BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

ELECTRICAL ENGINEERING (EE)

5th Semester				6th Semester			
Code	**Subjects**	**L-T-P**	**Credit**	**Code**	**Subjects**	**L-T-P**	**Credit**
	Theory				**Theory**		
HSSM3303	Environmental Engineering & Safety			HSSM3302	Optimization in Engineering		
	or	3-0-0	3		or	3-0-0	3
HSSM3302	Optimization in Engineering			HSSM3303	Environmental Engineering & Safety		
PCEC4303	Control Systems Engineering	3-0-0	3	PCEL4303	Microprocessors & Microcontrollers	3-0-0	3
PCEL4301	Power Electronics	3-0-0	3	PCEE4301	Transmission and Distribution System	3-0-0	3
PCEL4302	Electrical Machines-II	3-1-0	4	PCEE4302	Electromagnetic Theory	3-0-0	3
	Professional Elective-I (Any one)	3-0-0	3		*Professional Elective-II (Any one)*	3-0-0	3
PEEC4302	Fibre Optics & Optoelectronics Devices			PEEL5303	Electric Drives		
PEEL5302	Renewable Energy Systems			PCEE4304	Communication Engineering		
PEEL5301	Sensors and Transducers			PCEC4304	Digital Signal Processing		
	Free Elective-I (Any one)	3-0-0	3		*Free Elective-II (Any one)*	3-0-0	3
FESM6301	Numerical methods			PCCS4304	Operating Systems		
PCBM4301	Elements of Biomedical Instrumentation			PEEC4304	Computer Networks &Data Communication		
FEEC6301	Data Base Management Systems			PEME5305	Robotics & Robot Application		
PCIT4303	Java Progamming			FEEE6301	Industrial Process Control and Dynamics		
	Theory Credits		**19**		**Theory Credits**		**18**
	Practical/Sessional				**Practical/Sessional**		
PCEC7303	Control & Instrumentation Lab	0-0-3	2	PCEL7303	Microprocessor & Microcontroller Lab.	0-0-3	2
PCEL7301	Power Electronics Lab.	0-0-3	2	PCEL7304	Machine Design & Simulation Lab.	0-0-3	2
PCEL7302	Electrical Machines Lab-II	0-0-3	2	PEEL7303	Electric Drives Lab /	0-0-3	2
				PCEE7304	Communication Engineering Lab /		
				PCEC7304	Digital Signal Processing Lab		
	Practical/Sessional Credits		**06**		**Practical/Sessional Credits**		**06**
	TOTAL SEMESTER CREDITS		**25**		**TOTAL SEMESTER CREDITS**		**24**
	TOTAL CUMULATIVE CREDITS		**136**		**TOTAL CUMULATIVE CREDITS**		**160**

HSSM3303 ENVIRONMENTAL ENGINEERING & SAFETY

(3-0-0)

Module – I

Ecological Concepts: Biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Oxygen cycle, Nitrogen cycle etc., Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law. Chemistry in Environmental Engineering: Atmospheric chemistry, Soil chemistry. Noise pollution-Noise standards, measurement and control. Water Treatment: water quality standards and parameters, Ground water. Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.

Module – II

(a)Waste Water Treatment: DO and BOD of Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production.

(b)Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

(c) Solid waste, Hazardous waste management, Solid Waste Management, Source classification and composition of MSW: Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous Waste Management, Hazardous waste and their generation, Transportation and treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing,

Module – III

Occupational Safety and Health Acts, Safety procedures, Type of Accidents, Chemical and Heat Burns, Prevention of Accidents involving Hazardous substances, Human error and Hazard Analysis. Hazard Control Measures in integratednsteel industry, Petroleum Refinery, L.P.G. Bottling, Pharmaceutical industry. Fire Prevention – Detection, Extinguishing Fire, Electrical Safety, Product Safety. Safety Management- Safety Handling and Storage of Hazardous Materials, Corrosive Substances, Gas Cylinders, Hydro Carbons and Wastes. Personal Protective Equipments.

Text Book :

1. Environmental Engineering Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Environmental Engineering by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack
3. Industrial Safety Management, L. M. Deshmukh, Tata McGraw Hill Publication.

Reference Books

1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGraw Hill International Edition, 2004
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
6. Industrial Safety Management and Technology, Colling. D A – Prentice Hall, New Delhi.

HSSM3302 **OPTIMIZATION IN ENGINEERING** (3-0-0)

Module-I **(10 Hours)**

Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.

Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming

Module-II **(10 Hours)**

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method

Assignment problems: Hungarian method for solution of Assignment problems

Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems

Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Module-III **(10 Hours)**

Non-linear programming: Introduction to non-linear programming.

Unconstraint optimization: Fibonacci and Golden Section Search method.

Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method

Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming

Introduction to Genetic Algorithm.

Recommended text books

1. A. Ravindran, D. T. Philips, J. Solberg, " *Operations Research- Principle and Practice*", Second edition, Wiley India Pvt Ltd
2. Kalyanmoy Deb, " *Optimization for Engineering Design*", PHI Learning Pvt Ltd

Recommended Reference books:

1. **S**tephen G. Nash, A. Sofer, " *Linear and Non-linear Programming*", McGraw Hill
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis," *Engineering Optimization*", Second edition, Wiley India Pvt. Ltd
3. H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, "*Operations Research*", Eighth Edition, Pearson Education
4. F.S.Hiller, G.J.Lieberman, " *Operations Research*", Eighth Edition, Tata McDraw Hill
5. P.K.Gupta, D.S.Hira, "*Operations Research*", S.Chand and Company Ltd.

PCEC4303 **CONTROL SYSTEM ENGINEERING** (3-0-0)

Module-I : ***(12 Hours)***

Introduction to Control Systems : Basic Concepts of Control Systems, Open loop and closed loop systems, Servo Mechanism/Tracking System, Regulators, Mathematical Models of Physical Systems: Differential Equations of Physical Systems: Mechanical Translational Systems, Mechanical Acceloroments, Retational systems, Gear Trains, Electrical Systems, Analogy between Mechanical and electrical quanties, Thermal systems, fluid systems, Derivation of Transfer functions, Block Diagram Algebra, Signal flow Graphs, Mason's Gain Formula. Feedback characteristics of Control Systems: Effect of negative feedback on sensitivity, bandwidth, Disturbance, linearizing effect of feedback, Regenerative feedback.

Control Components : D.C. Servomotors, A.C. Servomotors, A.C. Tachometer, Synchros, Stepper Motors.

Module-II : ***(15 Hours)***

Time response Analysis : Standard Test Signals : Time response of first order systems to unit step and unit ramp inputs. Time Response of Second order systems to unit step input, Time Response specifications, Steady State Errors and Static Error Constants of different types of systems. Generalised error series and Gensalised error coefficients, Stability and Algebraic Criteria, concept of stability, Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion, Application of the Routh stability criterion to linear feedback system, Releative stability by shifting the origin in s-plane.

Root locus Technique: Root locus concepts, Rules of Construction of Root locus, Determination of Roots from Root locus for a specified open loop gain, Root contours, Systems with transportation lag. Effect of adding open loop poles and zeros on Root locus.

Module-III : ***(13 Hours)***

Frequency Response Analysis : Frequency domain specifications, correlation between Time and Frequency Response with respect to second order system, Polar plots, Bode plot. Determination of Gain Margin and Phase Margin from Bode plot.

Stability in frequency domain : Principle of argument, Nyquist stability criterion, Application of Nyquist stability criterion for linear feedback system.

Closed loop frequency response : Constant Mcircles, Constant N-Circles, Nichol's chart.

Controllers : Concept of Proportional, Derivative and Integral Control actions, P, PD, PI, PID controllers. Zeigler-Nichols method of tuning PID controllers.

Text Books :

1. Modern Control Engineering by K. Ogata, 5th edition PHI.
2. Control Systems Engg. by I.J. Nagrath and M.Gopal, 5th Edition, New Age International Publishers (2010).
3. Modern Control Systems by Richard C.Dorf and Robert H. Bishop, 11th Ed (2009), Pearson

Reference Books :

1. Design of Feedback Control Systems by R.T. Stefani, B. Shahian, C.J. Savator, G.H. Hostetter, Fourth Edition (2009), Oxford University Press.
2. Control Systems (Principles and Design) by M.Gopal 3rd edition (2008), TMH.
3. Analysis of Linear Control Systems by R.L. Narasimham, I.K. International Publications
4. Control Systems Engineering by S.P. Eugene Xavier and J. Josheph Cyril Babu, 1st Edition (2004), S. Chand Co. Ltd.
5. Problems and solutions in Control System Engineering by S.N. Sivanandam and S.N. Deepa, Jaico Publishing House.

PCEL4301 **POWER ELECTRONICS** (3-0-0)

Module-1 **12 Lecturers**

1. Power semiconductor devices: Switching and V-I characteristic of devices Thyristor family: SCR, TRIAC,GTO,RCT,MCT, and Transistor Family: BJT, IGBT, and MOSFET Ch: (1.3, 1.4, 4.2.2, 4.2.3, 4.3.2, 4.6, 4.10, 7.2, 7.4,7.5).
2. (a) Triggering Methods: SCR: UJT and R-C triggering scheme,Power Transistor: MOSFET Gate drive, BJT base drive, IGBT gate drive, Isolation of gate and base drive. Ch: (17.2, 17.3,17.4, 17.5).

   (b) Protection of Devices: SCR: Over voltage, over current, dv/dt, di/dt, Gate Protection. Transistor: protection of power BJT, IGBT and power MOSFET, dv/dt & di/dt limitation. Ch: (18.4, 18.5, 18.6, 18.7, 18.8, 4.8, 7.9, 7.10)

Module-2 **12 Lectures**

3(a). AC to DC converter: Un controlled Diode rectifier : Single phase half wave and full wave rectifiers with R-L and R -L-E load ,3 phase bridge rectifier with R-L and R-L-E load Ch: (3.2, 3.3, 3.4, 3.5, 3.8)

Controlled rectifiers : Principle of phase controlled converter operation, single phase full converter with R-L and R-L-E load,3 phase full converter with R-L and R-L-E load ,single phase semi converter with R-L and R-L-E load, 3 phase semi converter with R-L and R-L-E load. Ch: (10.2, 10.3, 10.6, 10.9, 10.10)

Single phase PWM rectifier, Three phase PWM rectifier.

Ch: (10.8.3, 10. 8.4, 10.8.5)

3(b).AC –AC converter : AC voltage controller: Single phase bi-directional controllers with R and R-L load, single phase cycloconverters, ac-voltage controllers with PWM control. Ch: (11.4, 11.5, 11.9.1, 11.10)

Module 3 **12 Lectures**

3(c). DC to DC converter: Classification: First quadrant, second quardrant, first and second quardrant, third and fourth quardrant, fourth quardrant converter.

Switching mode regulators: Buck regulators, Boost regulators, Buck-Boost regulators, Cuk regulators, Isolated Types: Fly Back Converters, Forward converters, Push Pull Converters, Bridge Converter.

Ch: (5.7,5.8.1,5.8.2,5.8.3,5.8.4)

3(d) DC to AC converter: Inverters: PWM inverters, Single phase Bridge Inverters, 3-Phase Inverters-180 deg. conduction, 120 deg. conduction. voltage control of 3-Phase Inverters: Sinusoidal PWM , space vector modulation, Current Source Inverter, Zero Current Switching resonant inverters, Zero Voltage Switching resonant inverter. Ch: (6.4, 6.5, 6.8.1, 6.8.4, 6.10, 8.8, 8.9)

4. Applications: UPS, SMPS, Battery Chargers, Electronic Ballast, Static VAR Compensator. Ch: (14.2.1, 14.2.2, 14.2.3, 14.2.4,14.2.6, 13.6.4)

Text Books:

1.Power Electronics: Circuits,Devices and Applications by M H Rashid, 3rd Edition, Pearson

Reference Books:

1. Power Electronics: Principles and Applications by J. Vithayathil, TMH Edition
2. Power Converter Circuits by W Shepherd and L Zhang, CRC, Taylor and Francis, Special Indian Edition
3. Power Electronics: Converters , Applications, and Design by Mohan, Undeland and Robbins, Wiley Student Edition.

PCEL4302 **ELECTRICAL MACHINES-II** (3-1-0)

MODULE-I **[15 HOURS]**

1. Three Phase Synchronous Generators (5 hours)

Synchronous Generator Construction (both Cylinderical Rotor and Salient Pole type), The Speed of Rotation of a Synchronous Generator, Induced voltage in A.C. Machines, The Internal Generated Voltage of a Synchronous Generator, The Effect of Coil Pitch on A.C. Machines, Distributed Windings in A.C. Machines, The Rotating Magnetic Field, The Equivalent Circuit of a Synchronous Generator (Armature Reaction Reactance, Synchronous Reactance and Impedance). **[Chapman: Ch. 5.1, 5.2, 4.4, 5.3, B.1, B.2, 4.2, 5.4]**

2. Cylindrical Rotor type Three Phase Synchronous Generators (4+2=6 hours)

(a) The Phasor Diagram of a Synchronous Generator, Power and Torque in Synchronous Generators (Power Angle Equation and Power Angle Characteristic), Measuring Synchronous Generator Model Parameters (Open Circuit and Short Circuit Tests and Determination of Synchronous Impedance and Reactance, The Short Circuit Ratio), Voltage Regulation and Speed Regulation. **[Chapman: Ch. 5.5, 5.6, 5.7, 4.8] (4 hours)**

(b) Zero Power Factor characteristic, Potier Reactance, Voltage Regulation by Synchronous Impedance Method, Potier Reactance (Zero Power Factor = ZPF) Method. **[M.G.Say: Selected Portions of Ch.10.2, 10.3, 10.4, 10.15] (2 hours)**

3. Salient Pole type Three Phase Synchronous Generators (3+1=4 hours)

Two Reaction Concept, Development of the Equivalent Circuit of a Salient Pole type Three Phase Synchronous Generator (Direct axis and Quadrature axis Reactances, Phasor Diagram for various load power factors,), Torque and Power Equations of Salient Pole Synchronous Generator (Power Angle Equation and Power Angle Characteristic with stator resistance neglected). **[Chapman: Appendix C.1, C.2] (3 hours)**

Slip Test for determination of Direct axis and Quadrature axis Reactances. **[M.G.Say: Ch.10.15] (1hour)**

MODULE-II **[12 HOURS]**

4. Parallel operation of Three Phase A.C. Synchronous Generators (4 hours)

The Conditions Required for Paralleling, The General Procedure for Paralleling Generators, Frequency - Real Power and Voltage – Reactive Power Characteristics of a Three Phase Synchronous Generator, Operation of Generators in Parallel with large Power Systems, Operation of generators in parallel with other Generators of the same size. **[Chapman: Ch.5.9]**

5. Three Phase Synchronous Motors (8 hours)

Basic Principles of Motor operation, Steady State Synchronous Motor operation, Starting Synchronous Motors, Synchronous Generators and Synchronous Motors, Synchronous Motor Ratings. **[Chapman: Ch.6.1, 6.2, 6.3, 6.4, 6.5]**

MODULE-III **[13 HOURS]**

6. Three Phase Transformers (5+3=8 hours)

Constructional features, Three-Phase Transformer connections, The per unit system for Three Phase Transformer, Transformer Ratings and Related problems, Two Single-Phase Transformers connected in Open Delta (V-Connection) and their rating, T-

Connection (Scott Connection) of Two Single-Phase Transformers to convert Three-Phase balanced supply to Two-Phase balanced supply.**[Chapman: Ch.2.10, 2.11, 2.12] (5 hours)**

Transformer Three phase Connections: Various Phase Displacements (0^o, 180^o,$+30^o$ and -30^o), Connection Diagrams and Phasor Diagrams of various Vector Groups (Yy0, Dd0, Dz0, Yy6, Dd6, Dz6, Yd1, Dy1, Yz1, Yd11, Dy11, Yz11), Parallel operation of three phase transformers. **[M.G.Say: Ch.5.9, 5.15] (3 hours)**

7. Single Phase and Special Purpose Motors (5 hours)

The Universal Motor, Introduction to Single Phase Induction Motors, Starting of Single Phase Induction Motors, Speed Control of Single Phase Induction Motors, The Circuit Model of a Single Phase Induction Motor, Other types of Motors: Reluctance Motors, Stepper Motors. **[Chapman: Ch.10.1, 10.2, 10.3, 10.4, 10.5, 10.6]**

TEXT BOOKS:

(1) Stephen J. Chapman-'Electric Machinery and Fundamentals'- McGraw Hill International Edition, (Fourth Edition), 2005.

(2) M.G.Say-'Alternating Current Machines', English Language Book Society (ELBS) /Longman, 5^{th} Edition, Reprinted 1990.

REFERENCE BOOKS:

(1) P.C.Sen-'Principles of Electric Machines and Power Electronics'-2^{nd} Edition, John Wiley and Sons, Wiley India Reprint, 2007.

(2) B.S.Guru & H.R.Hiziroglu-'Electric Machinery & Transformers'-3^{rd} Ed-Oxford Press, 2010.

PEEC4302FIBER OPTICS AND OPTOELECTRONICS DEVICES

Unit 1 (10 hours)

Fundamental of fiber optics, Different generations of optical fiber communication systems. Optical fiber structure, Fiber types, step index fiber and graded index fiber, ray propagation, total internal reflection, Numerical Aperature, acceptance angle. Wave propagation in a cylindrical wave guides, modal concept, V-number, power flow in step index fiber and graded index fiber, attenuation (absorbtion, scattering and bending) and dispersion (inter and intramodal, chromatic, wave guide and polarization) in fiber, dispersion shifted and dispersion flattened fiber

Unit 2 (12 hours)

Fiber fabrication, Double crucible method, Fiber optic cables, Connector and splice. Losses during coupling between source to fiber, fiber to fiber. Schemes for coupling improvement.

Optoelectronic Sources, LED, ILD,light source materials, Radiation Pattern modulation capability.

Unit 3 (13 hours)

Optoelectronic Detector, PIN AND APD, Responsivity,Band width, Detector noise ,equivalent circuit and SNR calculation.

Optoelectronic Modulators, Basic principle, Electro optic and Acousto optic modulators, Optical Amplifier, Semiconductor optical Amplifier and Erbium Doped Fiber Amplifier, Solar cells, basic principle,heterojunction,cascadedsolar cell,Schottky Barrier cells,WDM components-couplers, isolators ,circulators, filters. Optical switching-self electro optic effect Device, switching speed and energy

Text Books

1. Fiber optics and Optoelectronics, R.P.Khare, Oxford University Press(selected sections from chapters 1,2,3,4,5,6,7,8,9and10)
2. Semiconductor Optoelectronic Devices, Pallab Bhatttacharya, second edition, Pearson Education (selected sections from chapters 10 and 11)

Reference Books

1. Fiber optic communications, Joseph C Palais, fourth edition, Pearson Education.
2. Optical Fiber Communications, Keiser G, 4th Edition Tata McGraw Hill Education Private Limited.
3. Optical Fiber Communication Principles and practice,Senior J,Prentice Hall of India.

PEEL5302 **RENEWABLE ENERGY SYSTEMS**

Module I **(5 Hours)**

Introduction

Fossil fuel based systems Impact of fossil fuel based systems, Non conventional energy – seasonal variations and availability, Renewable energy – sources and features, Hybrid energy systems, Distributed energy systems and dispersed generation (DG)

Module II: **(20 Hours)**

Solar Photovoltaic systems:

Operating principle, Photovoltaic cell concepts, Cell, module, array, Series and parallel connections, Maximum power point tracking, Applications, Battery charging, Pumping, Lighting, Peltier cooling

Solar processes and spectral composition of solar radiation; Radiation flux at the Earth's surface. Solar collectors. Types and performance characteristics. Applications

Wind Energy:

Wind energy conversion; efficiency limit for wind energy conversion, types of converters, aerodynamics of wind rotors, power ~ speed and torque ~ speed characteristics of wind turbines, wind turbine control systems; conversion to electrical power: induction and synchronous generators, grid connected and self excited induction generator operation, constant voltage and constant frequency generation with power electronic control, single and double output systems, reactive power compensation; Characteristics of wind power plant. Applications:

Module III **(15 hours)**

Biomass Power:
Operating principle, Combustion and fermentation, Anaerobic digester. Wood gassifier, Pyrolysis, Applications, Bio gas, Wood stoves, Bio diesel, Combustion engine. Application,

Hybrid Systems
Need for Hybrid Systems, Range and type of Hybrid systems, Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles

Text Books:

1. D. P. Kothari, K. C. Singal, R. Ranjan, *Renewable Energy Sources and Emerging Technologies*, Prentice Hall of India, New Delhi, 2008.
2. B.H.Khan, Non-Conventional Energy Resources, Tata McGrawHill, 2009
3. S. N. Bhadra, D. Kastha, S. Banerjee, *Wind Electrical Systems*, Oxford Univ. Press, New Delhi, 2005.

Reference Books:

1. S. A. Abbasi, N. Abbasi, Renewable Energy Sources and Their Environmental Impact, Prentice Hall of India, New Delhi, 2006.

PEEL5301 **SENSORS AND TRANSDUCERS**

Module –1 **10 lectures**

Elements of a general measurement system;
Static Characteristics: systematic characteristics, statistical characteristics, calibration;
Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, dynamic error in measurement systems. (Bentley: Chapters 1-4)

Module-2 **14 lectures**

Sensing elements: Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages.
Capacitive sensing elements: variable separation, area and dielectric;
Inductive sensing elements: variable reluctance and LVDT displacement sensors;
Electromagnetic sensing elements: velocity sensors,
Thermoelctric sensing elements: laws, thermocouple characteristics, installation problems, cold junction compensation.
IC temperature sensor
Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.
(Bentley: Sections 8.1 to 8.6; Ghosh: Section 10.3 to 10.4).

Module-3 **10 lectures**

Signal Conditioning Elements:
Deflection bridges: design of resistive and reactive bridges, push-pull configuration for improvement of linearity and sensitivity
Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation.
(Bentley: Sections 9.1 to 9.3; Ghosh: Sections 15.1 and 15.2) .

Text Books:

1. Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi, 2007.
2. Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning, New Delhi, 2009.
3. Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.

Reference Books:

1. Measurement Systems Application and Design- E.O. Doeblin (4/e), McGraw-Hill, International, NY.
2. Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY, 2003.
3. Industrial Instrumentation- T.R. Padmanabhan, Springer, London, 2000.

Free Electives

FESM6301 **NUERICAL METHODS**

Unit –I (10 hors)
Approximation of numbers, Significant figures, Accuracy and precision, Error definition, Round off errors, Error propagation, Total numerical error
Roots of equation: Bisection ethos, False-position method, Fixed point iteration, Newton-Raphson method, Secant method, Convergence and error analysis, System of non-linear equations
Linear algebraic equation: LU decomposition, The matrix inversion, Error analysis and system conditions, Gauss-Siedel method

Unit-II (10 hours)
Interpolation: Newton's divided difference interpolating polynomial, Lagrange interpolating polynomial, Spline interpolation.
Numerical integration: The Trapezoidal rule, Simpson's rule, Newton-Cotes algorithm for equations, Romberg integration, Gauss quadrature

Unit-III(10 Hours)
Ordinary differential equation: Euler method, Improvement of Euler's method, Runge-Kutta methods, System of equations, Multi step methods,
General methods for boundary value problems, Eigen value problems

(Algorithm and error analysis of all methods are included)

Text Book:

1. S.C. Chapra, R.P.Canale," *Numerical methods for Engineers*", Fifth edition, THM Publication.

Reference Books

1. S. Kalavathy, " *Numerica methods*", Thomson/ Cengage India
2. K.E. Atkinson," *Numerical analysis,*" Second edition, John Wiley & Sons.

PCBM4301**ELEMENTS OF BIOMEDICAL INSTRUMENTATION** (3-0-0)

Module I (13 Hours)

(i) What is bioengineering: Engineering versus Science, Bioengineering, Biochemical Engineering, Biomedical Engineering, and Career Opportunities.

(ii) Medical Instrumentation: Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, use of microprocessors in medical instruments, PC based medical Instruments, general constraints in design of medical Instrumentation system & Regulation of Medical devices.

(iii) Bioelectrical Signals & Electrodes: Origin of Bioelectric Signals, Electrocardiogram, Electroencephalogram, Electromyogram, Electrode-Tissue Interface, Polarization, Skin Contact Impedance, Motion Artifacts.

(Text Book-I-Chapter-0 , Text Book-II —Chapter-1, Text book-II- Chapter-2)

Module -II (14 Hours)

(iv) Electrodes for ECG: Limb Electrode, Floating Electrodes, Prejelled disposable Electrodes, Electrodes for EEG, Electrodes for EMG.

(v) **Physiological Transducers:** Introduction to Transducers, Classification of Transducers, Performance characteristics of Transducers, Displacement, Position and Motion Transducers.

(Text book-II- Chapter-2 , Text Book-II, Chapter- 3)

Module –III (13 Hours)

(vi) **Physiological Transducers:** Strain gauge pressure transducers, Thermocouples, Electrical Resistance Thermometer, Thermister, Photovoltaic transducers, Photo emissive Cells & Biosensors or Biochemical sensor

(vii) Recording Systems: Basic Recording systems, General considerations for Signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling)

(Text Book-II, Chapter- 3, Text Book-II-Chapter-4)

Text Books:-

1. Introduction to Biomedical Engineering by Michael M. Domach, Pearson Education Inc,-2004
2. II-Hand Book of Biomedical Instrumentation-2nd Ed by R.S.Khandpur, Tata McGraw Hill, 2003.

Reference Books:

(1) Introduction to Biomedical equipment technology, 4e. By JOSEPH.J.CAAR & JOHN M.BROWN (Pearson education publication)

(2) Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & sons publications

(3) Leslie. Cromwell – Biomedical instrumentation & measurements, 2e PHI

(4) Dr. M. Arumugam – Biomedical instrumentations, Anuradha Publishers.

FEEC6301 **DATABASE MANAGEMENT SYSTEM** (3-0-0)

Module I : (10 hours)

Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages. Data models - Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

Module II : (12 hours)

Relation Query Languages, Relational Algebra and Relational Calculus, SQL.

Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.

Query Processing Strategy.

Module III: (10 hours)

Transaction processing: Recovery and Concurrency Control. Locking and Timestamp based Schedulers.

Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques

Text Books:

1. Database System Concepts by Sudarshan, Korth (McGraw-Hill Education)
2. Fundamentals of Database System By Elmasari & Navathe- Pearson Education

References Books:

(1) An introduction to Database System – Bipin Desai, Galgotia Publications
(2) Database System: concept, Design & Application by S.K.Singh (Pearson Education)
(3) Database management system by leon &leon (Vikas publishing House).
(4) Fundamentals of Database Management System – Gillenson, Wiley India
(5) Database Modeling and Design: Logical Design by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau, "", 4th Edition, 2005, Elsevier India Publications, New Delhi

PCIT4303 **JAVA Programming** (3-0-0)

Module – I **12 Hrs**

Introduction to Java and Java programming Environment. Object Oriented Programming.

Fundamental Programming Structure: Data Types, variable, Typecasting Arrays, Operators and their precedence.

Control Flow: Java's Selection statements (if, switch, iteration, statement, while, do-while, for, Nested loop).

Concept of Objects and Classes, Using Exiting Classes building your own classes, constructor overloading, static , final, this keyword .

Inheritance: Using Super to Call Super class constructor, Method overriding, Dynamic method Dispatch, Using Abstract Classes, Using final with inheritance. The Object Class.

Packages & Interfaces : Packages, Access Protection, Importing package, Interface, Implementing Interfaces, variables in Interfaces, Interfaces can be extended.

Exception Handling: Fundamentals, Types Checked , Unchecked exceptions, Using try & catch, Multiple catch, throw , throws, finally, Java's Built in exceptions, user defined exception.

Module - II **12 Hrs**

Multi Threading: Java Thread Model, Thread Priorities, Synchronization, Creating a thread, Creating Multiple threads, Using isAlive ( ) and join ( ), wait () & notify ( ).

String Handling: String constructors, String length, Character Extraction, String Comparison, Modifying a string.

Java I/O: Classes & Interfaces, Stream classes, Byte streams, Character streams, Serialization.

JDBC: Fundamentals, Type I, Type II, Type III, Type IV drivers.

Networking: Basics, Socket overview, Networking classes, & interfaces, TCP/IP client sockets, whois, URL format, URL connection, TCP/IP Server Sockets.

Module - III **12 Hrs**

Applets: Basics, Architecture, Skeleton, The HTML APPLET Tag, Passing Parameters to Applets, Applet context and show documents ().

Event Handing: Delegation Event model, Event Classes, Event Listener Interfaces, Adapter classes.

AWT: AWT Classes window fundamentals, component, container, panel, Window, Frame , Canvas, Creating a frame window in an Applet , working with Graphics , Control Fundamentals , Layout managers, Handling Events by Extending AWT components.

Core java API package, reflection, Remote method Invocation (RMI)

Swing: J applet, Icons & Labels, Text fields, Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees, Tables.

Exploring Java-lang: Simple type wrappers, Runtime memory management, object (using clone () and the cloneable Interface), Thread, Thread Group, Runnable.

Text Books:

1. Introduction to Java Programming: Liang, Pearson Education, 7th Edition.
2. Java The complete reference: Herbert Schildt, TMH, 5th Edition.

Reference Books:

1. Balguruswamy, Programming with JAVA, TMH.
2. Programming with Java*:* Bhave &. Patekar, Pearson Education.
3. Big Java: Horstman, Willey India, 2nd Edition.
4. Java Programming Advanced Topics: Wigglesworth, Cengage Learning.
5. Java How to Program: H.M. Deitel & Paul J. Deitel, PHI, 8th Edition.

PCEC7303 **CONTROL AND INSTRUMENTATION LAB** (0-0-3)

List of Experiment :

Control:

1. Study of a dc motor driven position control system
2. Study of speed torque characteristics of two phase ac servomotor and determination of its transfer function
3. Obtain the frequency response of a lag and lead compensator
4. To observe the time response of a second order process with P, PI and PID control and apply PID control to servomotor
5. To study the characteristics of a relay and analyse the relay control system (Phase Plane)
6. To study and validate the controllers for a temperature control system
7. To study the position control system using Synchros

Instrumentation:

1. Measurement of unknown resistance, inductance and capacitance using bridges
2. To plot the displacement-voltage characteristics of the given LVDT
3. Measurement of temperature-voltage characteristics of J-type thermocouple
4. Use a strain gauge to plot the curve between strain applied to a beam and the output voltage
5. Study of resistance-voltage characteristics of Thermistors
6. To study on the interface of PLC with PC for data acquisition applications.

PCEL7301 **Power Electronics laboratory** (0-0-3)

List of Experiment :

1. Study of the V-I characteristics of SCR, TRIAC and MOSFET.
2. Study of the V-I characteristics of UJT
3. (a)Study of the synchronized UJT triggering circuit.
   (b) Study of the cosine controlled triggering method
4. Study of the single phase half wave controlled rectifier and semi converter circuit with R and R-L Load
5. Study of single phase full wave controlled rectifier circuits(mid point and Bridge type) with R and R-L Load
6. Study of three phase full wave controlled rectifier circuits(Full and Semi converter) with R and R-L Load
7. Study of the forward converter (Buck converter) and flyback converter(boost converter) operation.
8. Study of the single phase pwm voltage source inverter.
9. Study the performance of three phase VSI with PWM control.
10. Study the performance of single phase AC Voltage controller with R and R-L Load
11. Ramp comparator scheme of regulating ac power using triac and opto isolator
12. Study of the resonant inverter.

PCEL7302 **Electrical Machines laboratory-II** (0-0-3)

List of Experiment :

1. Determination of the voltage regulation of an alternator by zero power factor (zpf) method
2. Determination of the V and inverted V curves of a synchronous motor
3. Speed control of a three phase induction motor using variable frequency drives
4. Determination of parameters of synchronous machine
   (a) Positive sequence reactance
   (b) Negative sequence reactance
   (c) Zero sequence reactance
5. Determination of power angle characteristics of an alternator
6. Determination of parameter of a single phase induction motor and study of
   (a) Capacitor start induction motor
   (b) Capacitor start and capacitor run induction motor
   (c) Universal motor
   (d) Shaded pole motor
7. Study of parallel operation of two alternators
8. Measurement of direct and quadrature axis reactance of a salient pole synchronous machine
9. Measurement of transient and sub transient reactance of a salient pole alternator
10. Performance of grid connected induction generator.

PCEL4303 MICROPROCESSOR & MICRO CONTROLLERS

MODULE - I (10 hours)

Microprocessor Architecture: Microprocessor and Microcomputer Architecture, Pins & Signals, Register Organization, Timing & Control Module, 8085 Instruction Timing & Execution.

Assembly Language Programming of 8085: Instruction set of 8085, Memory & I/O Addressing, Assembly language programming, Stack & Subroutines.

Interfacing EPROM & RAM Memories: 2764 & 6264, 8085 Interrupts

(Book 1: Ch.1,2, 3,4 & 7)

MODULE – II (15 hours)

8086 Microprocessor: Architectures, Pin Diagrams and Timing Diagrams: Register Organisation, Architecture, Signal Description, Physical Memory Organisations, Bus Operation, I/O Addressing Capability, Special Processor Activities, Minimum Mode System and Timings, Maximum Mode System and Timings

8086 Instruction Set and Assembler Directives: Machine Language Instruction Formats, Addressing Modes, Instruction Set, Assembler Directives and Operators

Assembly Language Programming with 8086: Machine Level Programs, Machine Coding the Programs ,Programming with an Assembler

Special Architectural Features and Related Programming: Stack, Interrupts and Interrupt Service Routines, Interrupt Cycle,Non Maskable Interrupt, Maskable Interrupt, Interrupt Programming, Passing Parameters to Procedures, Handling Programs of Size More than 64k,MACROS, Timings and Delays

Basic Peripherals and Their Interfacing with 8086: Semiconductor Memory Interfacing, Dynamic RAM Interfacing, Interfacing I/O Ports, PIO 8255],Modes of Operation of 8255, Interfacing Analog to Digital Data Converters, Interfacing Digital to Analog to Converters, Stepper Motor Interfacing ,

Special Purpose Programmable Peripheral Devices and Their Interfacing

Programmable Interval Timer 8253, Programmable Interrupt Controller 8259A, The Keyboard/Display Controller 8279, Programmable Communication Interface 8251USART

DMA, Floppy Disk and CRT Controllers

DMA Controller 8257,DMA Transfers and Operations, Programmable DMA Interface 8237, Floppy Disk Controller 8272, CRT Controller 8275

80386 Microprocessor: Introduction, Architecture, Pins & Signals, Memory System, Registers, Memory Management, Paging Technique, Protected Mode Operation.

(Book-2: Ch.1.1 to 1.9, ch.2.1 to 2.4,ch.3.1 to 3.3, ch.4.1 to 4.10,ch.5.1 to 5.8,ch.6.1 to 6.4, ch.7.1 to 7.5, ch.10.1 to 10.3, 10.7,10.9)

MODULE –III (15 HOURS)

8051 Microcontrollers: Microcontrollers and embedded processors, Overview of the 8051 family

8051 Hardware Connection: Pin description of the 8051

8051 Assembly Language Programming: Inside the 8051, Assembly, Programming Assembling and Running an 8051 Program, The Program Counter and ROM Space in the 8051

8051 data types and Directives, PSW Register, register Banks and Stack

Jump, loop, and Call Instructions: Loop and Jump Instructions, Call Instructions, Time Delay for Various 8051 chips

8051 I/O Port Programming: I/O Programming, I/O Bit Manipulation Programming,
8051 Addressing Modes: Immediate and register Addressing Modes, Accessing memory using various Addressing Modes, Bit Addresses for I/O and RAM
Arithmetic & Logic Instructions and Programs: Arithmetic Instructions, Signed number concepts and Arithmetic Operations, Logic and Compare Instructions, Rotate Instruction and data Serialization, BCD, ASCII, and other Application Programs
8051 Serial Port Programming in Assembly: Basic of Serial communication, 8051 connection to RS232, 8051 Serial port Programming in Assembly, Programming the second Serial port
Interrupts Programming in Assembly: 8051 Interrupts, Programming timer Interrupts, Programming external hardware Interrupts, Programming the Serial Communication interrupt, Interrupt Priority in the 8051
ADC, DAC, and Sensor Interfacing: Parallel and Serial ADC, DAC Interfacing
Sensor Interfacing and Signal Conditioning
Interfacing to External Memory: Semiconductor Memory, Memory Address Decoding, Interfacing with External ROM, 8051 Data Memory space, Accessing External data Memory
8051 Interfacing with the 8255: 8255 Interfacing, Pogramming for the 8255
Motor Control: RELAY, PWM, DC, and Stepper Motors: Relays and Opto-isolations, Stepper Motor Interfacing, DC Motor Interfacing and PWM
(Book-3: Ch.1.1,1.2,ch.2.1 to 2.7,ch.3.1 to 3.3,ch.4.1,4.2,ch.5.1 to 5.3,ch.6.1 to 6.5,ch.10.1 to 10.4,ch.11.1 to 11.5,ch.13.1 to 13.3,ch.14.1 to 14.4,ch.15.1,15.2,ch.17.1 to 17.3)

TEXT BOOKS

1. Ghosh & Sridhar,0000 to 8085–Introduction to Microprocessor for Scientists & Engineers, PHI
2. A.K. Roy & K.M. Bhurchandi, Advanced Microprocessor and Peripherals (Architecture, Programming & Interfacing)– TMH Publication
3. Mazidi & Mazidi, The 8051 Microcontroller & Embedded Systems– Pearson / PHI publication

. ***REFERENCE:***

1. M. Rafiqzzaman, Microprocessor – Theory & Applications. (Intel & Motorola), PHI
2. The 8086 Microprocessor: Programming & Interfacing the PC by Keneeth J. Ayela
3. Douglas V.Hall, “Microprocessors and Interfacing: Programming and Hardware”, TMH
4. R.S. Gaonkar, Microprocessor architecture, programming & application with 8085, Penram International Publishing. (India) Pvt. Ltd.
5. W.A.Triebel and Avtar Singh, The 8088 and 8086 Microprocessors, Pearson Education
6. Barry B. B The Intel Microprocessor – (Architecture, Programming & Interfacing) by Pearson

PCEL4303 **TRANSMISSION & DISTRIBUTION** (3-0-0)

Module – I **(13 Hours)**

Transmission Line Parameters: (Book – 1, Ch.4)
Types of Conductors, Resistance, Tabulated Resistance Values, Inductance of a Conductor due to Internal Flux, Flux Linkages between Two Points External to an Isolated Conductor, Inductance of a Single Phase Two Wire Line, Flux Linkages of One Conductor in a Group, Inductance of Composite-Conductor Lines, The Use of Tables, Inductance of a Three Phase Line with Equilateral Spacing, Inductance of a Three Phase Line with Unsymmetrical Spacing, Inductance Calculations for Bundled Conductors.
Book-1:Ch. 4.1, Ch. 4.2, Ch. 4.3, Ch. 4.4, Ch. 4.5, Ch. 4.6, Ch. 4.7, Ch. 4.8, Ch. 4.9, Ch. 4.10, Ch. 4.11, Ch. 4.12.

Resistance, Inductance, Capacitance (Book – 1, Ch.5)
Electric Field of a Long, Straight Conductor, The Potential Difference between Two Points due to a Charge, Capacitance of a Two Wire Line, Capacitance of a Three Phase Line with Equilateral Spacing, Capacitance of a Three Phase Line with Unsymmetrical Spacing, Effect of Earth on the Capacitance of a Three Phase Line, Capacitance Calculations for Bundled Conductors, Parallel-Circuit Three Phase Lines.
Book-1:Ch. 5.1, Ch. 5.2, Ch. 5.3, Ch. 5.4, Ch. 5.5, Ch. 5.6, Ch. 5.7, Ch. 5.8.

Module – II **(12 Hours)**

Transmission Line Performances (Book – 1, Ch.6)
Short, Medium & Long Transmission Lines
Representation of Lines, Short Transmission Lines, The Medium Transmission Lines, The Long Transmission Line: Interpretation of Equations, The Long Transmission Line: Interpretation of Equations, The Long Transmission Line: Hyperbolic Form of The Equations, The Equivalent Circuit of a Long Line, Power Flow Through Transmission Line, Reactive Compensation of Transmission Line.
Book-1:Ch. 6.1, Ch. 6.2, Ch. 6.3, Ch. 6.4, Ch. 6.5, Ch. 6.6, Ch. 6.7, Ch. 6.8, Ch. 6.9.

HVDC Transmission (Book – 2, Ch.15)
Introduction, Types of DC Links, Advantages of DC Transmission, Incorporating HVDC into AC system, Converter station Equipment, Ground Return, Earth Electrode, Station Earth, Reliability of HVDC Systems, Recent Advances, HVDC Systems in India.
Book-2:Ch. 15.1, Ch. 15.2, Ch.15.3, Ch. 15.4, Ch. 15.5, Ch. 15.6, Ch. 15.7, Ch. 15.8, Ch. 15.9, Ch.15.10.

Overhead Line Insulators (Book – 2, Ch.4)
Insulator Materials, Types of Insulators, Voltage Distribution over Insulator String, Improvement of String Efficiency, Insulator Failure, Testing of Insulators.
Book-2:Ch. 4.1, Ch. 4.2, Ch.4.3, Ch. 4.4, Ch. 4.5, Ch. 4.6.

Module – III **(15 Hours)**

Mechanical Design of Overhead Transmission Lines (Book – 2, Ch.5)
General Considerations, Line Supports, Types of Steel Towers, Cross Arms, Span, Conductor Configuration, Spacings and Clearances, Sag and Tension Calculations, Erection Conditions, Factors affecting Sag, Sag Template, Catenary, Conductor Vibration.
Book-2:Ch. 5.1, Ch. 5.2, Ch. 5.3, Ch. 5.4, Ch. 5.5, Ch. 5.6, Ch. 5.7, Ch. 5.8, Ch. 5.9, Ch.5.10, Ch.5.11.

Distribution (Book – 2, Ch.16)
Comparison of various Distribution Systems, AC three-phase four-wire Distribution System, Types of Primary Distribution Systems, Types of Secondary Distribution Systems, Voltage Drop in DC Distributors, Voltage Drop in AC Distributors, Kelvin's Law, Limitations of Kelvin's Law, General Design Considerations, Load Estimation, Design of Primary Distribution, Sub-Stations, Secondary Distribution Design, Economical Design of Distributors, Design of Secondary Network, Lamp Flicker, Application of Capacitors to Distribution Systems.
Book-2:Ch. 16.1, Ch. 16.2, Ch.16.3, Ch. 16.4, Ch. 16.5, Ch. 16.6, Ch. 16.7, Ch. 16.8, Ch. 16.9, Ch.16.10, Ch. 16.11, Ch. 16.12, Ch.16.13, Ch. 16.14, Ch. 16.15, Ch. 16.16, Ch. 16.17.

Underground Cables (Book – 2, Ch. 8)
Introduction, Insulation, Sheath, Armour and Covering, Classification of Cables, Pressurized Cables, Effective Conductor Resistance, Conductor Inductive Reactance, Parameters of Single Core Cables, Grading of Cables, Capacitance of Three Core Belted Cable, Breakdown of Cables, Cable Installation, Current Rating of Cables, System Operating Problems with Underground Cables, HVDC Cables.
Book-2:Ch. 8.1, Ch. 8.2, Ch.8.3, Ch. 8.4, Ch. 8.5, Ch. 8.6, Ch. 8.7, Ch. 8.8, Ch. 8.9, Ch.8.10, Ch. 8.11, Ch. 8.12, Ch.8.13, Ch. 8.14, Ch. 8.15.

Power System Earthing (Book – 2, Ch.18)
Soil Resistivity, Earth Resistance, Tolerable Step and Touch Voltage, Actual Touch and Step Voltages, Design of Earthing Grid.
Book-2: Ch. 18.4, Ch. 18.5, Ch. 18.6, Ch. 18.7, Ch. 18.8.

Text Books:

1. **Power System Analysis- By John J. Grainger & W. D. Stevenson, Jr, Tata Mcgraw-Hill, 2003 Edition, 15th Reprint, 2010.**
2. **Power System Analysis & Design- By B. R. Gupta, S. Chand Publications, 3rd Edition, Reprint, 2003.**

PCEE 4302 **ELECTROMAGNETIC THEORY** (3-0-0)

Module – I (15 hours)
Co-ordinate systems & Transformation:
Cortesian, co-ordinates, circular cylindrical co-ordinates, spherical co-ordinates
Vector Calculus: Differential length, Area & volume, Line surface and volume Integrals, Del operator, Gradient of a scalar, Divergence of a vector & divergence theorem, curl of a vector & Stoke's theorem, laplaciar of a scalar
Electrostatic Fields: Coulomb's Law and Field Intensity Electric Fields due to continuous charge distributions, Electric Flux Density.Gauss's Law – Maxwell's Equation, Applications of Gauss's Law, Electric Potential, Relationship between E and V – Maxwell's Equation An Electric Dipole & Flux Lines, Energy Density in Electrostatic Fields.
Book1:Ch.1.1 to 1.4, Ch.2.1 to 2.8, Ch. 3.1 to 3.10

Module – II (15 hours)
Electrostatic Boundary – Value Problems:
Possion's & Laplace's Equations, Uniqueness theorem, General procedures for solving possion's or Laplace's Equation, Resistance, Capacitance, Method of Images.
Magnatostatic Fields:
Biot-Savart's Law, Ampere's circuit law-Maxwell Equation, applications of Ampere's law, Magnatic Flux Density-Maxwell's equations. Maxwell's equation for static fields, Magnetic Scalar and Vector potentials Derivation of Biot-Savart's Law Ampere's Law.
Book1:Ch.4.8, Ch. 5.1 to 5.6 Ch. 6.1 to 6.8

Module – III (10 hours)
Maxwell's Equations:
Faradey's Law, Transformer & Motional Electromagnetic Forces, Displacement Current, Maxwell's Equation in Final forms, Time Varying Potentials, Time-Harmonic Field
Electromagnetic Wave Propagation:
Wave Propagation in lossy Dielectrics, Plane Waves in loss less Dielectrics, Power & pointing vector.
Numerical Methods: Finite element, Finite Difference & moment methods – some applications.
Book1:Ch.8.1 to 8.7, Ch.9.1 to 9.3 & 9.6, Ch. 13.1 to 13.5

Text Book:

1. Matthew N. O. Sadiku, Principles of Electromagnetics, 4th Ed., Oxford Intl. Student Edition.

Reference Book:

1. C. R. Paul, K. W. Whites, S. A. Nasor, Introduction to Electromagnetic Fields, 3rd,TMH.
2. Electromagnetic Field Theory, W.H. Hyat, TMH, 7th Ed.
3. Engineering Electromagnetics by Shen, Kong, Patnaik, CENGAGE Learning.

PEEL5303: **ELECTRIC DRIVES** (3-0-0)

Module-I **(12 Hours)**

Study of Motor Drives: Electrical Drives, Advantages of Electrical Drives, Electrical Motors, Power Modulators, Choice of electrical Drives, Fundamentals of Torque Equations, Speed Torque Conventions and Multi-quadrant Operation, Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization, Control of Electrical Drives, Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating.

Book-1:Ch. 1.1, Ch. 1.2, Ch. 1.3, Ch. 1.4; Ch. 2.1, Ch. 2.2, Ch. 2.3, Ch. 2.4, Ch. 2.5, Ch. 2.6, Ch. 2.7, Ch. 2.8; Ch. 3.3, Ch. 4.1; Ch. 4.2, Ch. 4.3.

Module-II **(14 Hours)**

Steady State Performance of DC/AC Drives: Closed Loop Control of Drives, DC Motors and their Performances, Starting, Braking, Transient Analysis, Speed Control, Methods of Armature Voltage Control, Transformer and Uncontrolled Rectifier Control, Controlled Rectifier Fed DC Drives, Chopper Controlled DC Drives.

Induction Motor Drives: Speed Control, Pole Changing, Pole Amplitude Modulation, Stator Voltage Control, Variable Frequency Control from Voltage Source, Voltage Source Inverter Control, Variable Frequency Control from Current Source, Current Source Inverter Control, Current Regulated Voltage Source Inverter Control, Rotor Resistance Control, Slip Power Recovery.

Synchronous Motor Drives: Synchronous Motor Variable Speed Drives, Variable Frequency Control of Multiple Synchronous Motors.

Book-1:Ch. 5.1, Ch. 5.2, Ch. 5.3, Ch. 5.4, Ch. 5.5, Ch. 5.6, Ch. 5.8, Ch. 5.9, Ch. 5.10, Ch. 5.11, Ch. 5.12, Ch. 5.13, Ch. 5.14, Ch. 5.15, Ch. 5.18, Ch. 5.19, Ch. 5.20, Ch. 5.21; Ch. 6.8, Ch. 6.9, Ch. 6.10, Ch. 6.11, Ch. 6.12, Ch. 6.13, Ch. 6.16, Ch. 6.17, Ch. 6.18, Ch. 6.20, Ch. 6.21; Ch. 7.3.1, Ch. 7.3.2, Ch. 7.4.

Module-III **(12 Hours)**

Traction Drives: Nature of Traction Load, Calculation of Traction Drive Ratings and Energy Consumption, Tractive Effort and Drive Ratings, Specific Energy Consumption, Maximum Allowable Tractive Effort, Conventional DC and AC Traction Drives, 25 kV AC Traction using Semiconductor Converter Controlled DC Motors, DC Traction employing Polyphase AC Motors, AC Traction employing Polyphase AC Motors.

Book-1:Ch. 10.2, Ch. 10.6, Ch. 10.10, Ch. 10.12, Ch. 10.15, Ch. 10.16.

Drives for Specific Applications: Drive Considerations for Textile Mills, Steel Rolling Mills, Cranes and Hoist Drives, Cement Mills, Sugar Mills, Machine Tools, Paper Mills, Coal Mines, Centrifugal Pumps.

Book-2:Ch. 7.1, Ch. 7.2, Ch. 7.3, Ch. 7.4, Ch. 7.5, Ch. 7.6, Ch. 7.7, Ch. 7.8, Ch. 7.9.

Microprocessors and Control of Electrical Drives:

Dedicated Hardware Systems versus Microprocessor Control, Application Areas and Functions of Microprocessors in Drive Technology, Control of DC Drives using Microprocessors.

Book-2:Ch. 8.2, Ch. 8.3, Ch. 8.4.1.

Text Books:

(1) Book-1: Fundamentals of Electrical Drives-By G.K.Dubey, Alpha Science International Limited, Pangbourne, UK, **Second Edition**, 2001.

(2) Book-2: Electric Drives-Concepts and Applications- By Vedam Subramanyam, **Second Edition**, Tata McGraw Hill Publication, 2010-11.

Reference Book:

(1) Modern Power Electronics and AC drives- by B.K.Bose, Pearson Education.

PCEE4304 **COMMUNICATION ENGINEERING** (3-0-0)

MODUE-I

INTRODUCTION: Elements of an Electrical Communication System, Communication Channels and their Characteristics, Mathematical Models for Communication Channels

FREQUENCY DOMAIN ANALYSIS OF SIGNALS AND SYSTEMS: Fourier series, Fourier Transforms, Power and Energy, Sampling and Band limited signals, Band pass signals

MODULE-II

ANALOG SIGNAL TRANSMISSION AND RECEPTION: Introduction to modulation, Amplitude Modulation (AM), Angle Modulation, Radio and Television broadcasting

MODULE-III

PULSE MODULATION SYSTEMS: Pulse amplitude modulation, Pulse Time Modulation

PULSE CODE MODULATION: PCM system, Intersymbol interference, Eye patterns, Equalization, Companding, Time Division Multiplexing of PCM signals, Line codes, Bandwidth of PCM system, Noise in PCM systems, Delta Modulation (DM), Limitations of DM, Adaptive Delta Modulation, Noise in Delta Modulation, Comparison between PCM and DM, Delta or Differential PCM (DPCM), S-Ary System

Text Book:

1. John G.Proakis,M. Salehi, *COMMUNICATION SYSTEMS ENGINEERING*, 2nd ed. New Delhi,India: PHI Learning Private Limited, 2009.; Selected portion from Chapter 1,2 and 3 for module MODULE-I and MODULE-II of the course.
2. R.P Singh and S.D Sapre, *COMMUNICATION SYSTEMS Analog & Digital*, 2nd ed. New Delhi, India: Tata McGraw Hill Education Private Limited, 2009; Selected portions from Chapter 7 and 8 of the book for MODULE-III.

Reference Book:

1. Taub, Schilling, Saha, Taub's Principles of Communication Systems, TMH.
2. Modern Digital and Analog Communication Systems, by B.P. Lathi, Oxford

PCEC4304 **DIGITAL SIGNAL PROCESSING** (3-0-0)

Module – I (10 hours)

The Z-Transform and Its Application to the Analysis of LTI Systems: The Z-Transform: The Direct Z-Transform, The Inverse Z-Transform; Properties of the Z-Transform; Inversion of the Z-Transforms: The Inversion of the Z-Transform by Power Series Expansion, The Inversion of the Z-Transform by Partial-Fraction Expansion; Analysis of Linear Time-Invariant Systems in the z-Domain: Response of Systems with rational System Functions, Transient and Steady-State Responses, Causality and Stability, Pole-Zero Cancellations.

Selected portions from Chapter 3 (3.1.1, 3.1.2, 3.2, 3.4.2, 3.4.3, 3.5.1, 3.5.2, 3.5.3, 3.5.4) of Textbook – I

The Discrete Fourier Transform: Its Properties and Applications: Frequency Domain Sampling: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, The Discrete Fourier Transform, The DFT as a Linear Transformation, Relationship of the DFT to other Transforms; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties; Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences; Frequency Analysis of Signals using the DFT; The Discrete Cosine Transform: Forward DCT, Inverse DCT, DCT as an Orthogonal Transform. Chapter – 7 of Textbook – 1.

Module – II (10 hours)

Implementation of Discrete-Time Systems: Structure for the Realization of Discrete-Time Systems, Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures; Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures.

Selected portions from Chapter 9 (9.1, 9.2.1, 9.2.2, 9.2.3, 9.3.1, 9.3.2, 9.3.3, 9.3.4)of Textbook–I

Design of Digital Filters:

General Considerations: Causality and Its Implications, Characteristics of Practical Frequency-Selective Filters; Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by the Frequency-Sampling Method; Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation. Selected portions from Chapter 10 (10.1.1, 10.1.2, 10.2.1, 10.2.2, 10.2.3, 10.2.4, 10.3.2, 10.3.3) of Textbook – I

Module- III (15 hours)

Efficient Computation of the DFT: Fast Fourier Transform Algorithms

Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of the DFT a 2N-Point Real Sequence, Use of the FFT Algorithm in Linear Filtering and Correlation.

Selected portions from Chapter 8 (8.1.1, 8.1.3, 8.2.1, 8.2.2, 8.2.3) of Textbook – I

Adaptive Filters:

Application of Adaptive Filters: System Identification or System Modeling, Adaptive Channel Equalization, Adaptive Line Enhancer, Adaptive Noise Cancelling; Adaptive Direct-Form FIR Filters-The LMS Algorithm: Minimum Mean Square Error Criterion, The LMS Algorithm.

Selected portions from chapter 13 (13.1.1, 13.1.2, 13.1.5, 13.1.6, 13.2.1, 13.2.2) of Text book –I

Text Books

1. Digital Signal Processing – Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.

Reference Book :

1. Digital Signal Processing: a Computer-Based Approach – Sanjit K. Mitra, TMH.
2. Digital Signal Processing – S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH
3. Digital Signal Processing – Manson H. Hayes (Schaum's Outlines) Adapted by Subrata Bhattacharya, TMH.
4. Digital Signal Processing: A Modern Introduction – Ashok Ambardar, Cengage Learning.
5. Modern Digital Signal Processing – Roberto Cristi, Cengage Learning.
6. Digital Signal Processing: Fundamentals and Applications – Li Tan, Academic Press, Elsevier.
7. Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, Cengage Learning.
8. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, Cengage

OPERATING SYSTEM (3-0-0)

MODULE-I **12 Hours**

INTRODUCTION TO OPERATING SYSTEM:

What is an Operating System? Simple Batch Systems, Multiprogramming and Time Sharing systems. Personal Computer Systems, Parallel Systems, Distributed Systems and Real time Systems.

Operating System Structures: Operating System Services, System components, Protection system, Operating System Services, system calls

PROCESS MANAGEMENT:

Process Concept, Process Scheduling, Operation on Processes, Interprocess communication, Examples of IPC Systems, Multithreading Models, Threading Issues, Process Scheduling Basic concepts, scheduling criteria, scheduling algorithms, Thread Scheduling.

MODULE-II **12 Hours**

PROCESS COORDINATION: Synchronization: The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

MEMORY MANAGEMENT: Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

MODULE-III **11 Hours**

STORAGE MANAGEMENT:

File System Concept, Access Methods, File System Structure, File System Structure, File System Implementation, Directory implementation, Efficiency and Performance, Recovery, Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, I/O System Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operation.

CASE STUDIES: The LINUX System, Windows XP, Windows Vista

TEXT BOOK:

1. **Operating System Concepts –** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009.
2. **Mordern Operating Systems –** Andrew S. Tanenbaum, 3rd Edition, PHI
3. **Operating Systems:** A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition

REFERENCE BOOK:

1. **Operating Systems –** Flynn, McHoes, Cengage Learning
2. **Operating Systems –** Pabitra Pal Choudhury, PHI
3. **Operating Systems –** William Stallings, Prentice Hall
4. **Operating Systems –** H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson

PEEC4304 COMPUTER NETWORK & DATA COMMUNICATION (3-0-0)

Module – I **12 Hrs**

Overview of Data Communications and Networking.

Physical Layer : Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals.

Digital Transmission: Line coding, Block coding, Sampling, Transmission mode.

Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals. Multiplexing : FDM , WDM , TDM ,

Transmission Media: Guided Media, Unguided media (wireless)

Circuit switching and Telephone Network: Circuit switching, Telephone network.

Module –II **12 Hrs**

Data Link Layer

Error Detection and correction: Types of Errors, Detection, Error Correction

Data Link Control and Protocols:

Flow and Error Control, Stop-and-wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC.

Point-to –Point Access: PPP

Point –to- Point Protocol, PPP Stack,

Multiple Access

Random Access, Controlled Access, Channelization.

Local area Network: Ethernet.

Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Token bus, token ring

Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.

Module – III **12 Hrs**

Network Layer:

Host to Host Delivery: Internetworking, addressing and Routing

Network Layer Protocols: ARP, IPV4, ICMP, IPV6 ad ICMPV6

Transport Layer: Process to Process Delivery: UDP; TCP congestion control and Quality of service.

Application Layer :

Client Server Model, Socket Interface, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Books:

1. Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4th Ed

3. Computer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5th Ed

Reference Book : .

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9th Ed.
4. Data communication & Computer Networks: Gupta, Prentice Hall of India
5. Network for Computer Scientists & Engineers: Zheng, Oxford University Press
6. Data Communications and Networking: White, Cengage Learning

PEME5305 **ROBOTICS & ROBOT APPLICATIONS (3-0-0)**

Module – I

1. Fundamentals of Robotics: Evolution of robots and robotics, Definition of industrial robot, Laws of Robotics, Classification, Robot Anatomy, Work volume and work envelope, Human arm characteristics, Design and control issues, Manipulation and control, Resolution; accuracy and repeatability, Robot configuration, Economic and social issues, Present and future application.

2. Mathematical modeling of a robot: Mapping between frames, Description of objects in space, Transformation of vectors.
   Direct Kinematic model: Mechanical Structure and notations, Description of links and joints, Kinematic modeling of the manipulator, Denavit-Hartenberg Notation, Kinematic relationship between adjacent links, Manipulator Transformation matrix.

Module – II

3. Inverse Kinematics: Manipulator workspace, Solvable of inverse kinematic model, Manipulator Jacobian, Jacobian inverse, Jacobian singularity, Static analysis.
4. Dynamic modeling: Lagrangian mechanics, 2D- Dynamic model, Lagrange-Euler formulation, Newton-Euler formulation.
5. Robot Sensors: Internal and external sensors, force sensors, Thermocouples, Performance characteristic of a robot.

Module – III

6. Robot Actuators: Hydraulic and pneumatic actuators, Electrical actuators, Brushless permanent magnet DC motor, Servomotor, Stepper motor, Micro actuator, Micro gripper, Micro motor, Drive selection.
7. Trajectory Planning: Definition and planning tasks, Joint space planning, Cartesian space planning.
8. Applications of Robotics: Capabilities of robots, Material handling, Machine loading and unloading, Robot assembly, Inspection, Welding, Obstacle avoidance.

Text Books:

1. Robotics and Control**,** R.K. Mittal and I.J. Nagrath, Tata McGraw Hill
2. Introduction to Robotics: Mechanics and control, John J Craig, PHI
3. Robotics Technology and Flexible Automation, S.R.Deb and S. Deb, TMH

Reference Books:

1. Introduction to Robotics, S. K. Saha, Tata McGraw Hill
2. Robotics: Control, Sensing, Vision and Intelligence, K.S.Fu, R.C.Gonzalez and C.S.G.Lee, McGraw Hill
3. Robotics, Appuu Kuttan K.K., I.K. international
4. Robot Dynamics and Control, M.W.Spong and M. Vidyasagar , Wiley India.
5. Industrial Robotics Technology, programming and application, M.P.Groover, TMH.
6. Introduction to Robotics: Analysis, Systems, Applications, S.B.Niku, PHI
7. Robotics: Fundamental Concepts and Analysis, A. Ghosal, Oxford University Press
8. Fundamentals of Robotics: Analysis and Control, R. J. Schilling, PHI
9. Robotic Engineering: An Integrated Approach, R.D. KLAFTER, T. A. Chmielewski, and M. Negin, PHI
10. Robot Technology: Fundamentals: J. G. Keramas, Cengage Learning

FEEE6301 **INDUSTRIAL PROCESS CONTROL AND DYNAMICS** (3-0-0)

Module-I (10 Hrs))

Analog Signal Conditioning

Introduction, Principles of Analog Signal Conditioning, Signal-Level Changes, Linearization, Conversions, Zero adjustment, Span adjustment, Level changing, AC/DC Power supply, Filtering and Impedance Matching, Passive Circuits, Divider Circuit, Bridge Circuits, RC Filters, Operational Amplifiers, Op Amp Characteristics, Op Amp Specifications, Op Amp Circuits in Instrumentation, Voltage Follower, inverting Amplifier, Non- inverting Amplifier, Differential Amplifier, Active Filters, Protection Voltage-to –Current Converter, Current-to-Voltage Converter, Integrator, Linearization.

Book-1-Ch-2.2,2.3,2.4,2.5,2.6.

Digital Signal Conditioning

Introduction, Review of Digital Fundamentals, Digital Information, Fractional Binary Numbers, Boolean Algebra, Digital Electronics, Programmable Logic Controllers, Busses and Tri-State Buffers, Converters, Comparators, Digital-to-Analog Converters (DCA), Analog-to-Digital Converters (ADCs), Sample and Hold, Multiplexer and De-multiplexer, decoder and encoder, Pulse modulations, Digital recorder.

Book-1-Ch-3.1,3.2,3.3,3.4,3.5.

Module-2 (20 Hrs)

Thermal Sensors

Definition of Temperature, Metal Resistance versus Temperature Device, Thermistors, Thermocouples, Other Thermal Sensors, Design Consideration.

Book-1-Ch-4.1,4.2,4.3,4.4,4.5,4.6,4.7.

Mechanical Sensors

Displacement, Position Sensors, Strain Sensors, Motion Sensors, Pressure Sensors, Flow Sensors.

Book-1-Ch-5.2,5.3,5.4,5.5,5.6

Optical Sensors

Photodetectors, Pyrometry, Leser Principles,Applications.

Book-1-6.2,6.3,6.4,6.5,6.6.

Final Control

Final Control Operation, Signal Conversions, Switching and Control Devices, Actuators, control Elements.

Book-1-Ch-7.2,7.3,7.4,7.5,7.6.

Discrete-State Process Control

Characteristics of the System, Relay Controllers and Ladder diagrams, PLCs.

Book-1-Ch-8.2,8.3,8.4,8.4,8.5.

Module-3 (10 Hrs)

Controller Principles

Process Characteristics, Control System Parameters, Discontinuous and Continuous Controller Modes, Composite Control Modes.

Book-1-Ch-9.2,9.3,9.4,9.5,9.6.

Analog Controllers

Electronic controllers, pneumatic controllers, design consideration.

Book-1-10.2,10.3,10.4,10.5.

Casecade,Feedforward, and Ratio Control

Casecade Control,Feedfrrward Control,Feedforward-feedback cControl Configuration,Ratio Control.

Book-2, Ch-!0.1,!0.2,!0.3,!0.4,!0.5.

Selective and Adaptive Control Systems

Selective Control, Adaptive Control,Adaptive Control Configuration.

Book-2. Ch-11.1,11.2,11.3,11.4.

TEXT BOOK

1.-PROCESS CONTROL INSTRUMENTATION TECHNOLOGY BY-Curtis D.Johnson.PHI Publication.
2-PROCESS CONTROL PRINCIPLES AND APPLICATIONS BY-Surekha Bhanot.Oxford Publication

Reference:-

Process control Systems and Instrumentation By-Terry Bartelt , Cengage Learning Publication

PCEL7303 **MICROPROCESSOR & MICROCONTROLLER LAB** (0-0-3)

A) 8085 (2 hours)

1. Addition, Subtraction, Multiplication, Division two 8 bit numbers resulting 8/16 bit numbers.
2. Smallest /Largest number among n number in a given data array + Binary to Gray Code / Hexadecimal to decimal conversion. (1 hour)

B) INTERFACING (5 hours)

COMPULSORY (1 hour)

1. Generate square waves on all lines of 8255 with different frequencies (concept of delay program) 1 lecturer)
2. Study of stepper Motor and its operations (Clockwise, anticlockwise, angular movement, rotate in various speeds)

OPTIONAL (Any Two) (1 hour)

1. Study of Traffic Light controller
2. Study of Elevator Simulator
3. Generation of Square , triangular and saw tooth wave using Digital to Analog Converter
4. Study of 8253 and its operation (Mode 0, Mode 2, Mode 3)
5. Study of Mode 0, Mode 1, BSR Mode operation of 8255.
6. Study of 8279 (keyboard & Display interface)
7. Study of 8259 Programmable Interrupt controller.

C) 8051MICROCONTROLLER (3 hours)

COMPULSORY (2 hours)

1. Initialize data to registers and memory using immediate, register , direct and indirect addressing mode

OPTIONAL (any one) (1 lecture)

1. Addition, subtraction of 16 bit numbers.
2. Multiplication, Division of 16 bit numbers
3. Transfer a block of data to another memory location using indexing.
4. Operation of 8255 using 8051 microcontroller

D) 8086 (2 hours)

COMPULSORY (1 hour)

1. Addition, subtraction, Multiplication , Division of 16 bit nos + 2's complement of a 16 bit no.

OPTIONAL (Any One) (1 hour)

1. Finding a particular data element in a given data array.
2. Marking of specific bit of a number using look-up table.
3. Largest /Smallest number of a given data array.
4. To separate the Odd and Even numbers from a given data array.
5. Sorting an array of numbers in ascending/descending order

Total – 13 hours

NOTE Total 10 (Ten) experiments have to be completed . Two from GP-A , four from Gp- B, Two from Gp – C Two from Gp – D

Reference Books:

1. Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, Cengage Learning.
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, Cengage Learning.

PCEL7304 **MACHINE DESIGN & SIMULATION LAB.** (0-0-3)

SEC-A (Design Using MATLAB) (Any one)
1. Design of single phase/3-phase transformers
2. Design of 3-phase induction motor
3. Design of 3-phase synchronous generator

SEC-B (Simulation Using SIMULINK) (Any two)
1. Simulation of 1-phase HW/FW Rectifier with R/RL Load
2. Simulation of 3-phase Controlled Rectifier with R/RL Load
3. Simulation of 1-phase/ 3-phase Inverter

SEC-C (Design/Simulation Using MATLAB/ SIMULINK) (Any two)
1. Obtaining time response of a given feedback control system to unit step/ ramp input
2. Obtaining frequency response (Bode plot & Polar Plot) of a given feedback control system
3. Design & Simulation of P / PI / PID Controller

Electrical Drives Lab (0-0-3)

(Any Eight Experiments)

1. Speed Control of Single Phase Induction Motor by using Single Phase AC to AC Converter.

2. Speed Control of Separately Excited DC Shunt Motor using Single Phase Fully Controlled AC to DC Converter.
3. Speed Control of Separately Excited DC Shunt Motor using Four-Quadrant Chopper.
4. Speed Control of Separately Excited DC Shunt Motor using Single Phase Dual Converter.
5. Speed Control of Three Phase Squirrel Cage Induction Motor using Three Phase AC to AC Controller.
6. Speed Control of Three Phase Squirrel Cage Induction Motor using Three Phase PWM Inverter.
7. Speed Control of Three Phase Slip Ring Induction Motor using Rheostatic Control Method.
8. Speed Control of DC Shunt Motor using Three Phase AC to DC Converter.
9. Determination of the Transfer Function of DC Shunt Motor.
10. Determination of the Moment of Inertia of DC Shunt Motor Drive System by Retardation Test.

Communication Engineering Lab (0 0 2)

Analyze and plot the spectrum of following signals with aid of spectrum analyzer: Sine wave, square wave, triangle wave, saw-tooth wave of frequencies 1KHz, 10Khz, 50Khz, 100KKz and 1 MHz.

Experiment objective: Analysis of spectrum of different signals. Measurement of power associated with different harmonics in signals.

Equipment Required:

- Signal/ function generator- frequency range upto 1MHz, signal types: square, triangle, sinusoidal, saw-tooth, DC offset signal.
- Spectrum analyzer Upto 100MHz atleast

1. Analyze the process of frequency division multiplexing and frequency division de-multiplexing.

   Experiment objective: Demonstrate the process of multiplexing of signals in time and frequency domain.

   Equipment Required:

   - Frequency division multiplexing/ de-multiplexing experiment board.
   - CRO

2. Study and design of AM modulator and demodulator. (Full AM, SSB, DSBSC, SSBSC)

   Experiment objective: Demonstrate the process of modulation and demodulation using AM. Measure different parameters associated with modulated signals. Analyze the spectrum of modulated signals.

   Equipment Required:

   - AM modulator/ demodulator experimental board.
   - Function generator (sine, square, modulating signal), 1MHz maximum frequency
   - CRO - 20MHz, dual trace
   - Spectrum analyzer.

3. Study of FM modulation and Demodulation Techniques.

   Experiment objective: Demonstrate the process of modulation and demodulation using FM. Measure different parameters associated with modulated signals. Analyze the spectrum of FM modulated signals and compare with theoretical bandwidth.

   Equipment Required:

   - FM modulator/ demodulator experimental board.
   - Function generator (sine, square, modulating signal), 1MHz maximum frequency
   - CRO - 20MHz, dual trace
   - Spectrum analyzer.

4. Observer the process of PAM, quantization and determination of quantization noise.

   Experiment objective: Demonstrate the process of PAM, PWM and PPM. Measure the spectrum of the PAM, PPM and PWM signals.

Equipment Required:

- Experiment board for PAM/ PPM/ PWM signal generation and detection
- Multiplexing board
- CRO

5. Multiplex 2-4 PAM/ PPM and PWM signals.

   Experiment objective: Demonstrate the process of multiplexing in time domain.

Equipment Required:

- Experiment board for PAM/ PPM/ PWM signal generation and detection
- Multiplexing board
- CRO

6. Study the functioning of PCM and Delta modulator

   Experiment objective: Demonstrate the process of PCM modulation and Delta modulation.

Equipment Required:

- Experiment board for PCM/ Delta Modulation/ Adaptive Delta Modulation generation and detection
- Signal generator
- CRO

7. Using MATLAB/ SCILAB generate a carrier and a modulating signal. Modulate the carrier using AM. Show the waveform in time domain and analyze its frequency spectrum. Repeat the simulation for modulating signal being square, triangular and other forms waveform.

8. Using MATLAB/ SCILAB generate a carrier and a modulating signal. Modulate the carrier using FM. Show the waveform in time domain and analyze its frequency spectrum. Repeat the simulation for modulating signal being square, triangular and other forms waveform.
   - For experiment 7/8 MATLAB of current version/ scilab is required.
   - Computer of good configuration

9. Using Lab-View software simulate AM modulation and demodulation system.

10. Using Lab-View software simulate FM modulation and demodulation system.
    - For experiment 9/10 Lab-View of current version is required.
    - Computer of good configuration

11. Design a receiver to demodulate and receive the signal from am AM radio station.

12. Design a receiver to demodulate and receive the signal from the local FM radio station.
    - For experiment 11/12 following equipment is required
    - CRO
    - Components of assorted values.
    - AM and FM receiver ICs.

Experiment objective (for simulation exercises): Verify the process of modulation and demodulation in simulation environment. Analyze frequency spectrum of the signal after modulation and demodulation. Observe the modulated and demodulated signals for different forms of modulation signal.

PCEC7304 Digital Signal Processing Lab

1. Familiarization with the architecture of a standard DSP kit (Preferably TMS 320C6XXX DSP kit of Texas Instruments)
2. Generation of various types of waveforms (sine, cosine, square, triangular etc.) using MATLAB and DSP kit.
3. Linear convolution of sequences (without using the inbuilt conv. function in MATLAB) and verification of linear convolution using DSP kit.
4. Circular convolution of two sequences and comparison of the result with the result obtained from linear convolution using MATLAB and DSP kit.
5. (i) Computation of autocorrelation of a sequence, cross correlation of two sequences using MATLAB.

   (ii) Computation of the power spectral density of a sequence using MATLAB also implementing the same in a DSP kit.
6. Finding the convolution of a periodic sequence using DFT and IDFT in MATLAB.
7. (i) Implementation of FFT algorithm by decimation in time and decimation in frequency using MATLAB.

   (ii) Finding the FFT of a given 1-D signal using DSP kit and plotting the same.
8. Design and implementation of FIR (lowpass and highpass) Filters using windowing techniques (rectangular window, triangular window and Kaiser window) in MATLAB and DSP kit.
9. Design and implementation of IIR (lowpass and highpass) Filters (Butterworth and Chebyshev) in MATLAB and DSP kit.
10. (i) Convolution of long duration sequences using overlap add, overlap XXXXX using MATLAB.

    (ii) Implementation of noise cancellation using adaptive filters on a DSP kit.

Reference Books:

1. Digital Signal Processing: A MATLAB-Based Approach – Vinay K. Ingle and John G. Proakis, Cengage Learning.
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling and Sandra L. Harris, Cengage Learning.

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