - IV

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

UNIT - V

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016.

REFERENCE BOOKS:

1. RERA Act, 2017.
2. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
3. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.
4. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers.

EI703PC: ANALYTICAL INSTRUMENTATION LAB

B.Tech. IV Year I Semester

L	T	P	C
0	0	2	1

Course Objectives

- To introduce the student to principles and theory of instrument analysis.
- To introduce the student to a whole array of modern analytical instruments.
- To emphasize a hands-on approach with sample preparation, application, method development, data analysis and interpretation being key elements.
- They can understand the applications and usage of Water quality, Air Quality, Spectrometry, chromatography in real time industrial environments.

Course Outcomes: After completion of the course the student is able to:

- Develop an understanding of the range and theories of instrumental methods available in analytical instrumentation
- Apply knowledge pertaining to the appropriate selection of instruments for the successful analysis of complex mixtures
- develop an understanding of the role of the Instrumentation Engineer in measurement and problem solving in chemical analysis
- Expand skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments

List of Experiments:

1. Ambient and emission air monitoring using gas analyzer.
2. Separation of different constituents in a mixture of chemical using chromatography
3. Identification of atoms and its concentration through absorption spectra with UV- VIS spectrophotometer.
4. Identification of chemical compound and its concentration using FTIR spectrometer.
5. Identification of atoms and its concentration through emission spectra using flame photometer.
6. Measurement of calorific value using digital bomb calorimeter
7. Determination of acid/alkaline nature of water using pH meter.
8. Food product quality determination using protein analyzers.
9. Qualitative analysis of milk –Milk Analyzer.
10. Determination of concentration of an unknown solution using colorimeter.
11. Radiation intensity measurement with varying distance and measurement of absorber thickness using nuclear radiation detector-G.M. counter.
12. Analysis of water quality using water purity meter
13. Measurement of TDS and conductivity of water using digital conductivity meter
14. Measurement of turbidity of water using digital turbidity meter.

EI811PE: TELEMETRY AND TELECONTROL (PE – V)

B.Tech. IV Year II Semester

L	T	P	C
3	0	0	3

Course Objectives:

- To study the concepts of classical telemetry systems
- To get an exposure to radio and satellite telemetry systems
- To learn the fundamentals of optical telemetering systems
- To understand the essential principles of telecontrol systems and installation.

Course Outcomes: After completion of the course the student is able to:

- Students will be able to apply techniques of telemetry and telecontrol.
- Applications of Telemetry and Telecontrol from a remote location.
- Use different communication technique to assist telemetry and telecontrol
- Able to design projects using Telecontrol and Telemetry concepts

UNIT – I

Telemetry Principles Introduction, Functional blocks of Telemetry system, Methods of Telemetry – Non-Electrical, Electrical, Pneumatic, Frequency, Power Line Carrier Communication. Symbols and Codes Bits and Symbols, Time function pulses, Line and Channel Coding, Modulation Codes. Inter symbol Interference.

UNIT – II

Frequency& Time Division Multiplexed Systems FDM, IRIG Standard, FM and PM Circuits, Receiving end, PLL TDM-PAM, PAM /PM and TDM – PCM Systems. PCM reception. Differential PCM Introduction, QAM, Protocols.

UNIT – III

Satellite Telemetry General considerations, TT&C Service, Digital Transmission systems, TT&C Subsystems, Telemetry and Communications. Modern Telemetry Zigbee, Ethernet

UNIT – IV

Optical Telemetry Optical Fibers Cable – Sources and detectors – Transmitter and Receiving Circuits, Coherent Optical Fiber Communication System.

UNIT – V

Telecontrol Methods Analog and Digital techniques in Telecontrol, Telecontrol apparatus – Remote adjustment, Guidance and regulation – Telecontrol using information theory –Example of a Telecontrol System.

TEXT BOOKS:

1. Telemetry Principles – D. Patranabis, TMH
2. Telecontrol Methods and Applications of Telemetry and Remote Control – by Swoboda G., Reinhold Publishing Corp., London, 1991

REFERENCE BOOKS:

1. Handbook of Telemetry and Remote Control – by Gruenberg L., McGraw Hill, New York, 1987.
2. Telemetry Engineering – by Young R.E., Little Books Ltd., London, 1988.
3. Data Communication and Teleprocessing System – by Housley T., PH Intl., Englewood Cliffs, New Jersey, 1987.

EC713PE/EI812PE: DIGITAL IMAGE PROCESSING (PE – V)

B.Tech. IV Year II Semester

L	T	P	C
3	0	0	3

Prerequisite: Digital Signal Processing

Course Objectives:

- To provide a approach towards image processing and introduction about 2D transforms
- To expertise about enhancement methods in time and frequency domain
- To expertise about segmentation and compression techniques
- To understand the Morphological operations on an image

Course Outcomes: Upon completing this course, the student will be able to

- Explore the fundamental relations between pixels and utility of 2-D transforms in image processer.
- Understand the enhancement, segmentation and restoration processes on an image.
- Implement the various Morphological operations on an image
- Understand the need of compression and evaluation of basic compression algorithms.

UNIT - I:

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT- II:

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT - III:

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT - IV:

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, thresholding, Region Oriented Segmentation.

Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

UNIT - V:

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXT BOOKS:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson, 2008
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- TMH, 2010.

REFERENCE BOOKS:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools - Scotte Umbaugh, 2nd Ed, CRC Press, 2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, 2nd Edition, TMH, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle- Cengage Learning (Indian edition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, 2nd Edition, BS Publication, 2008.

EI813PE: VLSI DESIGN (PE – V)

B.Tech. IV Year II Semester

L	T	P	C
3	0	0	3

Prerequisite: Electronic Circuit Analysis; Switching Theory and Logic Design

Course Objectives: The objectives of the course are to:

- Give exposure to different steps involved in the fabrication of ICs.
- Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of inverters designed with various loads.
- Give exposure to the design rules to be followed to draw the layout of any logic circuit.
- Provide design concepts to design building blocks of data path of any system using gates.
- Understand basic programmable logic devices and testing of CMOS circuits.

Course Outcomes: Upon completing this course, the student will be able to

- Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
- Draw the layout of any logic circuit which helps to understand and estimate parasitic effect of any logic circuit
- Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
- Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system

UNIT - I:

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS

Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage, g_m, g_{ds}, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT - II:

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT - III:

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

UNIT - IV:

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT -V:

Programmable Logic Devices: Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs.

CMOS Testing: CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

TEXT BOOKS:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. CMOS logic circuit Design - John. P. Uyemura, Springer, 2007.
3. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
4. VLSI Design- K. Lal Kishore, V. S. V. Prabhakar, I.K International, 2009.

EI821PE: POWER PLANT INSTRUMENTATION (PE – VI)

B.Tech. IV Year II Semester

L	T	P	C
3	0	0	3

Course Objective: Student will be able to

- **Understand** the working model of power plant
- **Understand** the necessity of a instrumentation engineer in a power plant
- **Understand** different components and their control in power plants.
- **Understand** various analyzers used in power plant

Course Outcome: After completion of the course the student is able to:

- **Appreciate** the power generation technique used in different types of power plants
- **Appreciate** different parameters and their control in the power plant
- **Understand** and standby the saying —one watt saved = two watts generatedll.
- **Understand** the concepts of Nuclear power plants.

UNIT - I

An Overview of Power Generation

Introduction-various sources of Electrical Energy - **Non-conventional Energy sources**-
Wind power, solar power, tidal power, geothermal power, magnetohydrodynamic (MHD) Power, Fuel Cells, Biomass Power, **Conventional energy sources-** hydropower, nuclear power, gas power, steam power (Thermal Power), comparison of various conventional power plants, Importance of instrumentation and control in power Generation **–** Classification of Instruments in a power plant, objectives of Instrumentation and control.
Piping and Instrumentation diagram (P and I Diagram) – Examples of ISA Instrumentation diagram symbols, examples of SAMA instrumentation diagram symbols, examples of ISA and SAMA diagram, piping and instrumentation diagramming, Cogeneration of Power-back pressure turbine, pass-out turbine process heat unit, control rooms, thermal or boiler control room, electrical control room, plan of control rooms.

UNIT - II

Instrumentation and Control in Water Circuit

Water circuit, boiler feed water circulation- natural circulation, forced circulation, combined circulation, **Measurements in Water Circuit-** Water Flow Measurement, Differential Pressure transmitter (DPT), steam flow measurement, water and steam pressure measurements, water and steam temperature measurements, drum water level measurement.
Controls in water circuit-boiler drum level control, superheated steam temperature control, steam pressure control, **impurities in water and steam-** impurities in Raw Water, Effects of Impurities, Measurement of Impurities, feed water treatment.

UNIT - III

Instrumentation and Control in Air-Fuel Circuit

Air-Fuel Circuit – Fuels, combustion air, flue gases, waste gases, **Measurements in Air Fuel Circuit –** Measurement of flow/quantity, Measurement of Pressures, Measurement of Temperatures, Measurement of level.
Controls in Air-Fuel Circuit – Combustion control, furnace Draft Control, **Analytical Measurement –** Oxygen Measurement in Flue Gas, Measurement of carbon dioxide in flue gas, combustibles analyser ($CO+H_2$), Infrared flue gas analyser, smoke detector, dust monitor, closed circuit television, fuel analysers, chromatography, pollution monitoring instruments.

UNIT - IV

Turbine Monitoring and Control

Introduction – Classification, instrumentation control points of View, Principal parts of steam turbines, **Turbine Steam Inlet System** – Inlet valve arrangements, inlet measurements, Governors, Turbine Measurements – Process Parameters, mechanical parameters, electrical parameters, Turbine control system **–** safety control systems, process control systems, **Lubrication for turbo-alternator –** Lubrication system, Controls in Lubrication system, **Turbo-Alternator Cooling System –** Lube Oil cooling system, Alternator/Generator cooling system.

UNIT - V

Nuclear Power Plant Instrumentation

Introduction – Instrumentation and Control for Nuclear Power Plant - Important Components of I&C System - Evolution of I&C in NPP – Reactor Control **–** Methods of Control, Control loops, Functionsof control system, Pressurized water reactor (PWR) controls, boiler water reactor (BWR) controls, Liquid metal cooled reactor (LMCR) Control, role of reactor controls during start-up, normal operation and shut down.

Digital Architectures in Nuclear Power Plants- System-level Instrumentation and control architecture, safety related systems, non-safety-related systems, man machine interface system (MMIS), Instrumentation and controls architecture platform.

Radiation protection and monitoring – accident at three-mile Island, USA, disaster at Chernobyl nuclear power plant, Ukraine, calamity at Fukushima, Daiichi nuclear power plant, Japan, Radiation Units, Biological Effects of Radiation, Radiation Monitoring, **Nuclear Reactor Safety** - Reactor protection system, Reactor Tripping, Engineered Safety Features, **Surveillance, Diagnostics and Prognostics** – Surveillance, Diagnosis, Prognosis.

TEXT BOOKS:

1. Modern Power Station Practice, Volume. 6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.
2. Power Plant Technology, Wakil M.M., McGraw Hill.

REFERENCE BOOKS:

1. Standard Boiler operations - Questions and Answers., Elonka S.M and Kohal A.L., Tata McGraw Hill, New Delhi, 1994.
2. Power Plant Instrumentation by Prof. K. Krishna Swamy, New Age International Publisher.
3. Standard Boiler Operations - Questions and Answers – by Elonka S. M., and Kohal A.L., TMH, New Delhi, 1994.

EI822PE: MACHINE LEARNING (PE – VI)

B.Tech. IV Year II Semester

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce the foundations of Artificial Neural Networks
- To acquire the knowledge on Deep Learning Concepts
- To learn various types of Artificial Neural Networks
- To gain knowledge to apply optimization strategies

Course Outcomes:

- Ability to understand the concepts of Neural Networks
- Ability to select the Learning Networks in modeling real world systems
- Ability to use an efficient algorithm for Deep Models
- Ability to apply optimization strategies for large scale applications

UNIT - I

Artificial Neural Networks Introduction, Basic models of ANN, important terminologies, Supervised Learning Networks, Perceptron Networks, Adaptive Linear Neuron, Back-propagation Network. Associative Memory Networks. Training Algorithms for pattern association, BAM and Hopfield Networks.

UNIT - II

Unsupervised Learning Network- Introduction, Fixed Weight Competitive Nets, Maxnet, Hamming Network, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Counter Propagation Networks, Adaptive Resonance Theory Networks. Special Networks-Introduction to various networks.

UNIT - III

Introduction to Deep Learning, Historical Trends in Deep learning, Deep Feed - forward networks, Gradient-Based learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms

UNIT - IV

Regularization for Deep Learning

Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

UNIT - V

Optimization for Train Deep Models

Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms

Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing

TEXT BOOKS:

1. Deep Learning: An MIT Press Book By Ian Goodfellow and Yoshua Bengio and Aaron Courville
2. Neural Networks and Learning Machines, Simon Haykin, 3rd Edition, Pearson Prentice Hall.

EI823PE: FUNDAMENTALS OF INTERNET OF THINGS (PE – VI)

B.Tech. IV Year II Semester

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to:

- understand the concepts of Internet of Things and able to build IoT applications
- Learn the programming and use of Arduino and Raspberry Pi boards.
- Known about data handling and analytics in SDN

Course Outcomes: Upon completing this course, the student will be able to

- Known basic protocols in sensor networks
- Program and configure Arduino boards for various designs
- Python programming and interfacing for Raspberry Pi
- Design IoT applications in different domains

UNIT - I:

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT - II:

Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

UNIT - III:

Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi

UNIT - IV:

Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics.

UNIT - V:

Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT.

Case Study: Agriculture, Healthcare, Activity Monitoring

TEXT BOOKS:

1. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. “Make sensors”: Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media, 2014.
   "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti

REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice".
3. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013