FACULTY OF ENGINEERING

Scheme of Instruction & Examination

and

Syllabi

B.E. V & VI Semesters

Of

Four Year Degree Programme

in

ELECTRONICS & INSTRUMENTATION ENGINEERING

(With effect from the Academic Year 2018 – 2019)
(As approved in the Faculty Meeting held on 26th June 2018)

Issued by
Dean, Faculty of Engineering
Osmania University, Hyderabad
July 2018

SCHEME OF INSTRUCTION & EXAMINATION
B.E. V - Semester
(ELECTRONICS AND INSTRUMENTATION ENGINEERING)

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Examination			Credits
			L	T	P/D		CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC503EE	Electrical Measurements and Instrumentation	3	1	-	4	30	70	3	3
2	PC504EE	Linear Control Systems	3	1	-	4	30	70	3	3
3	PC505EE	Digital Signal Processing and Applications	3	1	-	4	30	70	3	3
4	PC506EE	Power Plant Instrumentation	3	-	-	3	30	70	3	3
5	PC507EE	Instrumentation Systems	3	-	-	3	30	70	3	3
6	PE-I	Professional Elective-I	3	-	-	3	30	70	3	3
7	MC901EG	Gender Sensitization	3	-	-	3	30	70	3	0
Practical /Laboratory Courses										
8	PC552EE	Power Electronics Lab	-	-	2	2	25	50	3	1
9	PC554EE	Transducer Lab	-	-	2	2	25	50	3	1
10	PC555EE	Circuits and Measurement Lab	-	-	2	2	25	50	3	1
Total			**21**	**03**	**06**	**30**	**285**	**640**	-	**21**

Professional Elective-I

S. No.	Course Code	Course Title
1	PE504EE	Building Automation Systems
2	PE505EE	Principle of Communication Engineering
3	PE506EE	Advanced Sensors

PC: Professional Course **PE**: Professional Elective **MC**: Mandatory Course
L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note:
1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Course Code	Course Title						Core / Elective
PC503EE	ELECTRICAL MEASUREMENTS AND INSTRUMENTATION (Common to EEE and EIE)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	0	0	30	70	3

Course Objectives

- To learn and understand the fundamental concepts, principle of operation and applications of various electrical measuring instruments.
- To understand various types of Bridges in measurement of resistance, inductance, capacitance and frequency.
- To understand the operation and applications of Ballistic Galvanometer, Flux meter and DC/AC Potentiometer.
- To understand the application of CRO for measurement of amplitude , phase and frequency of sinusoidal signals.

Course Outcomes

At the end of the course students will be able to

- Choose the suitable instrument like Ammeter, Voltmeter for AC/DC applications.
- Select suitable Bridge for measurement of electrical parameters and quantities.
- Use CRO for measurement of Amplitude, Phase and frequency of sinusoidal signals.

UNIT I

Instruments: indicating, recording and integrating instruments, Ammeter, Voltmeter, Expression for torque of moving coil, moving iron, Dynamometer, induction and electrostatic instruments. Extension of range of instruments, Wattmeter Torque expression for dynamometer instruments, Reactive power measurement.

UNIT II

Meters: Energy meters, single phase and 3-phase, Driving torque and braking torque equations, Errors and testing compensation, Maximum demand indicator, Power factor meters, Frequency meters, Electrical resonance and Weston type of synchroscope.

UNIT III

Bridge Methods and transducers: Measurement of inductance, capacitance and resistance using Bridges, Maxwell's, Hay's. bridge, Anderson, Wein, Desauty's, Schering's bridges, Kelvin's double bridge, Megger, Loss of charge method, Wagners earthing device, Transducers - Analog and digital transducers, Strain gauges and Hall effect transducers.

UNIT IV

Magnetic Measurements and instrument transformers: Ballistic galvanometer, Calibration by Hibbert' s magnetic standard flux meter, Lloyd-Fischer square for measuring iron loss, Determination of B-H curve and Hysteresis loop using CRO, Instrument transformers – Current and potential transformers, ratio and phase angle errors of CT's and PT's.

UNIT V

Potentiometers: Crompton's DC and AC polar and coordinate types, Applications, Measurements of impedance, Calibration and ammeter voltmeter and wattmeters. Use of oscilloscope in frequency, phase and amplitude measurements

Suggested Reading:

1. Shawney A.K., Electrical and Electronics Measurements and Instruments,
2. Dhanpatrai & Sons, Delhi, 2000.Umesh Sinha, Electrical, Electronics Measurement & Instrumentations, Satya Prakashan, New Delhi.
3. Golding E.W., Electrical Measurements & Measuring Instruments, Sir Issac & Pitman & Sons Ltd., London.
4. U.A.Bakshi, A.V.Bakshi, Electrical and Electronic Instrumentation, Technical publications

Course Code	Course Title						Core / Elective
PC504EE	LINEAR CONTROL SYSTEMS (Common to EEE and EIE)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
Electric Circuits - II	3	1	0	0	30	70	3

Course Objectives

- To develop basic skills of utilizing mathematical tools needed to analyze and design classical linear control systems.
- To understand and develop the state space representation of control systems.

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Course Outcomes

At the end of the course students will be able to

- Understand the concept of the terms control systems, feedback, Mathematical modeling of Electrical and Mechanical systems.
- Explain the time domain and frequency response analysis of control systems.
- Acquire the knowledge of various analytical techniques used to determine the stability of control systems.
- Able to understand the importance of design of compensators
- Able to demonstrate controllability and observability of modern control systems.

UNIT-I

Introduction to Control Systems: Classification of control systems. Components of control systems, Feed-Back Characteristics, Effects of feedback - Mathematical modeling of Electrical and Mechanical systems, Transfer function, Transfer function of Potentiometer, synchro, AC servo motor, DC servo motor, Block diagram reduction technique, Signal flow graph, Mason's gain formula

UNIT-II

Time Domain Analysis: Standard test signals, Time response of first order systems, Transient response of second order system for unit step input, Time domain specifications, Steady state response, Steady state errors and error constants, Effects of P, PD, Pl and PID controllers.

UNIT-III

Stability Analysis in S-Domain: The concept of stability, Routh's stability Criterion, Absolute stability and relative stability, limitations of Routh's stability.

Root Locus Technique: The root locus concept, construction of root loci, Effects of adding poles and zeros on the root loci.

UNIT-IV

Frequency Response Analysis: Introduction to frequency response, Frequency domain specifications, Bode plot, Stability analysis from Bode plots, Determination of transfer function from the Bode Diagram, Polar Plots, Nyquist Plots, Stability Analysis, Gain margin and phase margin

Control System Design: Introduction - Lag, Lead and Lag-Lead Compensator design in frequency Domain.

UNIT-V

State Space Analysis: Concepts of state, State variables and state model, Derivation of state models of linear time invariant systems - Controllable, Observable and Diagonal state models, State transition matrix, Solution of state equation, Concepts of Controllability and Observability.

Suggested Reading:

1. Nagrath I.J. & Gopal.M - Control System Engineering, Wiley Eastern, 2003.
2. B.C.Kuo - Automatic Control Systems, Wiley India edition, 7th Edition, 2002.
3. K.Ogata - Modern Control System, Prentice Hall of India, 4th edition, 2002.
4. N.C.Jagan - Control Systems, B.S Publications, 2nd edition,2008

Course Code	Course Title						Core / Elective
PC505EE	DIGITAL SIGNAL PROCESSING AND APPLICATIONS (Common to EEE and EIE)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3	1	0	0	30	70	3

Course Objectives

- To be able to understand and apply classification: characterization, representation and analysis of signals and systems in time and frequency domain.
- To understand the principle and design of digital filters and to introduce digital signal processor and their architecture.

Course Outcomes

At the end of the course students will be able to

- Acquire the knowledge of - Classification of discrete time signals & discrete time systems, Properties of Z-transforms, Discrete time Fourier transform.
- Analyze the Characteristics of IIR digital filters, FIR digital filters.
- Explain the Advantages of Digital signal processors over conventional Microprocessors.

UNIT- I

Introduction to Digital Signal Processing: Sampling, Quantizing and coding, Classification of discrete time signals & discrete time systems, linear shift invariant systems, Stability and causality, Solution to Linear constant coefficient difference equations.

Z-transforms: Properties Inverse z – transform, System function, Relation between s-plane and z-plane - Stability in Z-domain, Solution of difference equations using one sided z-transform.

UNIT - II

Frequency domain analysis : Discrete time Fourier transform (DTFT), Properties, Frequency domain representation of discrete time signals and systems - DFS, Properties- Frequency domain sampling OFT, Properties - circular convolution - Linear convolution using OFT - Fast Fourier transforms (FFT), Radix-2 decimation in time(DIT) and decimation in frequency(DIF) FFT Algorithms, IDFT using FFT.

UNIT-III

IIR digital filters: Analog filter approximations, Butterworth and Chebyshev filters, Design of IIR Digital filters from analog filters using Bilinear transformation, Impulse invariant and step invariant methods. Realization of IIR filters - Direct form - I, Direct form - II, Cascade and parallel form realizations

UNIT- IV

FIR digital filters: Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital filters using window techniques, Linear phase realization, Applications of digital signal processing to speech processing.

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion, Implementation of sampling rate conversion.

UNIT-V

Introduction to Digital Signal Processors: Introduction to programmable DSPs -Advantages of Digital signal processors over conventional Microprocessors - Architecture of TMS 320C5X

introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, Program controller, Status registers, On- chip memory and On-chip peripherals

Suggested Reading:

1. Proakis & Manolakis - Digital Signal Processing, Principles, Algorithms and Applications, Prentice Hall of India - 3rd Edition-1994.
2. Opeinheim & Schaffter - Digital Signal Processing, PHI Publications, 2002.
3. Salivahanan Valluaraj & Gnanapriya - Digital Signal Processing• Tata McGraw Hill, 2001.
4. Anand Kumar.A - Digital Signal Processing - PHI learning Private Ltd. 2013.
5. B.Venkataramani and M. Bhaskar - Digital Signal Processors, Architecture programs and applications, Tata McGraw Hill, 2007.

Course Code	Course Title						Core / Elective
PC506EE	POWER PLANT INSTRUMENTATION						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3		0	0	30	70	3

Course Objectives

- To acquire good knowledge of power generation using various methods.
- To acquire good knowledge of Instrumentation involved in Power generation.
- To know the basics of Turbine supervisory instrumentation and control.

Course Outcomes

At the end of the course students will be able to

- Describe power generation using various methods and explain the working of thermal power plant in detail. Decode P & I diagrams for process control systems.
- Explain the techniques for measurement and control of four basic parameters like level, temperature, pressure and flow for power station as well as general process control systems.
- Describe the Instrumentation and control associated with boilers in TPP, and apply the knowledge gained for identifying and eliminating the redundancy in formulating the boiler control loops.
- Explain the prime mover supervision and control mechanism and describe the turbine supervisory instrumentation used in TPP.
- Explain the power generation using NPP, Hydro electric, wind power and combined cycle power plant with its associated Instrumentation.

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UNIT-I

Overview of Power Generation: Method of power generation in thermal power plants, building blocks, Boiler types, feed water systems, steam circuits, combustion process, products of combustion process, fuel systems, treatment of flue gases, condensate systems, feed water conditioning, P&I diagram of boiler, importance of instrumentation in power generation.

UNIT-II

Measurement in boiler system: Metal temperature measurement in boilers, piping system for pressure measuring devices, smoke and dust monitor, flame monitoring. Introduction to turbine supervising system, pedestal vibration, shaft vibration measurement. Non-contact type of transducers for speed measurement and LVDT for the measurement of shell expansion

UNIT-III

Control Loops in Boiler: Combustion control, air fuel ratio control, furnace draft control, boiler drum level control, three element drum level control, main and reheat steam temperature control, super-heater control, at temperator, de-aerator control, boiler following mode operation, turbine following mode operation.

UNIT-IV

Turbine, Monitoring and Control: Lubricant oil temperature control, Hydrogen generator cooling system. Condenser vacuum control and gland steam exhaust pressure control.

UNIT-V

Power generation using other methods: Layout of hydro electric power plant, power generation in nuclear power plant, importance of control rods in nuclear power generation, power generation using solar and wind energy, and combined cycle power plant.

Suggested Reading:

1. Power plant Engineering by S.C. Aurora and Domkundwar , Dhanpat rai.
2. Power plant Engineering by Sravana kumar, and Vijaya Ramanath, I.K.International.
3. Boiler control systems by David Lindsley, Mcgraw Hill.

Course Code	Course Title						Core / Elective
PC507EE	**INSTRUMENTATION SYSTEMS**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	
	L	**T**	**D**	**P**			**Credits**
-	**3**	**-**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To expose the students to various sensors and transducers for measuring mechanical quantities.
- To understand the specifications of sensors and transducers.
- To learn the basic conditioning circuits for various sensors and transducers.
- To introduce advances in sensor technology.

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Course Outcomes

At the end of the course students will be

- Familiar with the basics of measurement system and its input, output configuration of measurement system.
- Familiar with both static and dynamic characteristics of measurement system.
- Familiar with the principle and working of various sensors and transducers.
- Able to design signal conditioning circuit for various transducers.
- Able to identify or choose a transducer for a specific measurement application.

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UNIT -I

Measurement of Motion: Angular velocity (speed) measurement: Electrical methods like DC and AC Tacho generators, eddy current (drag cup) Tachometers and Stroboscopic method.
Acceleration measurements: Seismic displacement, velocity, acceleration pick-ups, electromagnetic and electro dynamic type of velocity transducers, piezoelectric transducers, deflection type of accelerometer, bonded strain gauge accelerometer, and piezoelectric accelerometers.

UNIT-II

Measurement of force, Torque and Temperature: Basic methods of force measurement: characteristics of elastic force transducers, load cells. **Various types of Torque measurement**: absorption, transmission, stress, deflection type. **Measurement of Temperature:** Laws of thermocouples, Thermocouple circuits, reference junction considerations ice bath reference junction special materials, configurations and techniques (cooled thermocouples, pulsed thermocouples, and multifunction thermocouples) and radiation thermometers.

UNIT - III

Measurement of flow: Classification of flow meters, head flow meters like orifice plate, venturi tube, flow nozzle and pitot tube. Rotameter, electromagnetic flow meter, positive displacement meter, hot wire and hot film anemometer, mass flow measurements, rotor torque mass flow meter.

UNIT-IV

Measurement of liquid level: Electrical methods: Resistive, inductive and capacitive methods, capacitive variable area method, capacitive voltage divider method, capacitive variable dielectric constant method. Measurement of liquid level using gamma rays, ultrasonic method and float
Measurement of humidity: Absolute Humidity, relative humidity, hygrometers (resistive and capacitive hygrometer), Microwave refractometer , Aluminum oxide hygrometers.
Measurement of P^H Electrodes: Station Glass and Calomel Electrodes, installation of P^H meters.

UNIT V
Measurement of sound: Sound level meter microphones with their types like carbon and capacitive microphone, dynamic microphone, inductive microphone, piezo electric microphone. Pressure response of capacitive microphone

Suggested Reading:

1. C.S.Rangan, G R Sarma & V S N Mani, Instrumentation Devices and Systems-TMH, 2nd Edition 2004
2. B.Nakra & Chowdhari, Instrumentation Measurement and Analysis, TMH, 2nd Edition 2003
3. D.V.S.Murthy, Transducers and Instrumentation. PHI, 1995 4. John P. Bentley, Principles of Measurement Systems, 3rd Edition, Pearson Education, 2000.
4. Doebelin E.O, Measurement Systems - Application and Design, 4th Edition, McGraw-Hill, New
5. Patranabis D, Principles of Industrial Instrumentation, 2nd Edition, Tata McGraw Hill, New Delhi, 1997.

Course Code	Course Title						Core / Elective
PE 504EE	BUILDING AUTOMATION SYSTEM (Professional Elective-I)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3	-	0	0	30	70	3

Course Objectives

- To understand the basic blocks of Building Management System.
- To design various sub systems (or modular system) of building automation
- To integrate all the sub systems

Course Outcomes

At the end of the course students will be able to

- Understand basic blocks and systems for building automation
- Design different systems for building automation and integrate those systems

UNIT-I

Introduction: Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.

UNIT-II

HVAC systems: Different components of HVAC system like heating, cooling system, chillers, AHUs, compressors and filter units and their types. Design issues in consideration with respect to efficiency and economics, concept of district cooling and heating.

UNIT-III

Access control & security system: Concept of automation in access control system for safety, physical security system with components, RFID enabled access control with components, computer system access control: DAC, MAC, and RBAC.

UNIT-IV

Fire & Alarm (FA) system: Different fire sensors, smoke detectors and their types, CO and CO_2 sensors, fire control panels, design considerations for the FA system, concept of IP enabled fire & alarm system, design aspects and components of FA system.

EPBX System & BMS subsystem integration: Design consideration of EPBX system and its components, integration of all the above systems to design BMS.

UNIT-V

CCTV & Energy Management System: Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system, concept of energy management system, occupancy sensors, fans & lighting controller.

Suggested Reading:

1. Jim Sinopoli,"Smart Buildings", Butterworth-Heinemann imprint of Elsevier,2nd ed., 2010.
2. E. Albert Ting Pat So, WaiLok Chan, Intelligent Building Systems, Kluwer Academic Published, 3rd 2012.
3. Reinhold A. Carlson, Robert A. Di Giandomenico, "Understanding Building Automation Systems", Published by R.S. Means Company, 1991.
4. Morawski, E, Fire Alarm Guide for Property Managers, Publisher: Kessinger Publishing,2007.

Course Code	Course Title						Core / Elective
PE 505EE	PRINCIPLE OF COMMUNICATION ENGINEERING (Professional Elective-I)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3	-	0	0	30	70	3

Course Objectives

- To introduce the principles of analog communication systems involving different modulation and demodulation schemes
- To introduce the principles of digital communication systems involving different modulation and demodulation schemes

Course Outcomes

At the end of the course students will be able to

- Develop an understanding of need for modulation and generation & detection of Analog modulation techniques
- Explore AM and FM Super heterodyne receiver working principle
- Discuss the techniques for generation and detection of pulse Analog modulation techniques
- To understand the basic operation involved in PCM like sampling, quantization & encoding and are able to calculate and derive entropy and channel capacity
- To compare different communication system with various modulation techniques in the presence of noise by analytically

UNIT-I

INTRODUCTION TO COMMUNICATIONS SYSTEMS: Information, Communication process, primary communication resources, communication networks & channels, modulation process, Analog and Digital types of communication, Digital communication problem, transmitter, Channel Noise, receiver modulation, description, need for modulation, bandwidth requirement, sine wave and Fourier series review, frequency spectra of non-sinusoidal waves.

UNIT-II

NOISE : Atmospheric noise, extra terrestrial noise, industrial noise, thermal agitation noise, short noise, transit time noise, miscellaneous noise.

NOISE CALCULATIONS: Addition of noise due to several sources, addition of noise due to several amplifiers in cascade, noise in reactive circuits, noise figure signal-to-noise ratio. Definition of noise figure, calculation of noise figure (using equivalent noise resistance, measurement, and noise temperature).

UNIT-III

AMPLITUDE MODULATION : Frequency spectrum of the AM wave, representation of AM, power relations in ·the AM wave, generation of AM , basic requirements, comparison of levels grid, modulated class C amplifier, plate modulated class C amplifier, modulated transistor amplifiers.

UNIT-IV

FREQUENCY MODULATION: Description of systems, mathematical representation of FM, frequency spectrum of the FM wave, phase modulation, intersystem comparisons, effects of noise on carrier-noise triangle, pre emphasis and de emphasis, other forms of interference, comparison of wideband and narrowband FM**,** stereophonic FM multiplex system.

UNIT-V

PULSE MODULATION: Introduction to sampling process, PAM, other forms of PM. Bandwidth, noise trade off, quantization process, PCM, TDM, digital multiplexer, delta modulation, linear prediction, differential PCM, adaptive differential PCM.

Suggested Reading:

1. Haykins. S, "Communication System**",** 4th Edition, John Wiley Inc. 2000.
2. Kennedy, G. "Electronic Communication System**"** McGraw – Hill 4th Edition, 2003.
3. Singh R.P and Spare S.D. "Analog and Digital Communication Systems**".** McGraw – Hill Publishing Company Ltd. 3rd Edition, 2003.
4. Manoj Duhan, "Communication System**",** IK International Publishing House, 2012.

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Course Code	Course Title						Core / Elective
PE 506EE	ADVANCED SENSORS (Professional Elective-I)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3	-	0	0	30	70	3

Course Objectives

- To introduce the principles of Advanced sensors
- To introduce the construction and applications of Advanced sensors

Course Outcomes

At the end of the course students will be able to

- Develop an understanding of need multi sensor and recent trends in technology
- Explore Smart sensors working principle
- Discuss the techniques for MEMS, NANO and Chemical sensors techniques
- To understand the basic operation involved in Robotics, fiber optics and Boi sensors

UNIT – I

Sensor Fundamentals: Basic sensor technology and sensor system.
Application Consideration: Sensor characteristics, system characteristics, instrument selection, data acquisition and readout, and installation.

UNIT –II

Biosensors: Overview, applications and of origin of biosensor, bio receptor molecules, transduction mechanisms in biosensors, application range of biosensors, and future prospects.
MEMS and NANO sensors: Micro electromechanical systems (MEMS), Micromachining, Biomedical Applications, NANO sensors and carbon NANO tubes.

UNIT – III

Smart Sensors: Technology fundamentals and applications.
Electromagnetism in sensing: Introduction to electromagnetism and inductance in sensor application, magnetic field sensors and applications.

UNIT – IV

Chemical Sensors: Introduction to semiconductor gas detectors, ion selective electrodes, Conduct metric sensors, and mass sensors.
Fiber optic sensors: Fiber optic sensors for the measurement of temperature, pressure, displacement, turbidity and pollution
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UNIT – V

Robotics sensors: Introduction, characteristics and types of sensors, touch or tactile sensors, binary and analog sensors, proximity sensors, types of proximity sensors, contact and non-contact proximity sensors, robotic vision.

Suggesting Reading:

1. Sensor Technology Handbook by Jon Wilson Newness Publication Elsevier
2. Pallas-Areny R and Webster JG, "Sensors and Signal Conditioning," Wiley India
3. Gardener, "Micro sensors, MEMS and Smart Devices," Wiley India
4. Khazan AD, "Transducers and their Elements – Design and Applications," Prentice Hall
5. Patranabis D, "Sensors and Transducers," Prentice Hall
6. Middlehook S and Audet SA, "Silicon Sensors," Academic Press
7. Dorf RC, "Sensors, Nanoscience, Biomedical engineering and instruments," CRC Press
8. Zanger H and Zanger C, "Fiber optics Communication and other applications," Macmillan publishing
9. Joshi RM, "Biosensors," ISHA Books
10. Webster JG, "Medical Instrumentation, Application and Design," Wiley India

Course Code	Course Title						Core/Elective
MC901EG	**GENDER SENSITIZATION**						**Core**
Prerequisite	**Contact Hours per week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**--**	**--**	**--**	**30**	**70**	**0**

Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT I:

Understanding Gender

Gender: Why Should We Study It? Socialization: Making Women, Making Men Introduction Preparing for Womanhood Growing up Male First lessons in Caste Different Masculinities

Just Relationships: Being Together as Equals

Mary Kom and Onler Love and Acid just do not Mix. Love Letters. Mothers and Fathers Rosa Parks-The Brave Heart.

UNIT – II

Gender and Biology

MissingWomen:

Sex Selection and Its Consequences Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary Two or Many? Struggles with Discrimination Our Bodies Our Health

UNIT – III

Gender and Labour

Housework: The Invisible Labour "My Mother doesn't Work." "Share the Load."

Women's Work: Its Politics and Economics Fact and Fiction. Unrecognized and Unaccounted work Wages and Conditions of Work

UNIT – IV

Issues of Violence

Sexual Harassment: Say No! Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment "Chupulu"

Domestic Violence: Speaking Out

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives New Forums for Justice.

Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life", the Caste Face of Violence

UNIT – V

Gender Studies

Knowledge through Lens of Gender

Point Of View – Gender and the structure of knowledge – Unacknowledged women artists of Telangana; Whose History Questions For Historians and Others: Reclaiming a past – Writing other histories – Missing Pages from modern Telangana History

Suggested Reading

1. A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu " Towards a World of Equals" A Bilingual Textbook on Gender by Telugu Akademi, Hyderabad,Telangana., 1ST Edition,2015.

Course Code	Course Title						Core/Elective
PC552EE	**POWER ELECTRONICS LAB (Common to EEE and EIE)**						**Core**
Prerequisite	L	T	D	P	CIE	SEE	Credits
Power Electronics	0	0	0	2	25	50	1

Course Objectives:

- To be able to understand various power switching devices, trigger circuits, characteristics and applications by conducting the experiments.
- To learn and understand the rectifiers, choppers and inverters principle operation, characteristics and applications.

Course Outcomes:

On successful completion of this course student will be able to

- Able to understand speed control of motors by using controlled rectifier
- Able to understand the applications of cycloconverters
- Able to simulate different power electronic devices using softwares.

LIST OF EXPERIMENTS:

1. R, RC, UJT Trigger Circuits for SCR's.
2. Design and fabrication of trigger circuits for single phase half - controlled and fully controlled bridge rectifiers.
3. Study of SCR chopper.
4. Design and fabrication of trigger circuit for MOSFET chopper.
5. Study of forced commutation techniques of SCRs.
6. Speed control of separately excited DC motor by controlled rectifier.
7. Speed control of universal motors using choppers.
8. Study of single phase half and fully controlled rectifier.
9. Study of single phase and three phase AC voltage controller.
10. Study of single phase dual converter.
11. Study of single phase cyclo-converter.
12. IGBT based PWM inverters.
13. Simulation of single-phase half and fully controlled rectifier.
14. Simulation of single phase and three phase AC voltage controller.
15. Simulation of single phase inverter & three phase inverter.

Suggested Reading:

1. Bimbra.P.S. - Power Electronics, Khanna Publications, 2006.
2. Rashid M.H. - Power Electronics Circuits, Devices and Applications - Prentice Hall of India, 2004.
3. Singh. M.D., Khanchandani K.B. - Power Electronics - Tata McGraw Hill, 14th reprint, 1999.
4. Mohan, Undeland & Robbins - Power Electronic Converters. Applications and Design - John Wiley & Sons - 3rd Edition, 2007.

Note: At least ten experiments should be conducted in the Semester.

Course Code	Course Title						Core/Elective
PC554EE	**TRANSDUCERS LAB**						**Core**
Prerequisite	L	T	D	P	CIE	SEE	Credits
PC406EE	0	0	0	2	25	50	1

Course Objectives

- To experimentally verify the principle and characteristics of various transducers.
- To learn and understand the measurement of non electrical quantities with the use of suitable transducers.

Course Outcomes

On successful completion of this course student will be able to

- Measure temperature by RTD, thermistor and Thermocouple.
- Measure linear and angular displacement using LVDT, capacitive and inductive transducers.
- Measure speed and toque by using suitable transducers.
- Demonstrate the performance characteristics of various transducers.

LIST OF EXPERIMENTS:

1. Measurement of speed by magnetic pickup
2. Measurement of temperature by (a) Thermistor's (b) Thermocouple
3. Study and calibration of strain gauge
4. Measurement of speed and torque using Opto Electronic Sensor
5. Measurement of pressure by bellows
6. Measurement of Displacement by Capacitive pickup
7. Measurement of Displacement by Light dependent resistor.
8. Level Measuring System
9. Study and Calibration of LVDT
10. Study and Calibration of RTD
11. Measurement of displacement by inductive pickup

Suggested Reading:

1. C.S.Rangan, G R Sarma & V S N Mani, Instrumentation Devices and Systems-TMH, 2nd Edition 2004
2. B.Nakra & Chowdhari, Instrumentation Measurement and Analysis, TMH, 2nd Edition 2003
3. D.V.S.Murthy, Transducers and Instrumentation. PHI, 1995 4. John P. Bentley, Principles of Measurement Systems, 3rd Edition, Pearson Education, 2000.
4. Doebelin E.O, Measurement Systems - Application and Design, 4th Edition, McGraw-Hill, New

Note: Atleast 10 experiments should be conducted in the semester

Course Code	Course Title						Core/Elective
PC555EE	CIRCUITS AND MEASUREMENT LAB (Common to EIE and EEE)						Core
Prerequisite	L	T	D	P	CIE	SEE	Credits
EC – I	0	0	0	2	25	50	1

Course Objectives:

- To train the students for acquiring practical knowledge for measuring resistance, inductance and capacitance using various bridges.
- To train the student for the usage of A.C. and D.C. potentiometers.
- To make the student understand the operation of CRO and its usefulness in finding the amplitude, phase and frequency of waveforms.

Course Outcomes:

On successful completion of this course student will be able to

- Measure the inductance, capacitance and resistance using various bridges.
- Measure resistance and calibrate ammeter, voltmeters and wattcmeters using A.C. and D.C. potentiometers.
- Have hands on experience on the operation of CRO

LIST OF EXPERIMENTS:

PART – A: CIRCUITS

1. Verification of KCL&KVL using Mesh and nodal analysis
2. Verification of (a) Thevenin's Theorem (b) Norton Theorem (c) Super Position Theorem (d) Max power transfer theorem
3. Frequency and time response of of 2nd order RLC circuits
4. Open circuit, short and ABCD parameters of two port parameters
5. Simulation of 2nd order RLC using Pspice
6. Transient Response of RLC circuits

PART – B: MEASUREMENTS

7. Measurement of low resistance by Kelvin's double bridge
8. Measurement of active, reactive power measurements using two wattmeter method
9. Calibration of Single phase energy meter by Phantom loading and measurement of power direct loading
10. Measurement of power by 3-voltmeter and 3-Ammeter methods
11. Measurement of a) Inductance by Maxwell's and Andersons bridge b) Measurement of capacitance by DeSauty's bridge
12. Use of DC Potentiometer for measurement of unknown voltage and impedance

Suggested Reading:

1. Shawney A.K., Electrical and Electronics Measurements and Instruments, Dhanpatrai & Sons, Delhi, 2000.
2. Umesh Sinha, Electrical, Electronics Measurement & Instrumentations, Satya Prakashan, New Delhi.
3. Golding E.W., Electrical Measurements & Measuring Instruments, Sir Issac & Pitman & Sons Ltd., London.

Note: Atleast ten experiments should be conducted in the Semester.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VI – Semester
(ELECTRONICS AND INSTRUMENTATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
	Theory Courses									
1	PC602EE	Microcontroller & Microprocessor	3	1	-	4	30	70	3	3
2.	PC605EE	Biomedical Instrumentation	3	-	-	3	30	70	3	3
3.	PC606EE	Process Control	3	-	-	3	30	70	3	3
4.	PC607EE	Electronics Instrumentation Systems	3	-	-	3	30	70	3	3
5	PE-II	Professional Elective-I	3	-	-	3	30	70	3	3
6.	OE-I	Open Elective-I	3	-	-	3	30	70	3	3
Practical /Laboratory Courses										
7	PC651EE	Electrical Machine Lab	-	-	2	2	25	50	3	1
8	PC652EE	Digital Signal Processing Lab	-	-	2	2	25	50	3	1
9	PC653EE	Control System Lab	-	-	2	2	25	50	3	1
10	MC	Mandatory Course	-	-	3	3	50	-	-	0
11	SI 671EE	Summer Internship**	-	-	-	-	-	-	-	-
Total			**18**	**01**	**09**	**28**	**305**	**570**		**21**

PC: Professional Course **PE**: Professional Elective **MC**: Mandatory Course
SI: Summer Internship
L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note 1:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Note 2:

* The students have to undergo a Summer Internship of four weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

****** Subject not offered to the students of Electronics and Instrumentation Engineering Department.

Open Elective-I:

S.No	Course Code	Course Title
1	OE601CE	Disaster Management
2	OE602CE	Geo Spatial Techniques
3	OE601CS	Operating Systems
4	OE602CS	OOP using Java
5	OE601IT	Database Systems
6	OE601EC	Principles of Embedded Systems
7	OE602EC	Digital System Design using HDL Verilog
8	OE601EE	Reliability Engineering**
9	OE602EE	Basics of Power Electronics**
10	OE601ME	Industrial Robotics
11	OE602ME	Material Handling
12	OE632AE	Automotive Safety & Ergonomics

Professional Elective – II

S.No.	Course Code	Course Title
1	PE604EE	Instrumentation in Aerospace and Navigation
2	PE605EE	Piping and Instrumentation Diagrams
3	PE606EE	Instrumentation and Control in Petrochemical industry

Mandatory Course

S.No.	Course Code	Course Title
1	MC951SP	Yoga Practice
2	MC952SP	National Service Scheme
3	MC953SP	Sports

Course Code	Course Title						Core / Elective
PC602EE	MICROPROCESSOR AND MICROCONTROLLERS (Common to EEE and EIE)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	0	0	30	70	3

Course Objectives

- To be able to understand in detail about 8086 microprocessor architecture, programming and interfacing.
- To be able to understand about 8051 microcontroller architecture, and programming.

Course Outcomes

At the end of the course students will be able to

- Acquire the knowledge of Architecture of 8086, writing assembly language programming for different applications.
- Explain types of microcontrollers and their applications.

UNIT- I

Microprocessor: Architecture of 8086 - Segmented memory, Addressing modes, Instruction set, Minimum and maximum mode operations.

UNIT-II

Introduction to Programming: Assembly language programming, Assembler directives, Simple programs using assembler, Strings, Procedures, Macros timing.

UNIT-III

Interfacing to Microprocessor: Memory and I/O interfacing, A/D and D/A interfacing, 8255(PPI), Programmable Internal Timer (8253), Keyboard and display interlace, Interrupts of 8086.

UNIT- IV

Micro Controller Architecture: Types of Micro Controllers, 8051 MC - Architecture input / output pins, Ports and circuits, Internal and external memories, Counters and timers, Serial data input / output, Interrupts & timers.

UNIT-V

Introduction to Programming: Basic Assembly Language Programming, instruction cycle, Addressing modes, 8051 instruction set, Classification of instructions. Simple programs.

Suggested Reading:

1. Douglas. V. Hall microprocessors and Interfacing -Tata McGraw Hill -Revised 2nd Edition, 2006.
2. Krishna Kant - microprocessors and Microcontrollers - Architecture, Programming and System Design 8085, 8086, 8051, 8096, Prentice-Hall India - 2007.
3. Kenneth. J. Ayala–The 8051 Microcontroller Architecture Programming and Applications", Thomson publishers, 2nd Edition, 2007.
4. Waiter A. Triebel & Avtar Singh - The 8088 and 8086 Microprocessor -Pearson Publishers, 4th Edition, 2007.

Course Code	Course Title						Core/Elective
PC605EE	BIOMEDICAL INSTRUMENTATION						Core
Prerequisite	L	T	D	P	CIE	SEE	Credits
PC406EE PC405EE	3	0	0	0	30	70	3

Course Objectives

- To provide students with an understanding of various medical instruments and latest techniques used in the hospital for diagnostic purpose.
- To learn and understand electrical hazards of medical instruments and patient's safety.

Course Outcomes

On successful completion of this course student will be able to

- Describe different general devices used in biomedical applications.
- Explain instruments for recording Bio-potentials.
- Explain different techniques and related instruments for measuring blood pressure, blood flow and heart sounds.
- Describe radiography and explain recent biomedical instruments.
- Describe electrical hazards, safety in hospital design.

UNIT-I

Introduction to Bio medical Instrumentation: General characteristics of medical instrumentation like linearity, range, frequency response, signal to noise ratio and stability. Amplifiers for Bio medical Applications: Differential, Carrier amplifiers. Recorders and display devices for Bio medical applications. General features of ink jet, thermo sensitive and optical recorders. General features of display devices for bio signals. Data acquisition and display using micro computers

UNIT-II

Electro Cardiograph(ECG) recording system: Block Schematic diagram of ECG machine, Amplifiers and circuits for ECG, ECG Leads, Noise problems and their elimination.

Electro Encephalography (EEG): Block schematic diagram of EEG recording system, General features of different blocks, Specification of EEG amplifiers, Qualitative requirements. 10 -20 electrode placement system, resting rhythms and sleep stages.

Electro Myography (EMG): Block schematic diagram of EMG recording system. EMG amplifiers. Design considerations of EMG amplifiers. Data display for EMG.

UNIT-III

Blood pressure and Blood Flows: Electronic Techniques for indirect and direct measurement of blood pressure. Measurement of blood flow by Electromagnetic, Doppler and Plethysmo graphic methods

Phonocardiography: Origin of heart sounds, Phonocardiography instrumentation consisting of microphone, filters and signal conditioners.

UNIT-IV

Introduction to Radiography: Physical properties of X-Rays, principles of generation of X-Rays. Radiation energy distribution, collimators and grids, fluoroscopy, and image intensifiers.

Recent Trends: Medical imaging, X-rays, laser applications, ultrasound scanner, echo cardiography, CT scan MRI/NMR, Cine angiogram, color Doppler systems, Holter monitoring, endoscopy.

UNIT-V

Electrical hazards during Bio electric monitoring: Safety codes and Standards, Micro and Macro shock and their physiological effects. Leakage currents and protection by the use of isolation transformers, Equipotential grounding and earth free monitoring.

Electrical factors in Hospital Design: Electrical power supply systems in a Hospital building. Proper installation and grounding for providing safe patient electrical environment.

Suggested Reading:

1. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, *"Biomedical Instrumentation and Measurements",* 2nd Edition, Prentice Hall, New Delhi, 1998.
2. John G. Webstar, *Medical instrumentation -Application & Design,* John Wiley & Sons Inc., 3rd Edition, 2003.
3. R.S. Khandpur, *Hand Book of Biomedical Instrumentation,* Tata McGraw Hill Publishing Company Ltd., 2nd Edition, New Delhi, 2003
4. Joseph J.Carr and John M.Brown, *Introduction to Biomedical Equipment Technology,* Pearson Education, 2001.
5. L. A. Geddes, *Principles of Applied Bio-Medical Instrumentation,* John Wiley and Sons, New York, USA, 1975.
6. Geddes L. A. and Baker L. E., *"Principles of Applied Biomedical Instrumentation",* 3rd Edition, John Wiley, New York, 1989.
7. Richard Aston, *"Principles of Bio-medical Instrumentation and Measurement",* Merril Publishing Company, New York, 1990.

Course Code	Course Title						Core / Elective
PC606EE	PROCESS CONTROL						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3	-	0	0	30	70	3

Course Objectives

- To introduce dynamics of various processes
- To impart knowledge on basic control actions, the effect of various control actions and tuning techniques of controllers
- To impart knowledge on the final control elements.
- To give an introductory knowledge on Programmable Logic Controller (PLC) and their Programming language

Course Outcomes

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

- Describe elements in process control loop and write a mathematical model for processes.
- Explain various control modes and realize different electronic controllers.
- Discuss effects of the closing of the loop with different controllers and estimate controller parameters by using various tuning methods.
- Explain different final control elements in the process control systems.
- Describe the nature of programmable logic controller (PLC) and develop PLC programs by using ladder diagram logic for process control applications

UNIT-I

Process characteristics: Process variables, process degrees of freedom, characteristics of physical systems, elements of process dynamics, liquid processes, gas processes, flow processes, thermal processes, dead time, thermal element lag, pressure element lag.

UNIT-II

Controller characteristics: Automatic controller, proportional control, integral control, proportional integral control, proportional derivative control, PID control action, two position control, single speed floating control, electronic controllers, two position floating controller.

UNIT-III

Closed loop in Automatic control: Effect of closing loop, proportional control, integral control, PI control, derivative control, static error offset, velocity error, Ziegler Nichols methods, two position control, single speed floating control.

UNIT-IV

Final control elements: Electrical actuators, Pneumatic actuators, Hydraulic actuators. **Valve accessories:** Pneumatic valve positioner, valve limit switches, solenoid valves, valves selection, performance, sizing and characteristics.

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UNIT-V

Discrete state process control: Introduction, relay controllers and Ladder diagrams, with elements and examples. **Programmable Logic Controllers (PLCs):** Introduction to PLC design, PLC operation, and programming PLC using software functions with examples.

Suggested Reading:

1. Eckman D. P, Automatic Process Control, Wiley Eastern, 1975.
2. Majumdar S.R, Pneumatic System, Tata McGraw, 1995.
3. 3.Curtis D.Johnson, Process Control & Instrumentation Technology, 7th Edition, Pearson Education.
4. Bela G.Liptak, Instrument Engineer's Handbook -Process Control, 3rd Edition, Gulf publications

Course Code	Course Title						Core / Elective
PC607EE	ELECTRONICS INSTRUMENTATION SYSTEMS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3	-	0	0	30	70	3

Course Objectives

- To learn the properties, construction, operation & applications of Electronic Instrumentation Systems.
- To learn the signal analyzers and computer controlled test systems involved in a digital instrument.
- To develop the ability of designing and using an Electronic Instrument system to Measure, Display & Record various electronic Parameters.

Course Outcomes

On successful completion of this course student will be able to:

- Describe the interfacing of transducers with various amplifiers & Data convertors.
- Explain operation & features of different types of Digital voltmeters and multimeters.
- Explain working operation of various wave analyzers required for an instrumentation system.
- Describe a Computer controlled testing system for interfacing & testing electronic instruments
- Express various techniques involved in digital instrumentation using Analog & Digital CROs.

UNIT-I

Analog and Digital Measuring system: Interfacing Active and Passive Transducers. **Amplifiers:** Instrumentation amplifier (fixed and programmable types and specifications), Isolation amplifiers (Types and specifications).

Digital to Analog Converters (DAC): R-2R ladder and Inverted ladder DACs. Main DAC specifications. **Analog to Digital Converters (ADC)**: Parallel (Flash) ADC, successive approximation ADCs, Microprocessor compatibility and Dual slope ADC, principal specifications of ADC.

UNIT- II

Digital Voltmeter and Multimeters: Simple D.C Voltage attenuator, current to voltage converter, resistance to voltage converter, Automatic ranging and automatic zeroing RMS detector in DMM, RMS and True RMS, digital frequency and time measurements, frequency ratio, time interval and pulse width measurements, scaling and checking modes. Counting errors, input signal conditioning, trigger level, hysteresis.

UNIT- III

Signal Analysis: Wave and signal analysers with applications. **Harmonic Distortion Analysers:** Harmonic distortion, heterodyne harmonic analyser or wave meter, tuned circuit, fundamental suppression. **Spectrum Analysers:** Block diagram, phase locked circuit for the local oscillator, successive limiting type and Log IF amplifier.

UNIT- IV

Computer controlled Test systems: Testing an Audio amplifier, radio receiver instruments used in computer controlled instrumentation, frequency counter, synthesized signal generator, IEEE 488 Bus, Relay switched attenuator, IEEE 488 electrical interfacing.

UNIT -V

Cathode Ray Oscilloscope (CRO): Block diagram, basic concepts, vertical amplifier, time base, trigger delay line and their role in a CRO. Digital Storage Oscilloscope, magnetic recorders, digital interface for Programmable Instrumentation. Description and simple examples of Automatic Instrumentation. Basic problems on CRO for Sensitivity & deflection.

Suggested Reading:

1. H.S. Kalsi , *Electronic Instrumentation* ,Tata McGraw Hill second edition 2004
2. Helfrick & Copper ,*Modern Electronic Instrumentation & Measurement Techniques* , Prentice Hall of India ,2002
3. A.K.Sawhney, *Electrical and Electronic measurements and Instrumentation*, 8th edition, 2007, Dhanpat Rai Publishers
4. A.J Bouwens , *Digital Instrumentation* ,McGraw Hill International Edition ,1995

Course Code	Course Title						Core / Elective
PE604EE	**INSTRUMENTATION IN AEROSPACE AND NAVIGATION (Professional Electives-II)**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To expose the students to the field of aerospace engineering
- To impart basic knowledge of its navigation instrumentation

Course Outcomes

At the end of the course students will be able to

- To understand the basics of aerospace and navigation
- To know the technical aspects of this subject
- To know about various troubles in aircrafts

UNIT-I

Introduction To Aviation: History of aviation and space flight anatomy of airplane and space vehicle with emphasis on control surfaces. Airfoil nomenclature, basics of aerodynamics to illustrate lift and drag, types of drag, finite wings, swept wings, flaps Airplane performance, thrust, power, rate of climb, absolute and service ceiling, range and endurance.

UNIT-II

Aircraft Instrumentation: Basic of engine instruments, capacitive fuel content, gauges, standard atmosphere, altimeters, aneroid, radio altimeters. Aircraft compass, remote indicating magnetic compass, rate of climb indicator, pilot static system, air speed indicator, mach meters, integrated flight instruments, flight testing and recording of flight tests.

UNIT-III

Radio Navigation Aids: Automatic direction finder distance measuring equipments, instrument landing system visual Omni range, radar, optical instruments, engine instruments and control, pressure measurements, thermal meter control, tachometer, accelerometer, smoke and fire detection, propeller controls, twin blade control, cabin pressure and temperature.

UNIT-IV

Satellite and space vehicle instrumentations: Satellite and space vehicle instrumentation, propulsion controls, sun sensors, horizon sensors, star tracker, stabilization controls.

UNIT-V

Electrical Troubles: Hydraulic systems trouble, landing gear troubles, cabin conditioning troubles, indication of unsafe canopy, Boeing condition, radio troubles, separate generator, system troubles, trouble indicator light, advantages of instrument flag, black box and its use.

Suggested Readings:

1. John D Anderson JR, “Introduction to flight”, Mc Graw hill
2. Pallett E.G.H, “ Aircraft instrumentation and integrated systems”, Longman scientific and Technical,1992
3. Nagaraja N.S, “Elements of electronic navigation”, Mc Graw Hill , New Delhi 1975

Course Code	Course Title						Core / Elective
PE605EE	PIPING AND INSTRUMENTATION DIAGRAMS (Professional Electives-II)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3	-	0	0	30	70	3

Course Objectives

- Identify ISA symbols and interpret basic flow sheets layout principles.
- Exhibit comprehension of instrumentation/flow diagram relationships and flow sheet/plotplans/piping/interrelationship.
- Prepare flow sheets (process and mechanical) diagrams and P&IDs.
- To provide knowledge on risk, hazard and their assessment techniques in Industry
- To provide knowledge on Safety in Instrumentation & Control Systems

Course Outcomes:

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

- Understanding of P&I Diagrams, standards involved and its preparation.
- Awareness on the different fittings used for instruments installation and various softwares used for the preparation of P&IDs.
- Understanding of Process safety, Safety Management Systems and instrumentation system design for hazardous applications.

UNIT–I

Introduction: P&I Diagram objectives. Industry codes and standards. Government regulations. **Engineering drawings:** Block flow diagram (BFD), process flow diagram (PFD), PFD symbols, piping and instrumentation diagrams, P&ID symbols. Line numbering, valve numbering, equipment identification.

UNIT–II

Interpreting P&ID equipment: Valves, Vessels, Pumps, Heat exchangers, Compressors, Equipment labeling and identification, KKS numbering system, Smart P&IDs, softwares used in preparation of P&IDs. Binary logic diagrams and Analog Loop diagrams for simple applications.

UNIT-III

Piping and Instrumentation diagram: Scope, references, definition and terminology, symbol and abbreviation units general (definition, representation, drafting, equipment location index, drawing number, arrangement)

Minimum information to be shown on P&I diagrams: General, equipment indication, instrumentation and piping.

UNIT–IV

Design criteria for preparation of P&I diagrams: Assembly piping of pumps, steam out, drain and vent for vessels, bypass for safety/relief valve, block and bypass valves for control valves, line numbering, philosophy of instrumentation installation, utility connection, unit battery limit installation, sample connection, steam trap assembly. Criteria for utility flow diagrams (abbreviations, graphical symbols and identifications).

UNIT – V

Preparation of P&I Diagrams: General, establishment of P&ID preparation steps, handling of licensed process, revision of P&I diagram, approval of P&I diagram.

Suggested Reading:

1. Instrumentation and Control System Documentation, ISA Publisher. Authors: Frederick
2. Meier and Clifford Meier, 2nd Edition, ISBN-13: 978-193600751 ISBN-10: 1936007517
3. The management of control system: Justification and Technical Auditing, N.E. Bhttiha, ISA.
4. Mannan S., "Lee's Loss Prevention in the Process Industries", Vol.I, 3rdEd., Butterworth Heinemann, 2004.
5. Mannan S., "Lee's Loss Prevention in the Process Industries",Vol.II & III, 3 rd Ed., Butterworth Heinemann, 2005.
6. Practical Industrial Safety, Risk Assessment and Shutdown Systems, By Dave Macdonald, Elsevier, 2004.
7. Engineering standard for piping & Instrumentation diagram IPS-E-PR-230, OCT-1996

Course Code	Course Title						Core / Elective
PE606EE	INSTRUMENTATION AND CONTROL IN PETROCHEMICAL INDUSTRY (Professional Electives-II)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	
	L	T	D	P			Credits
-	3	-	0	0	30	70	3

Course Objectives

- To provide a window of applications of instrumentation and automation in Petrochemical Industries.
- Additionally students know about the various methods in Petrochemical Industries and its control methods.

Course Outcomes

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

- An understanding on various petrochemical process, important parameter to be monitored and controlled, various parameters to be analyzed and monitored.
- Various instruments involved in and its controlling process.
- An ability to design and conduct experiments, as well as to analyze and interpret data.

UNIT–I

Brief survey of petroleum: Petroleum formation, petroleum exploration, petroleum production, petroleum refining and its methods, refining capacity and consumption in India, constituents of crude oil, recovery techniques , oil and gas separation , processing wet gases.

UNIT–II

P & I diagram of petroleum refinery: Atmospheric distillation process, vacuum distillation process, Thermal cracking, catalytic cracking, catalytic reforming, and utility plants, Air, N_2, and cooling water.

UNIT–III

Basics of field instruments: Parameters to be measured in Petrochemical industry, distillation column control, selection of instruments, basics of intrinsic safety of instruments, area classification.

UNIT–IV

Control for petroleum refinery: Control of furnace, reboiler control, reflux control, control of catalytic crackers, control of heat exchanger, control of cooling tower.

UNIT–V

Safety consideration: Basics of PLC, and Safety interlocks in furnace, separator, pump, and compressor. Basics of SIL, and introduction to standards.

Suggested Reading:

1. Waddams A.L, .Chemical from petroleum, Butter and Janner Ltd., 1968.
2. Balchan.J.G. and Mumme K.I., Process Control Structures and Applications, Van Nostrand Reinhold Company, New York, 1988.
3. Liptak B.G., Instrument Engineers' Handbook, Fourth Edition, CRC PRESS, 2003.

Course Code	Course Title						Core/Elective
PC651EE	ELECTRICAL MACHINES LAB						Core
Prerequisite	L	T	D	P	CIE	SEE	Credits
PC 407EE	-	0	0	2	25	50	1

Course Objectives

- To experimentally verify the principle and characteristics of various Motors.
- To learn and understand the measurement of Voltage, Current and Torque of AC and DC Machines.

Course Outcomes

On successful completion of this course student will be able to

- Conduct experiments, take measurements and analyze the data through hands-on experience in order to demonstrate understanding of the theoretical concepts of Electrical Machines, while working in small groups.
- Compare the experimental results with those introduced in lecture, draw relevant conclusions and substantiate them satisfactorily.
- Demonstrate the performance characteristics of DC and AC motors.

LIST OF EXPERIMENTS:

1. Magnetization Characteristics of a Separately Excited D.C Generator
2. No-load and Load Characteristics of a Shunt generator.
3. Load Characteristics of a D.C. Series Generator.
4. Performance Characteristics of a Shunt Motor.
5. Performance Characteristics of a DC Series Motor.
6. Performance Characteristics of a Compound Motor.
7. Speed control of D.C. Shunt Motor.
8. O.C. and S.C. Tests on Single phase Transformer.
9. Regulation of an alternator by O.C. and S.C. tests.
10. Study of starting methods of Squirrel cage and Slip ring Induction Motor.
11. Performance Characteristics of a 3-phase Induction Motor.
12. Performance Characteristics of a Single phase Induction Motor.

Suggested Reading:

1. P.S.Bimbhra- Electrical Machinery, Khanna Publishers 2006
2. D.P. Kothari & I.J. Nagrath, Electrical Machines, Tata McGraw Hill, 4th Edition, 2010.
3. M.G.Say - The Performance and Design of AC. Machines Pitman Publication, 2002.
   Irving L. Kosow - Electric Machinery and Transformers. PPH, Pearson Education, 2nd Edition, 2009

Note: Atleast 10 experiments should be conducted in the semester

Course Code	Course Title						Core/Elective
PC652EE	DIGITAL SIGNAL PROCESSING LAB (Common to EEE and EIE)						Core
Prerequisite	L	T	D	P	CIE	SEE	Credits
-	0	0	0	2	25	50	1

Course Objectives

- To prepare the students
- To develop MATLAB code to generate different discrete signals and perform basic operations.
- To develop MATLAB code to convert continuous to discrete by DFT and FFT computations. to obtain Convolution of sequences and sampling theorem.
- To develop MATLAB code to design FIR and IIR filters.
- To use DSP kit and CCS, write code to obtain convolution of sequences, design of FIR and IIR filters, compute DFT and FFT algorithms, Impulse response and generate basic waves

Course Outcomes

On successful completion of this course student will be able to

- Compute and write MATLAB code to generate basic waves and perform basic operations on them.
- Compute and write MATLAB code to apply sampling theorem, to obtain convolution and compute DFT and FFT.
- Compute and write MATLAB code to design FIR and IIR filters.
- Compute and write MATLAB code to obtain convolution of sequences, Design of FIR and IIR filters, compute DFT and FFT algorithms, Impulse response and generate basic waves using DSP kit

List of Experiments

1. Generation of different discrete signal sequences and Waveforms.
2. Basic Operations On Discrete Time Signals
3. DFT Computation and FFT Algorithms.
4. Verification of Convolution Theorem.
5. Verification of sampling theorem.
6. Design of Butterworth and Chebyshev LP and HP filters.
7. Design of LPF using Rectangular, Hamming and Kaiser Windows.
8. To perform linear and circular convolution for the given sequences.
9. Design and implementation of FIR and IIR filter.
10. Computation of DFT using DIT and DIF algorithm.
11. Generation of basic waves.
12. Impulse response.

Suggested Reading:

1. Proakis & Manolakis - Digital Signal Processing, Principles, Algorithms and Applications, Prentice Hall of India - 3rd Edition-1994.
2. Opeinheim & Schaffter - Digital Signal Processing, PHI Publications, 2002.

Note: Atleast ten experiments should be conducted in the Semester

Course Code	Course Title						Core/Elective
PC653EE	CONTROL SYSTEMS LAB (Common to EEE and EIE)						Core
Prerequisite	L	T	D	P	CIE	SEE	Credits
-	0	0	0	2	25	50	1

Course Objectives:

- To prepare the students
- To develop transfer function of various control system plants practically by conducting the experiments.
- To understand the various controllers, basic features of PLC
- Programming and control system concepts using MATLAB.

Course Outcomes:

On successful completion of this course student will be able to

- Able to understand Performance of P, PI and PID Controllers
- Able to develop PLC programs for certain applications
- Acquire the knowledge of Data acquisition system and Industrial process control

LIST OF EXPERIMENTS

1. Characteristics of D.C. and AC. Servomotor and their transfer function.
2. Characteristics of synchros.
3. Frequency response of second order system.
4. Operating characteristics of Stepper motor.
5. Step response of second order system.
6. D.C. Position control system.
7. A.C. Position control system.
8. Performance of P, PI and PID Controller on system response.
9. Design of lag and lead compensation.
10. ON - OFF temperature control systems.
11. Simulation of control system concepts using MATLAB.
12. PLC (Programmable Logic Controller) applications. (a) Bottle filling (b) Speed control of Stepper motor (c) Liquid level control.
13. Data acquisition system and applications.
14. Industrial process control trainer.

Suggested Reading:

1. Nagrath I.J. & Gopal.M - Control System Engineering, Wiley Eastern, 2003.
2. B.C.Kuo - Automatic Control Systems, Wiley India edition, 7th Edition, 2002.
3. K.Ogata - Modern Control System, Prentice Hall of India, 4th edition, 2002.
4. N.C.Jagan - Control Systems, B.S Publications, 2nd edition,2008.

Note: Atleast ten experiments should be conducted in the Semester.

Course Code	Course Title						Core / Elective
OE 601 CE	**DISASTER MANAGEMENT**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Course Outcomes

- The students will be able to understand impact on Natural and manmade disasters.
- Able to classify disasters and destructions due to cyclones
- Able to understand disaster management applied in India

UNIT-I

Introduction to Disasters: Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Natural and Manmade disasters, impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT-II

Disaster: Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc. Differential Impacts, in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change. Cyclones and Floods: Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

UNIT-III

Approaches to Disaster Risk Reduction: Disaster cycle, its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural-nonstructural sources, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRis/ULBs), states, Centre, and other stake-holders.

UNIT-IV

Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change, Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V

Disaster Risk Management in India: Hazard and Vulnerability profile of India
Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation)
Field Work and Case Studies: The field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.

Suggested readings:

1) Sharma V. K., "**Disaster Management, National Centre for Disaster Management**", IIPE, Delhi, 1999.
2) Gupta Anil K, and Sreeja S. Nair., "**Environmental Knowledge for Disaster Risk Management"**, NIDM, New Delhi, 2011.
3) Nick., **"Disaster Management: A Disaster Manager's Handbook"** Asian Development Bank, Manila Philippines, 1991.
4) Kapur, et al. , "**Disasters in India Studies of Grim Reality"**, Rawat Publishers, Jaipur, 2005.
5) Pelling Mark, "**The Vulnerability of Cities**: **Natural Disaster and Social Resilience**", Earth scan publishers, London, 2003.

Course Code	Course Title						Core / Elective
OE 602 CE	**GEO-SPATIAL TECHNIQUES**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- Description about various spatial and non-spatial data types, and data base management techniques
- Development of the concepts and professional skills in utility of geospatial techniques Enhancement of knowledge of geospatial techniques to field problems

Course Outcomes

- The students will be able to understand and apply GIS tools
- Will be able to analyse and process data to apply to the GIS tools.
- Will be able assimilate knowledge on field problems using remote sensing

UNIT I

Introduction: Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems. Projections and Coordinate Systems: Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations map analysis.

UNIT II

Data Acquisition and Data Management: data types, spatial, non-spatial (attribute) data, data structure and database management, data format, vector and raster data representation, object structural model filters and files data in computer, key board entry, manual digitizing, scanner, aerial photographic data, remotely sensed data, digital data, cartographic database, digital elevation data, data compression, data storage and maintenance, data quality and standards, precision, accuracy, error and data uncertainty. Data Processing: Geometric errors and corrections, types of systematic and non-systematic errors, radiometric errors and corrections, internal and external errors.

UNIT III

Data Modeling: Spatial data analysis, data retrieval query, simple analysis, recode overlay, vector data model, raster data model, digital elevation model, cost and path analysis, knowledge based system. GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data

UNIT IV

Applications of GIS: Environmental and natural resource management, soil and water resources, agriculture, land use planning, geology and municipal applications, urban planning and project management, GIS for decision making under uncertainty, software scenario functions, standard GIS packages, introduction to Global Positioning Systems (GPS) and its applications.

UNIT V

Introduction to Remote Sensing: General background of remote sensing technology, objectives and limitations of remote sensing, electro-magnetic radiation, characteristics, interaction with earth surface and atmosphere, remote sensing platforms and sensors, satellite characteristics, digital image processing, IRS series and high resolution satellites, software scenario functions, remote sensing applications to watershed modeling, environmental modeling, urban planning and management.

Suggested readings:

1) Burrough, P. A., and McDonnell R. A., '**Principles of Geographical Information Systems'**, Oxford University Press, New York, 1998.
2) Choudhury S., Chakrabarti, D., and Choudhury S. **'An Introduction to Geographic Information Technology**', I.K. International Publishing House (P) Ltd, New Delhi, 2009.
3) Kang-tsung Chang , "**Introduction to Geographical information Systems'**, Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi, 2006.
4) Lilysand T.M., and Kiefer R.W. '**Remote Sensing and Image Interpretation'**, John Wiley and Sons, Fourth Edition, New York, 2002.
5) Tor Bernhardsen, **'Geographical Information System'**, Wiley India (P) Ltd., Third Edition, New Delhi, 2002.
6) Hoffman-Wellenhof, B, et al. '**GPS Theory and Practice'**, Fourth Edition, Springer Wein, New York, 1997.

Course Code	Course Title						Core / Elective
OE 601 CS	**OPERATING SYSTEMS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To understand CPU, Memory, File and Device management
- To learn about concurrency control, protection and security
- To gain knowledge of Linux and Windows NT internals

Course Outcomes

- Explain the components and functions of operating systems.
- Analyze various Scheduling algorithms.
- Apply the principles of concurrency
- Compare and contrast various memory management schemes
- Perform administrative tasks on Linux Windows Systems

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory Management: Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring, Encryption. UNIT-IV Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU- Device interactions, I/O optimization.

UNIT-V

Case Studies: The Linux System, Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication Windows NT, General Architecture, The NT kernel, The NT executive

Suggested readings:

1. Abraham Silberschatz, Peter B Galvin, ***"Operating System Concepts",*** Addison Wesley, 2006
2. William Stallings, "***Operating Systems-Internals and Design Principles"***, 8th edition, Pearson, 2014
3. Andrew S Tanenbaum, "***Modern Operating Systems"***, 4th edition, Pearson, 2016.

Course Code	Course Title						Core / Elective
OE 602 CS	**OOPS USING JAVA**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To introduce fundamental object oriented concepts of Java programming Language, such as classes, inheritance packages and interfaces.
- To introduce concepts of exception handling and multi-threading.
- To use various classes and interfaces in java collection framework and utility classes.
- To understand the concepts of GUI programming using AWT controls.
- To introduce Java I/O streams and serialization

Course Outcomes

- Able to develop java applications using OO concepts and packages.
- Able to write multi-threaded programs with synchronization
- Able to implement real world applications using java collection frame work and I/O classes Able to write Event driven GUI programs using AWT/Swing

UNIT – I

Object Oriented System Development: understanding object oriented development, understanding object oriented concepts, benefits of object oriented development. Java Programming Fundamentals: Introduction, overview of Java, data types, variables and arrays, operators, control statements

UNIT – II

Java Programming Object Oriented Concepts: classes, methods, inheritance, packages and interfaces. Exceptional Handling, Multithreaded Programming

UNIT – III

I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling Exploring Java. Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer

UNIT – IV

Introducing AWT Working with Graphics: AWT Classes, Working with Graphics Event Handling: Two Event Handling Mechanisms, the Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, Check box Group, Choice Controls, Using Lists, Managing Scroll Bars, Using Text Field, Using Text Area, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, File Dialog, Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers.

UNIT – V

Java I/O Classes and Interfaces: Files, Stream and Byte Classes, Character Streams, Serialization.

Suggested readings:

1) Herbert Schildt, "**The Complete Reference JAVA"**, Tata McGraw Hill, 7thEdition, 2005
2) James M Slack, **"Programming and Problem Solving with JAVA"**, Thomson learning, 2002
3) C.Thomas Wu,**"An Introduction to Object-Oriented Programming with Java"**, Tata McGraw Hill, 5thEdition, 2005.

Course Code	Course Title						Core/Elective
OE601IT	**DATABASE SYSTEMS**						**Elective**
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce E-R Model and Normalization
- To learn formal and commercial query languages of RDBMS
- To understand the process of database application development
- To study different database architectures
- To introduce security issues in databases

Course Outcomes:

Student will be able to:

- Understand the mathematical foundations of Database design
- Model a set of requirements using the Entity Relationship (E-R)Model , transform an E-R model into a relational model ,and refine the relational model using theory of Normalization
- Understand the process of developing database application using SQL
- Understand the security mechanisms in RDBMS

UNIT 1

Design: Conceptual design (E-R modeling), the relational model, normalization

UNIT II

Queries: algebra and logic (relational algebra and calculus), relational query languages and queries (namely SQL),select, project, join, union, intersection, except, recursion, aggregation, data manipulation

UNIT III

Applications: application development, database application interfaces (e.g., JDBC), internet applications,proper database application paradigms, transactions, transaction management, concurrency control, crash recovery

UNIT IV

Distributed DB, Architecture, Query processing and Optimization in Distributed DB, Introduction to NoSQL Databases, Graph databases, Columnar Databases

UNIT V

Introduction to Database Security Issues, Security mechanism, Database Users and Schemas, Privileges

Suggested Books

1. Jim Melton and Alan R. Simon.SQL 1999: Understanding Relational Language Components.First Edition, 1999.Morgan Kaufmann Publishers.
2. Don Chamberlin.Using the New DB2: IBM's Object-Relational Database System.First Edition, 1996.Morgan Kaufmann Publishers.
3. Database System Concepts Sixth Edition, by Abraham Silberschatz , Henry F Korth, S Sudarshan,Mc Graw-Hill Education
4. Fundamentals of Database Systems , Elmasri, Navathe, Sixth Edition , Addison- Wesley

Course Code	Course Title						Core / Elective
OE 601 EC	**PRINCIPLES OF EMBEDDED SYSTEMS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- To understand the fundamentals of embedded systems
- To study the block diagram and advanced hardware fundamentals
- To study the software architecture of embedded systems
- To learn the tool chain of embedded systems
- To understand the tools and debugging process of embedded systems.

Course Outcomes

Student will be able:

- To acquire an overview of what an embedded system implies
- To understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.
- To apply theoretical learning to practical real time problems for automation.
- To understand how to build and debug an embedded system application.
- To analyze and design real world applications and interface peripheral devices to the microprocessor.

UNIT – I

Fundamentals of Embedded Systems: Definition of Embedded system, Examples of Embedded Systems, Typical Hardware, Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory

UNIT – II

Advanced Hardware Fundamentals: Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor, Conventions used in Schematics, Microprocessor Architecture, Interrupts Basics, Shared Data Problem, Interrupt Latency.

UNIT – III

Software Architecture of Embedded Systems: Round- Robin, Round-Robin with Interrupts, Function- Queue- Scheduling Architecture, Real- Time Operating System Architecture, Selecting Architecture

UNIT – IV

Embedded Software Development Tools: Host and Target Machines, Cross compilers, Cross Assemblers and Tool Chains, Linkers /Locaters for Embedded Software, Getting Embedded Software into Target System: PROM programmers, ROM Emulators, In-Circuit Emulators.

UNIT – V

Debugging Techniques: Testing on your host machine, Instruction Set Simulators, The assert Macro, Using Laboratory Tools

Suggested readings:

1) David. E. Simon, "**An Embedded Software Primer**", Low price edition, Pearson Education, New Delhi, 2006.
2) Frank Vahid and Tony Givargis "**Embedded System Design: A Unified Hardware/Software. Approach"**. John Wiley & Sons, October 2001.
3) Rajkamal, "**Embedded systems: Programming, architecture and Design",** second edition, McGraw-Hill Education (India), March 2009.

Course Code	Course Title						Core / Elective
OE 602 EC	**DIGITAL SYSTEM DESIGN USING VERILOG HDL**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- Describe Verilog hardware description languages (HDL).
- Develop Verilog HDL code for combinational digital circuits.
- Develop Verilog HDL code for sequential digital circuits.
- Develop Verilog HDL code for digital circuits using switch level modeling and describes system tasks, functions and compiler directives
- Describes designing with FPGA and CPLD.

Course Outcomes

After completion of this course, students should be able:

- To understand syntax of various commands, data types and operators available with verilog HDL
- To design and simulate combinational circuits in verilog
- To design and simulate sequential and concurrent techniques in verilog
- To write Switch level models of digital circuits
- To implement models on FPGAs and CPLDs

UNIT I

Introduction to Verilog HDL: Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools

Verilog Data Types and Operators: Binary data manipulation, Combinational and Sequential logic design, Structural Models of Combinational Logic, Logic Simulation, Design Verification and Test Methodology, Propagation Delay, Truth Table models using Verilog.

UNIT II

Combinational Logic Circuit Design using Verilog: Combinational circuits building blocks: Multiplexers, Decoders , Encoders , Code converters, Arithmetic comparison circuits, Verilog for combinational circuits , Adders-Half Adder, Full Adder, Ripple-Carry Adder, Carry Lookahead Adder, Subtraction, Multiplication.

UNIT III

Sequential Logic Circuit Design using Verilog: Flip-flops, registers & counters, synchronous sequential circuits: Basic design steps, Mealy State model, Design of FSM using CAD tools, Serial Adder Example, State Minimization, Design of Counter using sequential Circuit approach.

UNIT IV

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with Strengths and Delays, Strength Contention with Trireg Nets.

System Tasks Functions and Compiler Directives: Parameters, Path Delays, Module Parameters. System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

UNIT V

Designing with FPGAs and CPLDs: Simple PLDs,ComplexPLDs,Xilinx 3000 Series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices (CPLDs), Altera FLEX 10K Series CPLDs.

Suggested readings:

1) T.R. Padmanabhan, B Bala Tripura Sundari, "**Design Through Verilog HDL**", Wiley 2009.
2) Samir Palnitkar, "**Verilog HDL**", 2nd Edition, Pearson Education, 2009.
3) Stephen Brown, Zvonko Vranesic , "**Fundamentals of Digital Logic with Verilog Design**, TMH, 2nd Edition 2003.

Course Code	Course Title						Core / Elective
OE 601 EE	**RELIABILITY ENGINEERING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	**30**	**70**	3

Course Objectives

- To understand the concepts of different types of probability distributions importance of reliability evaluation of networks.
- To make the students understand about Reliability, availability model of Power Systems and markov modeling of Power Plants. With identical and no identical units.

Course Outcomes

- Able to understand the meaning of discrete and continuous random variables and their significance, causes of failures of a system.
- Able to acquire the knowledge of different distribution functions and their applications.
- Able to develop reliability block diagrams and evaluation of reliability of different systems.

UNIT- I

Discrete and Continuous Random Variables: probability density function and cumulative distribution function, Mean and Variance, Binomial, Poisson, Exponential and Weibull distributions.

UNIT, II

Failure and Causes of Failure: Failure rate and failure density, Reliability function and MTTF, Bath tub curve for different systems, parametric methods for above distributions, Non- Parametric methods from field data.

UNIT- III

Reliability Block Diagram: Series and parallel systems, Network reduction technique, Examples, Evaluation of failure rate, MTTF and reliability, Active and Standby Redundancy, r out of n configuration. Non-series, parallel systems. Path based and cut set methods.

UNIT- IV

Availability, MTTR and MTBF: Markov models and State transition matrices, Reliability models for single component, two components, Load sharing and standby systems, Reliability and availability models of two unit parallel system with repair and standby systems with repair.

UNIT- V

Repairable Systems: Maintainability, Preventive maintenance, Evaluation of reliability and J1TTF, Overhauling and replacement, Optimum maintenance policy, Markov model of

a power plant with identical units and non-identical unit, Capacity outage probability table. Frequency of failures and Cumulative frequency

Suggested readings:

1) Charles E.Ebeling, "**Reliability and Maintainabelity Engineering**", Mc Graw Hill International Edition, 1997.
2) Balaguruswamy, "**Reliability Engineering,**"Tata McGraw Hill Publishing company Ltd,1984.
3) R.N.Allan. "**Reliability Evaluation of Engineering Systems**", Pitman Publishing, 1996.
4) Endrenyi. "Reliability Modelling in Electric Power Systems". JohnWiley & Sons, 1978.

Course Code	Course Title						Core / Elective
OE602EE	BASICS OF POWER ELECTRONICS						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	0	0	0	30	70	3

Course Objectives

- To be able to understand various power switching devices, characteristics and applications.
- To learn and understand the various converters like rectifiers, choppers and inverters principle operation, characteristics and applications.

UNIT I: Power Switching Devices

Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, methods of SCR commutation, UJT as a trigger source, gate drive circuits for BJT and MOSFETs

UNIT II: AC-DC Converters (Phase Controlled Rectifiers)

Principles of single-phase fully-controlled converter with R, RL, and RLE load, Principles of single-phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits, Single phase and Three phase dual converters

UNIT III: DC-DC Converters (Chopper/SMPS)

Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current Buck converter - Power circuit, analysis and waveforms at steady state, duty ratio control of output voltage. Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage. Buck-Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage

UNIT IV: DC-AC Converters (Inverters)

Introduction, principle of operation, performance parameters, single phase bridge inverters with R, RL loads, 3-phase bridge inverters - 120 and 180 degrees mode of operation, Voltage control of single phase inverters –single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

UNIT V: AC-AC Converters

Phase Controller (AC Voltage Regulator)-Introduction, principle of operation of single phase voltage controllers for R, R-L loads and its applications. Cycloconverter-Principle of operation of single phase cycloconverters, relevant waveforms, circulating current mode of operation, Advantages and disadvantages

Suggested Reading:

1. Singh.M.D and Khanchandani.K.B, Power Electronics, Tata McGraw Hill, 2nd Edition, 2006.
2. Rashid.M.H, Power Electronics Circuits Devices and Applications. Prentice Hall of India, 2003
3. M.S.Jamil Asghar, Power Electronics, Prentice Hall of India, 2004 With effect from Academic Year 2016-2017
4. Bimbra.P.S, Power Electronics, Third Edition, Khanna Publishers, 1999
5. Mohan, Undeland, Robbins, Power Electronics, John Wiley, 1996

Course Code	Course Title						Core / Elective
OE 601 ME	**INDUSTRIAL ROBOTICS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To familiarize the student with the anatomy of robot and their applications.
- To provide knowledge about various kinds of end effectors usage.
- To equip the students with information about various sensors used in industrial robots.
- To make the student understand the importance of spatial transformation of robots using forward and inverse kinematics.
- To specify and provide the knowledge of techniques involved in robot vision in industry.
- To equip students with latest robot languages implemented in industrial manipulators.

Course Outcomes

- Able to demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and have an understanding of the functionality and limitations of robot actuators and sensors.
- Able to demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulation tools.
- Able to apply knowledge and choose the best & economically suitable sensors/end effectors required for specific applications.
- Able to understand the importance of robot vision and apply the learnt techniques to get the required information from input images.
- Able to design and develop a industrial robot for a given purpose economically.
- Appreciate the current state and potential for robotics in new application areas.

UNIT – I

Introduction to Robotics: Basic structure of Robots. Degree of freedom of Robots, Work envelope, Classification of Robots based on Drive Technology, Work-Envelope and motion control methods. Application of Robots in Industry, Repeatability, Precision and Accuracy as applied to Robots, Specifications of robots used for various applications. End effectors, Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers, Two fingered and three fingered grippers, internal grippers and external grippers, Selection and design considerations.

UNIT – II

Requirements of a Sensor: Principles and Applications of the following types of sensors- Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors), Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters), Proximity sensors (Inductive, Hall effect,

Capacitive, Ultrasonic and Optical proximity sensors), Touch sensors (Binary sensors, Analog sensors), Wrist Sensors, Compliance Sensors, Slip Sensors.

UNIT – III

Kinematic Analysis of Robots: Rotation matrix. Homogeneous transformation matrix, Denavit & Hartenberg representation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots, Static force analysis

UNIT – IV

Introduction to Techniques used in Robot Vision: Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, segmentation & description of 3- dimensional structures, their recognition and interpretation. Types of Camera, frame grabbing, sensing and digitizing image data, Signal conversion, Image Storage, Lighting techniques, Image processing and analysis, Data reduction, Segmentation, Feature extraction, Object recognition, and various algorithms, Applications, Inspection, identification, visual serving and navigation.

UNIT – V

Robot Programming Languages: Characteristics of robot level languages, task level languages. Teach pendant programming, Lead through programming, Robot programming languages, VAL programming, Motion commands, Sensor commands. End effecter commands, Simple programs. RGV, AGV, Implementation of robots in industries, various steps, Safety considerations for robot operations. Economic analysis of robots, Pay back method, EUAC method and Rate of return method

Suggested readings:

1. Groover M P, "**Industrial Robotics**", McGraw Hill Publications, 1999.
2. Fu. K.S., Gon Zalez R.C., Lee C.S.G. "**Robotics, Control-sensing vision and Intelligence**", McGraw Hill, Int. Ed., 1987.
3. Spong and Vidyasagar, "**Robot Dynamics & Control**", John Wiley and Sons, Ed.,1990.
4. Mittal and Nagrath, "**Industrial Robotics**", Tata McGraw Hill Publications, 2004.
5. Saha & Subir kumar saha, '**Robotics'**, TMH, India.

Course Code	Course Title						Core / Elective
OE 602 ME	**MATERIAL HANDLING**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives

- To know about the working principle of various material handling equipments.
- To understand the Material handling relates to the loading, unloading and movement of all types of materials.
- To understand the estimation of storage space and maintenance of material handling equipments.

Course Outcomes

- Able to understand various conveying systems that available in industry.
- Able to understand various bulk solids handling systems and their design features.
- Able to understand and various modern material handling systems and their integration.
- Able to calculate number of MH systems required, storage space, cost and maintenance.

UNIT – I

Mechanical Handling Systems: Belt Conveyors and Desing, Bucket Elevators, Package conveyors, Chain and Flight Conveyors, Screw Conveyors, Vibratory Conveyors, Cranes and Hoists.

UNIT – II

Pneumatic and Hydraulic Conveying Systems: Modes of Conveying and High pressure conveying systems, Low Velocity Conveying System. Components of Pneumatic Conveying Systems: General Requirements, Fans and Blowers, Boots-Type Blowers, Sliding-Vane Rotary Compressors, Screw Compressors, Reciprocating Compressors, Vacuum Pumps.

UNIT – III

Solids Handling: Particle and Bulk Properties- Adhesion, Cohesion and Moisture Content. Gravity Flowof Bulk Solids: Static and Dynamic Pressure Distribution in Bulk Solids. Modes of Flow: Mass Flow, Funnel Flow and Expanded Flow from Hoppers, Bins and Silos.

Unit IV

Modern Material Handling Systems: Constructional features of (i) AGV (ii) automated storage and retrieval systems. Sensors used in AGVs and ASRS.Bar code systems and RFID systems: Fundamentals and their integration with computer-based information systems.

UNIT – V

Total MH Throughput: Calculation for no. of MH systems; storage space estimation based on number of aisles. Maintenance of MH equipment, spare parts management, cost of materials handling, cost per unit load computations

Suggested Readings:

1. Dr. Mahesh Varma, "**Construction Equipment and its Planning & Application**", Metropolitan Book Co. (P) Ltd., New Delhi, India, 1997.
2. James M. Apple, **"Material Handling Systems Design",** the Ronald Press Company, New York, USA, 1972.
3. Woodcock CR. and Mason J.S., **"Bulk Solids Handling: An Introduction to Practice Technology**", Leonard Hill USA, Chapman and Hall, New York.
4. M P Groover etal, **"Industrial Robotics**", Me Graw Hill, 1999.

Course Code	Course Title						Core / Elective
OE 632 AE	**AUTOMOTIVE SAFETY AND ERGONOMICS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**0**	**0**	**0**	**30**	**70**	**3**

Course Objectives:

It is intended to make the students to

- Understand the basics of vehicle collision and its effects
- Understand the various safety concepts used in passenger cars.
- Gain knowledge about various safeties and its equipment.
- Understand the concepts of vehicle ergonomics.
- Gain knowledge about various automotive comforts features.

Course Outcomes:

After the completion of this unit, the student is able to

- Break down the importance of safety in Automobiles
- Describe the various safeties equipment used in Automobiles
- Explain about Vehicle ergonomics and Comforts in Automobiles

UNIT-I

Introduction: Design of the Body for safety, Energy equations, Engine location, Effects of Deceleration inside passenger compartment, Deceleration on impact with stationary and movable obstacle, Concept of Crumble zone and Safety sandwich construction, Active and passive safety, Characteristics of vehicle structures, Optimization of vehicle structures for crash worthiness, Types of crash / roll over tests, Regulatory requirements for crash testing, instrumentation, High speed photography, image analysis.

UNIT-II

Safety Concepts: Active safety- driving safety, Conditional safety, Perceptibility safety and Operating safety, Passive safety: Exterior safety, Interior safety, Deformation behaviour of vehicle body, Speed and acceleration characteristics of passenger compartment on impact, pedestrian safety, human impact tolerance, determination of injury thresholds, severity index, study of comparative tolerance, Study of crash dummies.

UNIT-III

Safety equipments: Seat belt, automatic seat belt fastening system, Collapsible steering column, tilt-able steering wheel, Air bags, electronic systems for activating air bags, Frontal design for safety, collision warning system, Causes of rear end collision, frontal object detection, rear vehicle object detection system, Object detection system with braking system interactions. Anti-lock braking system ESP and EBD systems

UNIT- IV

Vehicle Ergonomics: Introduction to human body - anthropometrics and its application to vehicle ergonomics, Cockpit design, Driver comfort – seating, visibility, Man-machine system- psychological factors – stress, attention, Passenger comfort - ingress and egress, spaciousness, Ventilation, temperature control, Dust and fume prevention and vibration, Interior features and conveniences, Use of modern technology for the same

UNIT-V

Comfort and Convenience System: Cabin comfort - in-car air conditioning – overall energy efficiency, Air management, central and Unitary systems, air flow circuits, air cleaning, ventilation, air space diffusion, Compact heat exchanger design, controls and instrumentation, Steering and mirror adjustment, central locking system, Garage door opening system, tire pressure control system, rain sensor system, environment information system, Automotive lamps, types, design, construction, performance, Light signalling devices- stop lamp, Rear position lamp, Direction indicator, Reverse lamp, reflex reflector, position lamp, gas discharge lamp, LED, Adoptive front lighting system (AFLS) and Daylight running lamps (DRL).

Suggested Reading:

1. Prasad, Priya and BelwafaJamel, "Vehicles Crashworthiness and Occupant Protection", American Iron and Steel Institute, USA.
2. JullianHappian-Smith "An Introduction to Modern Vehicle Design" SAE, 2002
3. Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.
4. "Recent development in Automotive Safety Technology", SAE International Publication. Editor: Daniel J Helt, 2013.
5. Keitz H.A.E. "Light Calculations and Measurements", Macmillan 1971.

Course Code	Course Title						Core/Elective
MC 951 SP	**YOGA PRACTICE**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**20**	**30**	**3U**

Course Objectives:

- Enhances body flexibility
- Achieves mental balance
- Elevates Mind and Body co-ordination
- Precise time management
- Improves positive thinking at the expense of negative thinking

Course Outcomes:

Student will be able to:

- Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
- An all-round development-physical, mental and spiritual health-takes place.
- Self-discipline and discipline with respect society enormously increases.
- University environment becomes more peaceful and harmonious.

UNIT-I

Introduction: Yoga definition – Health definition from WHO-Yoga versus Health-Basis of Yoga-yoga is beyond science-Zist of 18 chapters of Bhagavadgita- 4 types of yoga: Karma, Bhakti, Gnyana and Raja yoga–Internal and External yoga-Elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi)-Panchakoshas and their purification through Asana, Pranayama and Dhyana.

UNIT-II

Surya Namaskaras (Sun Salutations): Definition of sun salutations-7 chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar)- Various manthras (Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya and Om Bhaskaraya) and their meaning while performing sun salutations-Physiology-7systems of human anatomy-Significance of performing sun salutations.

UNIT-III

Asan as (Postures): Pathanjali's definition of asana-Sthiram Sukham Asanam-3rdlimbofAshtangayoga-Looseningorwarmingupexercises- Sequence of perform in as an as (Standing, Sitting, Prone, Supine and Inverted)-Nomenclature of as an as (animals, trees, rishis etc)-As an as versus Chakras-As an as versus systems-As an as versus physical health-Activation of Annamaya kosha

UNIT-IV

Pranayama (Breathing Techniques): Definition of Pranayama as per Shankaracharya-4th limb of Ashtanga yoga-Various techniques of breathing-Pranayama techniques versus seasons-Band has and their significance in Pranayama-Mudras and their significance in Pranayama-Restrictions of applying band has with reference to health disorders-Pranayama versus concentration-Pranayama is

the bridge between mind and body-Pranayam versus mental health-Activation of Pranamaya kosha through Pranayama.

UNIT-V

Dhyana (Meditation): Definition of meditation-7th limb of Ashtanga yoga- Types of mind (Conscious and Sub-Conscious)-various types of dhyana. Meditation versus spiritual health-Dharana and Dhyana-Extention of Dhyana to Samadhi-Dhyana and mental stress-Activation of Mano mayakosha through dhyana- Silencing the mind

Suggested Reading:

1. Light on Yoga by BKS lyengar
2. Yoga education for children Vol-1 by Swami Satyananda Saraswati
3. Light on Pranayama by BKS lyengar
4. Asana Pranayama Mudra and Bandha by Swami Satyananda Saraswati
5. Hatha Yoga Pradipika by Swami Mukhtibodhananda
6. Yoga education for children Vol-11 by Swami Niranjan an and a Saraswati
7. Dynamics of yoga by Swami Satyananda Saraswati

Course Code	Course Title						Core/Elective
MC 952 SP	**NATIONAL SERVICE SCHEME (NSS)**						**Elective**
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	**3U**

Course Objectives:

- To help in Character Molding of students for the benefit of society
- To create awareness among students on various career options in different fields
- To remold the students behavior with assertive skills and positive attitudes
- To aid students in developing skills like communication, personality, writing and soft skills
- To educate students towards importance of national integration, participating in electoral process etc. by making them to participate in observing important days.

Course Outcomes:

Student will be able to:

- Students will become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
- An all-round development-physical, mental and spiritual health-takes place.
- Self-discipline and discipline with respect society enormously increases.
- University environment becomes more peaceful and harmonious.

List of Activities:

1. Orientation programme about the role of NSS in societal development
2. Swachh Bharath Programme
3. Guest lecture's from eminent personalities on personality development
4. Plantation of saplings/Haritha Haram Programme 5.BloodDonation / Blood Grouping Camp
5. Imparting computer education to schoolchildren
6. Creating Awareness among students on the importance of Digital transactions
7. Stress management techniques
8. Health Checkup Activities
9. Observation of Important days like voters day, World Water Day etc.
10. Road Safety Awareness Programs
11. Energy Conservation Activities
12. Conducting Programme' son effective communication skills
13. Awareness programme's on national integration
14. Orientation on Improving Entrepreneurial Skills
15. Developing Effective Leadership skills
16. Job opportunity awareness programs in various defence, public sector undertakings
17. Skill Development Programmes
18. Creating awareness among students on the Importance of Yoga and other physical activities
19. Creatingawarenessamongstudentsonvariousgovernmentsponsoredsocialwelfare schemes for the people

Note: At least Ten Activities should be conducted in the Semester**.** Each event conducted under Swachh Barath, Plantation and important days like voters day, world water day may be treated as a separate activity.

Course Code	Course Title						Core/Elective
MC 953 SP	**SPORTS**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**20**	**30**	**3U**

Course Objectives:

- To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
- To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
- To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
- To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
- To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

Course Outcomes:

Student will be able to:

- Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.
- Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.
- Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.
- Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.
- Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive.

I. Requirements:

i) Track Pant (students should bring)
ii) Shoes
iii) Volley Ball, Foot Ball and Badminton (Shuttle)
iv) Ground, Court, indoor stadium and swimming pool

II. Evaluation Process:

Total Marks 50
i) 20marks for internal exam (continuous evaluation) a) 8 marks for viva
b) 12marks for sports & fitness

ii) 30marksforendexam a) 10marks for viva
b) 20marks for sports & fitness

Course Code	Course Title						Core/Elective
SI 671 EE	**SUMMER INTERNSHIP**						**Core**
Prerequisite	**L**	**T**	**D**	**P**	**CIE**	**SEE**	**Credits**
-	**0**	**0**	**0**	**2**	**50**	**0**	**2***

Course Objectives: To prepare the students

- To give an experience to the students in solving real life practical problems with all its constraints.
- To give an opportunity to integrate different aspects of learning with reference to real life problems.
- To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes: On successful completion of this course student will be

- Able to design/develop a small and simple product in hardware or software.
- Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
- Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
- Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Industry / R & D Organization / National Laboratory for a period of 4 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional marks are based on the performance of the student at the work place and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

Note: * Students have to undergo summer internship of four weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.