Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

THIRD YEAR 5TH SEMESTER SYLLABUS

Course Code: PC-EI501	**Category:** Professional Core Courses
Course Name: Control System	**Semester: 5**
L-T-P: 3-0-0	**Credit: 3**
Total Lectures: 46	
Pre-Requisite: Engineering mathematics that teaches complex variables and Laplace transform.	

Objectives:

1. To understand the use of transfer function models for analysis of physical systems. and introduce the control system components.
2. To provide adequate knowledge in the time response of systems and steady state error analysis.
3. To accord basic knowledge in obtaining the open lop and closed–lop frequency responses of systems.
4. To introduce state variable representation of physical systems.
5. To introduce stability analysis and design of compensators.

Module No.	Description of Topics	Contact Hrs
1.	**Introduction and overview:** Define the Control problem with examples. Meaning of reference input, Control input, disturbance input and controlled output.	2
2.	**Modeling:** Define Linear Time variant system. Modeling problem for linear time invariant system. Impulse response and convolution integral for LTI system. Transfer function modeling of systems: Input output relation in Laplace domain and Transfer function; Block Diagram reduction, signal flow graph, Mason's Gain theorem. Representation of system and reduction to their transfer function. Modeling of some physical system--- Electrical circuit, Mechanical motors, thermal (room temperature), pneumatic etc. Concepts of States, State space modeling, Solution of state equations, State space to transfer function, transfer function to state space (realization problem). Examples of state space modeling---- Coupled tank system, inverted pendulum, biological system etc	10
3.	**Characterization of Plant:**	10

	Definition of stability. Criteria for stability of a system. Pole-zero concept, Routh-Hurwitz Criterion, Eigen value. Equivalence of pole and Eigen value. Time domain: Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Frequency-domain: Meaning of frequency response, Analytical evaluation of Frequency response of given transfer function. Polar plots, Bode plots and Nyquist plot for representation of frequency response. Gain cross over frequency, phase cross over frequency. Role off rate. DC gain, corner frequency.	
4.	**Characterization of feedback loop:** Advantages of feedback**.** Loop Stability: Bode and Nyquist plot criteria. Bode stability criteria Nyquist stability criteria, loop robustness, gain margin, phase margin, delay margin. Loop performance: Frequency domain parameter sensitivity, tracking, disturbance rejection. Loop performance in time domain: Transient response: Root locus, Steady state response: Steady state error.	9
5.	**Controller Design problem:** PID Control. Frequency domain Loop shaping approach: Lead, Lag, Lag-lead compensator. Model matching approach: Two degree of freedom controller. State feedback approach: Controllability, Observability, Pole placement, State Observer.	8
6.	**Introduction to Optimal Control and Nonlinear Control:** Nonlinear Control: Linearization about operating points. Optical Control: Performance Indices and their optimization. LQR problem.	7

Course Outcomes: At the end of this course, students will understand

1. The modeling of linear-time-invariant systems using transfer function and state-space representations.
2. The concept of stability and its assessment for linear-time invariant systems.
3. Characterization of plants and control loops.

4. The need for compensation, & the methods used for compensation techniques.
5. Linearization of non-linear system
6. Performance indices for optimal control.

Text/References:

1. Automatic Control System: Basic analysis and design by William A. Wolovich, The Oxford Series in Electrical and Computer Engineering.
2. B. C. Kuo, "Automatic Control System", 10th Mc Graw Hill.
3. K. Ogata, "Modern Control Engineering", Prentice Hall, 5th edition.
4. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009
5. Control Systems Engineering, 6th edition, ISV (WSE), by Norman Nise, Wiley
6. Control Systems, Ambikapathy, Khanna Publishing House, 2018.
7. Control Systems, N K Sinha, New Age International Pvt, 2013.

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Course Code: PC-EI502	**Category: Professional Core Courses**
Course Name: Communication Techniques	**Semester:5**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 45	
Pre-Requisite: Knowledge of signals and systems and some probability	

Course Objective:

- To introduce the concepts of various analog modulations and their spectral characteristics.
- To understand the properties of random process.
- To know the effect of noise on communication systems.
- To study the limits set by Information Theory.

Module No.	Description of Topics	Contact Hrs
1.	The elements of communication systems, need for antenna, origin of noise and its effects, important of different noise in communication, importance of SNR in the system design Basic principle of Amplitude Modulation: Time domain representation of AM signal (expression derived using a single tone message), modulation index, frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM. Generation and Detection of AM wave: Different methods of generation and demodulation.	9
2.	Principle of Super heterodyne receivers: Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency. Basic principle of non-linear (FM and PM) modulation, Generation of FM wave and detection of PM wave, relation between FM and PM, generation of PM from FM and vice versa. Sampling theorem, sampling rate, impulse sampling, reconstruction from sampling, Aliasing. Analog Pulse Modulation-PAM (natural and flat top sampling), PPM, PWM. Basic concept of Pulse Code Modulation-Block diagram of PCM, Multiplexing-FDM, TDM.	9
3.	**Digital transmission:** Concept of Quantization & Quantization error, Uniform quantizer, Non-uniform quantizer, A-law and μ-law. Encoding, coding efficiency. Line coding & properties, NRZ & RZ, AMI, Manchester coding, PCM, DPCM. Base band pulse transmission, Matched filter, error rate due to noise, ISI, Raised cosine function, Nyquist criterion	7

	for distortion-less base band binary transmission, Eye pattern, Signal power in binary digital signal.	
4.	Bit rate, Baud rate, Information capacity, Shanon's limit, M-ary encoding, Introduction to the different digital modulation techniques-ASK.FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK. Bit rate, Baud rate, Information capacity, Shanon's limit, M-ary encoding, Introduction to the different digital modulation techniques-ASK.FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK.	7
5.	Introduction to QAM, basic of 8 QAM, 16 QAM. Basic concept of Delta modulating, Adaptive delta modulation. Introduction to the concept DPCM. Basic concept of spread spectrum modulation.	6
6.	**Introduction to coding theory:** Introduction, News value & Information content, Entropy, Mutual information, Information rate, Shanon-Fano algorithm for encoding, Shanon's theorem- source coding theorem, Channel coding theorem, Information capacity theorem. Basic principle of Error control & coding.	7

Outcome:

- Analyze and compare different analog modulation schemes for their efficiency and bandwidth.
- Analyze the behavior of a communication system in presence of noise.
- Investigate pulsed modulation system and analyze their system performance.
- Analyze different digital modulation schemes and can compute the bit error performance.

Text/Reference Books:

Text Books:

1. An Introduction to Analog and Digital communication, Simon Haykin, Wiely India.
2. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
3. Principle of digital communication, P. Chakrabarti, Dhanpat Rai & Co.
4. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford university press

Reference Books:

1. Digital and Analog communication Systems, Leon W Couch II, Pearson Education Asia.
2. Communication Systems, A.B. Calson, Mc Graw Hill.

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Course Code: PC-EI503	**Category: Professional Core Courses**
Course Name: Electromagnetic Theory	**Semester:5**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 45	
Pre-Requisite: Knowledge differential and integral calculas	

Objectives:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields
2. To impart knowledge on the concepts of Electrostatic fields, electrical potential, energy density and their applications. Magneto static fields, magnetic flux density, vector potential and its applications.
3. Different methods of emf generation and Maxwell's equations Electromagnetic waves and characterizing parameters.

Module No.	Description of Topics	Contact Hrs
1.	Introduction: Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems. Introduction to Vector calculus: DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Strokes theorem, Laplacian of a scalar, Classification of vector fields, Helmholtz's theorem. Solution of problems.	9
2.	Scalar and Vector fields, Coulomb's Law and concept of Electric Field, Divergence, the Divergence Theorem and Gauss' Law, Concept of Electrostatic Potential, Poisson's Equation, Energy in the Field, Capacitance, capacitance of common two-plate capacitors, including two-wire capacitors, Dielectrics, dielectric boundary conditions, Solution of Laplace's Equation and Poisson's Equation in 1-D Capacitance. Scalar and Vector fields, Coulomb's Law and concept of Electric Field, Divergence, the Divergence Theorem and Gauss' Law.	9
3.	Concept of Electrostatic Potential, Poisson's Equation, Energy in the Field, Capacitance, capacitance of common two-plate capacitors, including two-wire capacitors, Dielectrics, dielectric boundary conditions, Solution of Laplace's Equation and Poisson's Equation in 1-D Capacitance.	6
4.	Force due to a Magnetic field, Force due to combined Electric and Magnetic fields, Biot-Savart Law, calculation of Magnetic Field for simple coil configurations, Ampere's Law, Magnetic flux, Stokes theorem, Magnetic materials, magnetic boundary conditions, Solution of problems. Electromagnetic fields: Faraday's law, Transformer and	6

	motional emf, Displacement current, Maxwell's equations, Time varying Potential, Time harmonic fields. Solution of problems.	
5.	Electromagnetic wave propagation: Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarization. Solution of problems. Electromagnetic wave propagation: Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarization. Solution of problems	9
6.	Transmission line: Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems.	6

Course Outcomes:

At the end of the course, students will demonstrate the ability

1. To understand the basic laws of electromagnetism.
2. To obtain the electric and magnetic fields for simple configurations under static conditions.
3. To analyze time varying electric and magnetic fields.
4. To understand Maxwell's equation in different forms and different media.
5. To understand the propagation of EM waves.
6. To impart knowledge on the concepts of Electrostatic fields, electrical potential, energy density and their applications. Magneto static fields, magnetic flux density, vector potential and its applications. Different methods of emf generation and Maxwell's equations Electromagnetic waves and characterizing parameters

Text/References:

1. Principles and Applications of Electromagnetic Fields - Plonsey, R.and Collin, R.E., McGraw Hill. 1961.
2. Engineering Electromagnetics - William H. Hayt, Jr. Fifth Edition.TMH.1999
3. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
4. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd,
5. New Delhi, 2009.
6. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.

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Course Code: PE-EI501	**Category: Professional Elective Courses-I**
Course Name: Optical Instrumentation	**Semester:5**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 45	
Pre-Requisite: Knowledge of basic optics, Fundamentals of Electromagnetic theory	

Course Objective:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand the different kind of losses, signal distortion, SM fibers.
- To learn the various optical sources, materials and fiber splicing
- To learn the fiber optical receivers and noise performance in photo detector.

Module No.	Description of Topics	Contact Hrs
1.	**Optical Fibers and Their Properties:** Introduction to optical fiber – fiber characteristics – principles of light propagation through a fiber – Different types of fibers and their properties – Losses in the optical fiber – Dispersion – advantages and disadvantages of optical fibers, Connector and splices. Optical Fibers and Their Properties: Introduction to optical fiber – fiber characteristics – principles of light propagation through a fiber – Different types of fibers and their properties – Losses in the optical fiber – Dispersion – advantages and disadvantages of optical fibers, Connector and splices.	12
2.	**Optoelectronic Components:** Optical sources: LED, Double Heterojunction LED, LD – Optical detectors: PIN, APD – Electro-optic, Magneto optic and Acousto-optic Modulators.	10
3.	**Optical switches –** coupled mode analysis of directional couplers, electro-optic switches. Optical amplifiers - EDFA, Raman amplifier	3
4.	**LASER fundamentals:** Three level and four level lasers –Properties of laser –Laser modes – Resonator configuration –Q-switching and mode locking –Cavity damping –Types of lasers –Gas lasers, solid lasers, liquid lasers, semiconductor lasers	9
5.	**Industrial Application of LASERS:** Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect –Material processing –Laser heating, welding, melting and trimming of material –Removal and vaporization. Medical applications of lasers, laser and tissue	8

	interactive –Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.	
6.	**Holography**– Basic principle - Methods –Holographic interferometry and application.	3

Outcome:

- Recognize the structures of Optical fiber and their properties.
- Understand the principles fiber-optic communication, the components and the bandwidth advantages.
- Understand the properties of the optical fibers and optical components.
- Understand operation of lasers, LEDs, and detectors
- Realize the application of Laser.
- Understand the basic principle of Holography.

Text/Reference Books:

- Optical Fiber Communication – Principles and Practice, J.M. Senior, Prentice Hall of India, 1985.
- Fiber Optics and Optoelectronics by R. P. Khare(2004-07-01). by R. P. Khare | 1 January 2004. Paperback.
- Lasers: Principles,Types and Application-K.R.Nambiar
- Introduction to Optoelectronics, J. Wilson and J.F.B. Hawkes, Prentice Hall of India, 2001.

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Course Code: PE-EI502	**Category: Professional Elective Courses-I**
Course Name: Introduction to MEMS	**Semester:5**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 45	
Pre-Requisite: Knowledge of semiconductor device	

Course Objective:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS.

Module No.	**Description of Topics**	**Contact Hrs**
1.	**Introduction:** Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.	9
2.	**Sensors and Actuators-I:** Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.	9
3.	**Sensors and Actuators-II:** Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.	8

4.	**Micromachining:** Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies –Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.	8
5.	**Mechanics of solids in MEMS:** Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of finite element method, Modeling of coupled electromechanical systems.	4
6.	**POLYMER AND OPTICAL MEMS:** Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.	7

Outcome:

- Ability to understand the working principle of MEMS devices and their application.
- Students will be able to explain micro-sensors, micro-actuators, their types and applications.
- Students will be able to explain about fabrication processes for producing micro-sensors and actuators.
- Ability to understand and analyze linear and digital electronic circuits

Text/Reference Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

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Course Code: PE-EI503	**Category: Professional Elective Courses-II**
Course Name: Embedded System	**Semester:5**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 45	
Pre-Requsite: Microprocessor and Microcontroller	

Objectives:

1. To have knowledge about the basic working of a microcontroller system and its programming in assembly language.

2. To provide experience to integrate hardware and software for microcontroller applications systems.

Module No.	Description of Topics	Contact Hrs
1	**Introduction to Embedded System :** Embedded system VS General computing systems, Purpose of Embedded systems, Design challenge – optimizing design metrics, embedded processor technology, Microprocessor and Microcontroller, Hardware architecture of the real time systems. A/D converter and D/A Converter, RISC vs CISC, Example of Embedded system.	7
2.	**Introduction to AVR microcontroller:** Introduction to AVR (ATmega 328p-pu) microcontroller, pin layout, architecture, program memory, Data Direction register , Port Registers (PORTx), PWM registers (8-bit), ADC registers, basics of communication, overview and interfacing I/O devices with I2C Bus, UART and Serial Peripheral Interchange (SPI) bus, Programming Embedded Systems with AVR (Arduino API).	10
3.	**Introduction to ARM microcontroller:** Architecture of ARM Embedded microcontroller, ARM instruction set, Introduction to ARMv8-A based embedded development board (i.e. Raspberry Pi rev.4), Programming a Raspberry Pi rev.4 using Python 2.7, User defined LED blink using Raspberry Pi GPIOs, communication	

	between an Arduino UNO rev.3 with Raspberry Pi 4 over USB serial.	10
4.	**Embedded operating systems :** Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling; task communication: shared memory, message passing, remote procedure call and sockets, task synchronization: task communication/synchronization issues, task synchronization techniques, device drivers, how to choose an RTOS.	10
5.	**CASE Studies:** i) Interfacing with Temperature Sensor.(AVR MICROCONTROLLER and ARM MICROCONTROLLER Based) ii) Interfacing with Servo Motor.(AVR MICROCONTROLLER and ARM MICROCONTROLLER Based) iii) Interfacing with Gas Sensor.(AVR MICROCONTROLLER and ARM MICROCONTROLLER Based) iv)Interfacing with Ldr light sensor.(AVR MICROCONTROLLER and ARM MICROCONTROLLER Based)	8

Outcomes:

To acquire knowledge about microcontrollers embedded processors and their applications.

1. Foster ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
2. Foster ability to write the programs for microcontroller.
3. Foster ability to understand the role of embedded systems in industry.
4. Design processor and controller based intelligent systems for real life problems.

Text/References:

1. Raj Kamal, Embedded systems- Architecture, Programming and Design, McGraw Hill Education (India) Pvt. Ltd.
2. Dhananjay Gadre, “Programming and Customizing the AVR Microcontroller”; McGraw Hill Education, 2014.
3. Elliot Williams, “AVR Programming: Learning to Write Software for Hardware”, Maker Media, Incorporated, 2014
4. An Embedded Software Primer – David E. Simon, Pearson Ed., 2005.

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Course Code: PE-EI504	**Category: Professional Elective Courses-II**
Course Name: Power Electronics and Drives	**Semester:5**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 46	
Pre-Requsite: Kowledge of Analog Electronics	

Objectives:

1. To present the principles of power electronics and its applications.
2. The student will learn analysis and design techniques for switch -mode converters using the buck, boost, and buck-boost topologies.
3. The course will emphasize complex theoretical analysis and computer simulation tools as course project.

Module No.	Description of Topics	Contact Hrs
1	**Power switching devices:** Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.	8
2.	**Thyristor rectifiers:** Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.	7
3.	**DC-DC buck converter:** Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.	5
4.	**Single-phase voltage source inverter Single-phase voltage source inverter:** Power circuit of single-phase voltage source inverter, switch states	10

	and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage	
5.	**Three-phase voltage source inverter:** Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation	8
6.	**Electric drives:** Introduction and classification. DC motor drives: speed-torque characteristics of shunt, series, PMDC motors; dynamic models; speed and position control methods; AC motor drives: d-q model of induction motor; constant flux speed control structure; vector control model; vector control structure.	8

Course Outcomes:

1. At the end of this course students will demonstrate the ability to Understand the differences between signal level and power level devices.
2. Analyse controlled rectifier circuits.
3. Learn about the control of various converters.
4. Analyse the operation of DC-DC choppers.
5. Analyse the operation of voltage source inverters.
6. Develop capability to choose a suitable DC and AC Motor and Power Electronic Converter
7. Develop design knowledge on how to design the speed control and current control loops of a DC Motor drive

Text/References:

1. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and v Design”, John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2007.
4. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.
5. B. K. Bose, Modern Power Electronics and AC Drives, Pearson Education, 2003.
6. Fundamentals of Electric Drives, Gopal K Dubey, Narosa

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Course Code: OE-EI501	**Category: Open Elective Courses-I**
Course Name: Object Oriented Programming Language	**Semester:5**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 45	
Pre-Requisite:	

Course Objective:

- To understand Object Oriented Programming concepts and basic characteristics of Java.
- To know the principles of packages, inheritance and interfaces.
- To define exceptions and use I/O streams.
- To develop a java application with threads and generics classes.
- To design and build simple Graphical User Interfaces

Module No.	Description of Topics	Contact Hrs
1.	**Introduction to oop and java fundamentals** Object Oriented Programming – Abstraction – objects and classes – Encapsulation- Inheritance – Polymorphism- OOP in Java –	5
2.	**Characteristics of Java** – The Java Environment – Java Source File Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers – static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages – JavaDoc Comments.	5
3.	**Inheritance And Interfaces** Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning -inner classes, ArrayLists – Strings	9
4.	**Exception Handling And I/O** Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	8
5.	**Multithreading And Generic Programming Differences:** Between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, and thread groups. Generic Programming – Generic classes –	9

	generic methods – Bounded Types – Restrictions and Limitations.	
6.	**Event Driven Programming** Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images – Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows – Menus – Dialog Boxes.	9

Outcome:

- Develop Java programs using OOP principles.
- Develop Java programs with the concepts inheritance and interfaces.
- Build Java applications using exceptions and I/O streams.
- Develop Java applications with threads and generics classes.
- Develop interactive Java programs using swings

Text/Reference Books:

Text Books:

1. Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education, 2011.
2. Steven Holzner, ―Java 2 Black book‖, Dreamtech press, 2011.
3. Timothy Budd, ―Understanding Object-oriented programming with Java‖, Updated Edition, Pearson Education, 2000.
4. R.S. Salaria – Mastering Object-Oriented Programming using C++, Khanna Publishing House, 2018.

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Course Code: OE-EI502	**Category: Open Elective Courses-I**
Course Name: Database Management Systems	**Semester:5**
L-T-P: 3-0-0	**Credit:3**
Total Lectures: 45	
Pre-Requisite:	

Course Objective:

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with• the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Module No.	Description of Topics	Contact Hrs
1.	**Introduction:** Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.	4
2.	**Entity-Relationship Model :** Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.	6
3.	**Relational Model:** Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.	5
4.	**SQL and Integrity Constraints:** Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.	8
5.	**Relational Database Design:** Functional Dependency, Different anamolies in designing a	9

	Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF	
6.	**Internals of RDBMS** Physical data structures, Query optimization : join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management : transaction model properties, state serializability, lock base protocols, two phase locking.	7
7.	**File Organization & Index Structures:** File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .	6

Course Outcomes:

At the end of the course, students will demonstrate following abilities

- For a given query write relational algebra expressions for that query and optimize the developed expressions
- For a given specification of the requirement design the databases using ER method and normalization.
- For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
- For a given query optimize its execution using Query optimization algorithms
- For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
- Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Text/References:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education
4. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

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Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI591	**Category:** Professional core Courses
Corse Name : Control System Lab	**Semester:** 5
L-T-P :0-0-3	**Credit:** 1.5
Pre-requisites: No Pre-requisites	

Laboratory Experiments:

1.	Familiarization with MATLAB control system toolbox, MATLAB-SIMULINK toolbox and PSPICE.
2.	Study of step response for first and second order system with unity feedback with display on CRT screen and calculation of parameters for different system designs.
3.	Simulation of impulse response for types 0, 1 and 2 with unity feedback using MATLAB and PSPICE.
4.	Determination of root-locus, Bode plot, Nyquist plot using MATLAB toolbox for a given second order transfer function and listing of the specifications.
5.	Determine the effect of P, I, D actions on first order simulated process and obtaining the system transfer functions from Bode plot
6.	Lag and lead compensation – Magnitude and phase plot
7.	Create the state space model of a linear continuous system.

Course Outcome:

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response.
- To assess the system performance using time domain analysis and methods for improving it.
- To assess the system performance using frequency domain analysis and techniques for improving the performance.
- To design various controllers and compensators to improve system performance.

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Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : OE-EI591	**Category:** Open Elective Courses-I
Corse Name : Object Oriented Programming language Lab	**Semester:** 5
L-T-P: 0-0-3	**Credit:** 1.5
Pre-requisites: No Pre-requisites	

Laboratory Experiments:

1	Assignments on class, constructor, overloading, inheritance, overriding
2	Assignments on wrapper class, arrays
3	Assignments on developing interfaces- multiple inheritance, extending interfaces
4	Assignments on creating and accessing packages
5	Assignments on multithreaded programming
6	Assignments on applet programming

Note: Use Java for programming
Preferably download "**java_ee_sdk-6u4-jdk7-windows.exe**" from
http://www.oracle.com/technetwork/java/javaee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html

Course Outcome:

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.
- Understand advanced features of C++ specifically stream I/O, templates and operator overloading
- Understand how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism

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(Applicable from the academic session 2018-2019)

Course Code : OE-EI592	**Category:** Open Elective Courses-I
Course Name : Data Base Management System Lab	**Semester:** 5
L-T-P: 0-0-3	**Credit:** 1.5
Pre-requisites: No Pre-requisites	

Laboratory Experiments:	
1.	**Creating Database** • Creating a Database • Creating a Table • Specifying Relational Data Types • Specifying Constraints • Creating Indexes
2.	**Table and Record Handling** • INSERT statement • Using SELECT and INSERT together • DELETE, UPDATE, TRUNCATE statements • DROP, ALTER statements
3.	**Retrieving Data from a Database** • The SELECT statement • Using the WHERE clause • Using Logical Operators in the WHERE clause • Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause • Using Aggregate Functions • Combining Tables Using JOIN • Sub queries
4.	**Database Management** • Creating Views • Creating Column Aliases • Creating Database Users • Using GRANT and REVOKE

Course Outcome:

- Understand, appreciate and effectively explain the underlying concepts of database technologies.
- Design and implement a database schema for a given problem-domain.
- Normalize a database.
- Populate and query a database using SQL DML/DDL commands.
- Programming PL/SQL including stored procedures, stored functions, cursors, packages.
- Design and build a GUI application using a 4GL

Course Code : PC-EI592	**Category:** Professional Core Courses
Course Name : Industrial Instrumentation Lab	**Semester:** 5
L-T-P: 0-0-3	**Credit:** 1.5
Pre-requisites: Knowledge of sensor & Transducers	

Laboratory Experiments:

1.	Calibration of Pressure Gauge using Dead Weight Tester.
2.	Study of Thermocouple characteristics and Measurement of Temperature with it.
3.	Study of RTD characteristics and Measurement of Temperature with it.
4.	Measurements of flow rate and velocity of fluid flow by head type flow meter.
5.	Measurements of flow rate and velocity of fluid flow by Variable Area type flow meter.
6.	Measurement of level using capacitive type level instrument.
7.	Measurement of moisture using moisture analyser
8.	Measurement of viscosity

Course Outcome: After the successful completion of the course the students will be able to:

1. Illustrate the different methods for the measurement of length and angle
2. Elucidate the construction and working of various industrial devices used to measure pressure, level and flow.
3. Explicate the construction and working of various industrial devices used to measure temperature, level, vibration, viscosity and moisture.
4. Ability to analyze, formulate and select suitable sensor for the given industrial applications
5. Demonstrate a working knowledge of safety practices used in the measurement and control of real time processes.
6. Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes.

Course Code : EI-581	**Category:** Seminar
Course Name : Seminar	**Semester:** 5
L-T-P: 0-0-4	**Credit:** 2
Pre-requisites: No Pre-requisite	