FACULTY OF ENGINEERING

Scheme of Instruction & Examination

and

Syllabi

B.E. III-Semester & IV-Semester

of

Four Year Degree Programme

In

Electronics & Instrumentation Engineering

(With effect from the academic year 2017 – 2018)
(As approved in Faculty Meeting held on 26 June 2017)

Issued by
Dean, Faculty of Engineering
Osmania University, Hyderabad
July 2017

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

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1.	BS301MT	Engineering Mathematics - III	3	1	-	4	30	70	3	3
2.	ES322EC	Electronic Engineering-II	3	-	-	3	30	70	3	3
3.	ES323ME	Prime Movers & Pumps	3	-	-	3	30	70	3	3
4.	PC302EE	Electromagnetic Fields	3	1	-	4	30	70	3	3
5.	PC303EE	Digital Electronics & Logic Design	3	-	-	3	30	70	3	3
6.	PC304EE	Network Theory	3	1	-	4	30	70	3	3
7.	MC916CE	Environmental Sciences	3	-	-	3	30	70	3	3
Practical /Laboratory Courses										
8.	ES361ME	Mechanical Engineering Lab	-	-	2	2	25	50	3	1
9.	ES362EC	Electronic Engineering Lab.	-	-	2	2	25	50	3	1
			21	**3**	**4**	**28**	**260**	**590**		**23**

BS: Basic Sciences ES: Engineering Sciences MC: Mandatory Course
PC: Professional Course HS: Humanities and Sciences
L: Lectures T: Tutorials Pr : Practicals Drg: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note: 1) Each contact hour is a Clock Hour
2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.
3) Students admitted into B.E./B.Tech. courses under lateral entry scheme (through ECET) from the academic year 2017-18 should undergo the following bridge course subjects at III Semester (CBCS).
(1) ES 154 CS Computer Programming Lab
(2) MC 156 EG Engineering English Lab

Course Code	Course Title						Core / Elective
BS 301 MT	**ENGINEERING MATHEMATICS – III** (Common to all branches)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives

- To introduce the concept of functions of complex variables and their properties
- To formulate partial differential equations and to introduce a few methods to solve first order linear and non-linear partial differential equations
- To study Fourier series and its applications to partial differential equations

Course Outcomes

- Determine the analyticity of a complex functions and expand functions as Taylor and Laurent series
- Evaluate complex and real integrals using residue theorem
- Expand function as a Fourier series
- Find solutions of first order and second order partial differential equations

UNIT-I

Functions of Complex Variables: Limits and continuity of function, differentiability and analyticity, necessary & sufficient conditions for a function to be analytic, Cauchy- Reimann equations in polar form, harmonic functions, complex integration, Cauchy's integral theorem, extension of Cauchy's integral theorem for multiply connected regions, Cauchy's integral formula, Cauchy's formula for derivatives and their applications.

UNIT - II

Residue Calculus: Power series, Taylor's series, Laurent's series, zeros and singularities, residues, residue theorem, evaluation of real integrals using residue theorem, bilinear transformation, conformal mapping.

UNIT - III

Fourier series: Fourier series, Fourier series expansions of even and odd functions, convergence of Fourier series, Fourier half range series.

UNIT - IV

Partial Differential Equations: Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, Nonlinear first order equations, Charpit's method, higher order linear equations with constant coefficients.

UNIT - V

Fourier Series Applications to Partial Differential Equations: Classification of linear second order partial differential equations, separation of variables method (Fourier method), Fourier series solution of one dimensional heat and wave equations, Laplace's equation.

Suggested Reading:

1. R.K.Jain, S.R.K Iyengar, **Advanced Engineering Mathematics**, Narosa Publication, 4th Edition, 2014.
2. B.S.Grewal, **Higher Engineering Mathematics**, Khanna Publications, 43rd Edition, 2014.
3. Gupta, Kapoor, **Fundamentals of Mathematical statistics**, Sultan chand & sons, New Delhi, 2014.
4. Erwin Kreyszig, **Advanced Engineering Mathematics**, 9th Edition, 2012.
5. James Brown, Ruel Churchill, **Complex variables and Applications**, 9th Edition, 2013.

Course Code	Course Title						Core / Elective
ES322EC	**ELECTRONIC ENGINEERING – II**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives

- Identify the components that effect the frequency response and analyze the single and multi stage amplifiers
- Recognize the type of feedback and analyze its effect on amplifier's characteristics
- Calculate the frequency of oscillation for different types of oscillator circuits suited for various applications using Barkhausen's criterion
- Identify the importance of power amplifiers and calculate the efficiencies of class -A, B, AB and examine the effect on distortion. Identify the linear and non-linear wave shaping circuits for various waveforms & analyze their response

.**Course Outcomes**

- Ability to design feedback amplifiers circuit with its applications
- Ability to analyze and design various oscillators
- Ability to design power amplifier for various applications
- Ability to design various filters required
- Ability to design clipping and clamping circuits and various multi-vibrators

UNIT-I

Multistage amplifiers: Classification of amplifiers, Low, mid and high Frequency response of single stage RC coupled amplifiers, step response of amplifier. Cascading of amplifier. Interacting and non interacting amplifiers, effect of cascading on gain and Bandwidth.

UNIT-II

Feedback Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations, Local Versus global feedback.

UNIT-III

Oscillators: Barkhausen's Criterion, RC oscillator, Weinbridge, Phase shift, LC Hartley and colpitts oscillator, Crystal controlled oscillator, (Analysis oscillators using BJTs only) frequency stability of oscillator.

UNIT-IV

Large Signal Amplifiers: BJTas large signal audio amplifiers. Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transform less push-pull audio power amplifiers under Class-A. Class-B, Class D and Class-AB operations

UNIT-V

Wave-Shaping Circuits: RC Low Pass and High Pass circuit, response to Step, Pulse, Ramp and square wave inputs, Differentiating and Integrating circuits using diode, Clipping Circuits for Single level and two levels, Clamping Circuits.

Suggested Reading:

1. Jacob Millman, Christos Halkias, Satyabrata jit, **Electronics Devices and Circuits**, 3rd ed., McGraw Hill Education (India) Private Limited, 2010.
2. Jacob Millman, Christos Halkias, Chetan Parikh, **Integrated Electronics**, 2nd ed., McGraw Hill Education (India) Private Limited, 2011.
3. Donald L Schilling & Charles Belove, **Electronics Circuits, Discrete & Integrated**, 3rd ed., McGraw Hill Education (India) Private Limited, 2002.
4. Jacob Millman and Herbert Taub, Pulse, **Digital and Switching waveforms**, 3rd ed., McGraw Hill Education (India) Private Limited, 2011.

Course Code	Course Title						Core / Elective
ES323ME	**PRIME MOVERS AND PUMPS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To acquire fundamental knowledge of fluid mechanics and the governing equations applied to fluid machinery.
- To understand the basic types of hydraulic turbines, their components calculations involved in power output and performance characteristics of turbines.
- To understand the basic differences between positive displacement and roto dynamic pumps, their working principles and performance characteristics of reciprocating and centrifugal pumps.
- To understand the mechanism involved in steam formation, types of steam generators; to understand the basic cycle of steam engines.
- To understand the basic cycles, principles involved in operation of different types of steam turbines and gas turbines.

Course Outcomes

- Get a quick look into fundamental aspects of fluid mechanics with basic knowledge acquired to conduct preliminary calculations applied to fluid machinery.
- Understand the basic types of hydraulic turbines, their components, operation and their rated and off design performance characteristics.
- Understand the working principle of reciprocating pumps and centrifugal pumps, their performance over wide range of operations and about the negative effects of cavitation on pump performance.
- Explain basic principles involved in steam formation, types of steam boilers, principle of steam engines.
- Familiarizes basic knowledge of working of steam turbine, gas turbine and methods of improving their efficiency.

Unit-I

Fluid Mechanics: Newtonian and Non-Newtonian Fluids, viscosity, types of fluid flows, continuity, momentum and energy equations, Bernoulli's equation and its applications, laminar and turbulent flows, Reynolds number and its significance.

Unit-II

Hydraulic Turbines: Classification and working principles of turbines, Pelton, Francis, and Kaplan turbine, function of draft tube and types of draft tubes, unit quantities, performance and characteristic curves.

Unit-III

Pumps: Reciprocating pumps, working of single and double acting types, effect of acceleration head and friction, use of air vessels, work done and power required without and with air vessels

Centrifugal pumps: Classification and working of centrifugal pumps, need for priming, cavitation and its effect on performance

Unit-IV

Generation of steam: Dryness fraction and properties of steam, function of boilers, working principle of Lancashire boiler, Babcock and Wilcox boiler, boiler mounting and accessories.

Steam engines: Rankine and Modified Rankine cycle for steam engines.

Unit-V

Steam turbines: Classification of steam turbines, compounding of steam turbines, pressure compounding, velocity compounding, and pressure-velocity compounding.

Gas turbine: Classification of gas turbine-constant pressure combustion cycle, closed cycle and constant volume combustion gas turbine plants.

Suggested Reading:

1. Ballaney P. L, **Thermal Engineering**, Khanna Publishers, 19th Edn., 1993.
2. Yadav R, **Steam and Gas turbines**, Galgotia Publishers, 6th Edn., 1992.
3. Rajput., **Thermal Engineering**, Laxmi Publications (P) Ltd, New Delhi.
4. Bansal R.K., **Fluid Mechanics and Hydraulic Machines**, Laxmi Publications (P) Ltd, New Delhi.
5. Kumar D.S, **Fluid Mechanics and Fluid Power Engineering**, S.K. Kataria & Sons
6. S.Ramamrutham, **Hydraulic Machines**, Dhanpat Rai and Sons.2004.

Course Code	Course Title						Core / Elective
PC302EE	**ELECTROMAGNETIC FIELDS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives

- To be able to understand the concepts of electrostatic fields, magneto static fields, electromagnetic waves and Maxwell's equation.
- To understand the concepts of electromagnetic wave propagation in different media.

Course Outcomes

- Formulate problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media.
- Derive expressions for the energy for electrostatic and magnetostatic fields, and derive Poyntings theorem.
- Calculate the boundary conditions for electric and magnetic fields between different media.
- Calculate the reflection and refraction coefficients of electromagnetic waves for different conditions.

UNIT-I

Review of Vector Analysis: Coulomb's Law, Electric field intensity, Electric field due to different charge distributions. Electric field due to line charge, Sheet charge, Volume charge distribution, Electric flux density, Gauss's law, Divergence theorem,. Potential, Potential gradient, Potential field of different charge distributions, Applications of above laws.

UNIT-II

Energy in electrostatic field, Poisson's and Laplace equations, Uniqueness theorem, Solution of Laplace's equation, Conductors, Dielectric capacitance, Conductor properties and Boundary conditions, Calculation of capacitance, Boundary conditions for conductors and perfect dielectric materials.

UNIT-III

Steady magnetic field, Biot-Savart's law, Ampere's law, Stoke's theorem, Magnetic scalar vector potential Faraday's law, Magnetic boundary conditions, Self and Mutual inductances, Force on moving charge, Force on differential elements, Magnetic circuits, Analogy with electrical circuits, Applications of above laws.

UNIT-IV

Maxwell's equations in Integral form, Line and surface integrals, Application to static fields, Boundary conditions, Maxwell's equations in differential forms, Continuity equation, Potential function for static fields, Field equations in vector forms, energy storage in electric and magnetic fields.

UNIT-V

EM waves in homogeneous medium solutions for free space conditions, Uniform plane wave propagation, Poisson's and Laplace's equations, Sinusoidally time varying uniform plane waves in free space, Uniform plane waves in dielectrics and conductors, Poynting vector, Power dissipation, Reflection of uniform plane waves, Introduction to method of moments, Method of images.

Suggested Reading:

1. Matthew Sadiku N.O., **Elements of Electromagnetics**, Oxford University Press, 4th Edition, 2006.
2. William. Hayt H, Buck John A., **Engineering Electromagnetics**, Tata McGraw Hill, 7th Edition, 2003.
3. Nannapaneni Narayana Rao, **Elements of Engineering Electromagnetics**, PHI, New Delhi, 5th Edition, 2002.

Course Code	Course Title						Core / Elective
PC303EE	**DIGITAL ELECTRONICS & LOGIC DESIGN**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To be able to understand the principles of digital systems and binary arithmetic circuits
- To study the properties and realization of various logic gates, A/D and D/A converters

Course Outcomes

- Differentiate the number system, convert and compare a number system to another number systems used in digital logic design
- Understand Boolean algebra and its application to DeMorgan's theorems and karnaugh map reduction method
- Analyze and design various digital combinational circuits

UNIT-I

Boolean algebras and combinational logic, AND, OR and NOT operations. Laws of Boolean algebra, Minimization of Boolean expressions, Truth tables and maps. Sum of products and product of sums, Map method of reduction, Incompletely specified functions, Multiple output minimization.

UNIT-II

Tabular minimization, Digital logic families and IC's, Characteristics of Digital IC's, Introduction to RTL, DTL, TTL, CMOS, ECL families, Details of TTL logic family, Totem pole, Open collector outputs, wired AND Operation, Comparison of performance, TTL sub-families, Multiplexer and dc-multiplexer, Encoder and decoder, Code converters, Implementation of combinational logic using standard logic gates and multiplexers.

UNIT-III

Binary arithmetic and circuits, Half and Full adder, Subtractor and Magnitude comparator, Number complements, Two's complement arithmetic, Carry look ahead adder, Decimal numbers and their codes, BCD and Excess -3 arithmetic

UNIT-IV

Synchronous Sequential Circuits: basic latch circuits, Debouncing switch, SR, JK, D and T flip-flops, Truth table and execution table, Ripple and Synchronous counters, Up/down counters, General BCD counter, Shift registers, ring counters

UNIT-V

A/D and D/A Converters: Converter types — Tracking type, Flash type, Successive approximation type: R-2R ladder, Weighed register type, Switched current source type, Switched capacitor type

Suggested Reading:

1. Anand Kumar A., **Fundamentals of Digital Circuits**, Prentice Hall of India, 4th Edition, 2003.
2. Morriss Mano M., **Digital Design**, Prentice Hall of India, 3rd Edition, 2002.
3. Zvykohavi, **Switching & Finite Automata Theory**, Tata McGraw Hill, 2nd Edition, 1991.

Course Code	Course Title						Core / Elective
PC304EE	**NETWORK THEORY**						**Core**
Prerequisite	Contact Hours per Week				**CIE**	**SEE**	**Credits**
	L	T	D	P			
NIL	3	1	0	0	**30**	**70**	**3**

Course Objectives

- To acquire knowledge in circuits and to understand the fundamentals of derived circuit laws.
- To understand theorems, steady state and transient analysis of single phase and 3-phase circuits.

Course Outcomes

- Understand network analysis, techniques using mesh and node analysis.
- Evaluate steady state and transient behavior of single port network for DC and AC excitations.
- Analyze electric circuits using network theorems.
- Understand the concept of coupled circuits and poly-phase circuits.

UNIT -I

Network Elements: Active elements, dependent and independent sources, passive elements –RLC and Magnetic Energy stored in inductance and capacitance. D.C. Circuit analysis. Superposition theorem. Thevenin's and Norton's theorem. Maximum Power transfer theorem. Star-delta transformation.

UNIT-II

Response of RLC Circuits: Formulation of integro differential equations in RLC networks, I duality, Initial conditions. Response of RL, RC, RLC networks subjected to internal energy. Response of networks to impulse, step, ramp, exponential and sinusoidal excitations. Transient and steady state response. Response to arbitrary inputs by convolution.

UNIT - III

Steady state response of RLC networks : Average and RMS value of periodic time function. Steady state sinusoidal response of RL, RC, RLC network notation, vector l i representation, series, parallel and series parallel network. Active and reactive power.

UNIT-IV

Resonance: Series parallel resonance, Bandwidth, Q-factor. Coupled circuit -Analysis of circuits with mutual inductance. Three phase circuits. Generation of 3 phase voltages, star - delta connections -solution of 3 phase balanced circuits. Power measured by two wattmeter method.

UNIT V

Two port parameters: Impedance, Admittance, transmission -Hybrid parameters of two port passive networks. Their inter relationships. Terminated two ports. Inter connection of two ports.

Suggested Reading*:*

1. Van Valkenburg-**Network Analysis**-Prentice Hall of lndia-3rd Edn.1992 H. Hayt,
2. J.E Kimmerley-**Engineering Circuit Analysis**-McGraw Hill, 5th Edition.
3. A. Sudhakar, Shyam Mohan S Palli, **Network Analysis**, Tata McGraw Hill.

Course Code	Course Title						Core / Elective
MC916CE	**ENVIRONMENTAL SCIENCES**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To study the basic concepts, sources of water, floods and their impact on environment
- To know the ecosystems and energy resource systems
- To understand the Biodiversity concepts and their advantages
- To study the different pollutions and their impact on environment
- To know the social and environment related issues and their preventive measures

Course Outcomes

- Awareness of effects of hazardous environment.
- Idea about optimum utilization of natural resources.
- Be a catalyst in moving towards Green technologies
- Information about rules and regulations of pollution control

UNIT-I

Environmental Studies: Definition, scope and importance, need for public awareness. **Natural resources:** Water resources; use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams: benefits and problems. Effects of modern agriculture, fertilizer- pesticide problems, water logging and salinity.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).
Energy resources: Growing energy needs, renewable and non-renewable energy sources. Land Resources, land as a resource, land degradation, soil erosion and desertification.

UNIT-III

Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

UNIT-IV

Environmental Pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution; solid and liquid waste management.

Environment Protection Act: Air, water, forest and wild life Acts, enforcement of environmental legislation.

UNIT-V

Social Issues and the Environment: Water conservation, watershed management, and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion. **Environmental Disaster Management:** Types of disasters, impact of disasters on environment, infrastructure and development. Basic principles of disaster mitigation, disaster management and methodology. Disaster management cycle and disaster management in India.

Suggested Reading:

1. A.K. De, **Environmental Chemistry**, Wiley Eastern Ltd.
2. E.P. Odum, **Fundamentals of Ecology**, W.B. Sunders Co., USA.
3. M.N. Rao and A.K. Datta, **Waste Water Treatment**, Oxford and IBK Publications.
4. Benny Joseph, **Environmental Studies**, Tata McGraw Hill, 2005.
5. V.K. Sharma, **Disaster Management**, National Centre for Disaster Management, IIPE, Delhi, 1999.
6. **Green Building Council of India**, Teri Document.

Course Code	Course Title						Core / Elective
ES361ME	**MECHANICAL ENGINEERING LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2	**25**	**50**	**1**

Course Objectives

- To gain knowledge of working of petrol and diesel engines
- To be able to estimate the power developed in the engine
- To understand the working principle of hydraulic turbines and pumps
- To understand the performance of turbines using characteristic curves
- To gain the knowledge of various flow meters and the concept of fluid mechanics

Course Outcomes

- Knowledge regarding components and functioning of engines
- Ability to calculate the power developed, losses in the engines
- Understanding of viscosity of oils
- Knowledge of flash and fire point of oils, and its importance
- Knowledge of estimating the power of turbines and pumps

a) Thermal Engineering Laboratory:

1. Flash and Fire point test.
2. Performance test on diesel engine
3. Valve timing diagram test on a I.C engine
4. Morse test on multi-cylinder petrol engine.
5. Heat balance test on diesel engine.
6. Performance test on VCR engine

b) Hydraulic Machinery Laboratory:

7. Performance test on Pelton wheel turbine.
8. Characteristics curves test on Pelton wheel turbine.
9. Performance test on Francis turbine.
10. Characteristics curves test on Francis turbine.
11. Performance test on Turgo wheel.
12. Characteristics curves test on Turgo wheel.
13. Performance test on Reciprocating pump.

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

Course Code	Course Title						Core / Elective
ES362EC	**ELECTRONIC ENGINEERING LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2	**25**	**50**	**1**

Course Objectives

- Designing basic circuits of rectification with and without filters using diodes
- Designing wave shaping circuit using diodes.
- Designing of single and multistage amplifier circuits.
- Demonstrate negative feedback in amplifier circuits and positive feedback in Oscillators
- Design of Class Power Amplifiers

Course Outcomes

- Calculate ripple factor, efficiency and % regulation of rectifier circuits
- Analyze feedback amplifiers and BJT oscillator circuits
- Design single, multi-stage, wave shaping and power amplifier circuits

List of Experiments:

1. Characteristics of Silicon, Germanium and Zener Diode in forward bias and reverse bias
2. Application of diode as a full wave rectifier with and without filters. Calculation of Ripple factor, voltage regulation and efficiency with various loads
3. Static characteristics of BJT in CE configuration
4. Static characteristics of JFET in CS configuration
5. Frequency response of Single and two stage BJT amplifier in CE configuration
6. Voltage series amplifier without and with feedback
7. Voltage shunt amplifier without and with feedback.
8. Current shunt amplifier without and with feedback.
9. LC Oscillators: Hartley Oscillator and Colpitts Oscillator.
10. RC Phase Oscillator and Wein Bridge Oscillator.
11. Power Amplifier
12. Clipping circuits
13. Clamping Circuits.

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

Suggested Reading:

1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, **Basic Electronics**, A text-Lab Manual, 7th Edition. Mc- Graw- Hill Higher Education 2001.

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

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	Pr/ Drg	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
	Theory Courses									
1.	BS401MT	Engineering Mathematics - IV	3	1	-	4	30	70	3	3
2.	PC404EE	Power Electronics	3	1	-	4	30	70	3	3
3.	PC405EE	Linear Integrated Circuits	3	-	-	3	30	70	3	3
4.	PC406EE	Transducer Engineering	3		-	3	30	70	3	3
5.	PC407EE	Electrical Machines	3	1	-	4	30	70	3	3
6.	PC408EE	Signal and Systems	3	1	-	4	30	70	3	3
7.	HS401BM	Managerial Economics & Accountancy	3	-	-	3	30	70	3	3
	Practical /Laboratory Courses									
8.	PC451EE	Digital Electronics and Integrated Circuits Lab	-	-	2	2	25	50	3	1
9.	PC453EE	Computer Aided Instrumentation Drawing Lab.	-	-	2	2	25	50	3	1
			21	**04**	**04**	**29**	**260**	**260**		**23**

BS: Basic Sciences ES: Engineering Sciences MC: Mandatory Course
PC: Professional Course HS: Humanities and Sciences
L: Lectures T: Tutorials Pr : Practicals Drg: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note: 1) Each contact hour is a Clock Hour
2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Course Code	Course Title						Core / Elective
BS401MT	**ENGINEERING MATHEMATICS - IV** (Common to all branches)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives

- To introduce transforms like Laplace, Fourier, Z-transforms and their properties
- To introduce a few numerical methods to solve certain types of problems
- To understand curve fitting, correlation and regression

Course Outcomes

- Solve differential equations using Laplace and Fourier transforms
- Solve difference equation using Z-transforms
- Find numerical solution of algebraic, transcendental equations and ordinary differential equations.
- Perform a regression analysis and compute and interpret the coefficient of correlation

UNIT- I

Laplace transforms: Introduction of Laplace transforms, sufficient condition for existence of Laplace transform, Laplace transform of Derivatives, Laplace transform of integrals, Translation theorems (I & II shifting theorems), Differentiation of Laplace transform (Multiplication by t), Integration of Laplace transform(Division by t), convolution theorem, Solving initial value problems using Laplace transform.

UNIT- II

Fourier transforms: Introduction, Fourier integrals, Fourier sine and cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier sine and cosine transforms, Finite Fourier sine and cosine transforms, Properties of Fourier transforms, Convolution theorem for Fourier transforms.

UNIT- III

Z-Transforms: Introduction, basic theory of Z-transforms, Z-transforms of standard sequences, existence of Z-transform, linearity property, translation theorem, scaling property, initial and final value theorems, differentiation of Z-transform, convolution theorem, solution of difference equations using Z-transforms.

UNIT- IV

Numerical methods: Solution of Algebraic and Transcendental equations**:** Bisection method, Newton-Raphson method, Solution of linear system of equations: Gauss elimination method, Gauss- Seidel iteration method, Interpolation: Lagrange's interpolation, Newton's divided difference interpolation, Newton's Forward and Backward difference interpolations, Numerical differentiation, Numerical solutions of ordinary differential equations : Taylor's series method, Euler method, Runge-Kutta method of 4^{th} order.

UNIT- V

Curve fitting:

Curve fitting by method of least squares**,** correlation and regression, types of correlations, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, equal ranks, equations to the lines of regression.

Suggested Reading:

1. R.K.Jain, S.R.K Iyengar, **Advanced Engineering Mathematics**, Narosa Publication, 4^{th} Edition, 2014.
2. B.S.Grewal, **Higher Engineering Mathematics**, Khanna Publications, 43^{rd} Edition, 2014.
3. Vasishtha, Gupta, **Integral Transforms**, Krishnan Prakashan Publications, 2014.
4. Erwin Kreyszig, **Advanced Engineering Mathematics**, 9^{th} Edition, 2012.

Course Code	Course Title						Core / Elective
PC404EE	**POWER ELECTRONICS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives

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

Course Outcomes

- Explain the characteristics of power semiconductor devices and their applications
- Select a triggering circuit and commutation method to turn on and turn off the devices
- Select controlled rectifier to control the voltage as well as speed of the DC machines
- Explain the operation of Switch mode regulators and select appropriate converter as required
- Describe principle of operation of Inverters and select a method to control the inverters

UNIT-I

Power Semiconductor Diodes and Transistors: Types of power diodes - General purpose diodes -Fast recovery diodes -Their characteristics and applications. Bipolar Junction transistors, Power MOSFETs P-Channel, N- Channel. IGBTs - Basic structure and working, Steady state and switching characteristics-Comparison of BJT, MOSFET and IGBT -Their applications. SCRs-Static and dynamic characteristics, Two transistor analogy.

UNIT-II

Turn on and turn off mechanisms: BJT, Power MOSFET, IGBTs .SCR trigger circuits-R, RC and UJT triggering circuits. Triggering circuits for Single phase bridge rectifier and Choppers. Driver Circuits for MOSFET, IGBT and BJT. Protection of SCR's, Difference between forced and line commutation

UNIT-III

Principles of controlled rectification -Study of Single phase and three-phase half controlled and full controlled bridge rectifiers with R, RL, RLE loads. Effect of source inductances. Dual converters- circulating current mode and circulating current free mode-control strategies.

UNIT-IV

Classification of Choppers: Class A, B, C, D and E, Switching mode regulators - Study of Buck, Boost and Buck-Boost regulators, Cuk regulators. Principle of operation of Single phase bridge type Cyclo converters and their appl.ications. Single phase AC Voltage Controllers with R, L and RL loads.

UNIT-V

Principle of operation of Single phase Inverters -Three phase bridge Inverters (1800 and 1200 modes)-voltage control of inverters-Single pulse width modulation- multiple pulse width modulation, sinusoidal pulse width modulation. Comparison of Voltage Source Inverters and Current source Inverters, Elementary Multilevel Inverters.

Suggested Reading:

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

Course Code	Course Title						Core / Elective
PC405EE	**LINEAR INTEGRATED CIRCUITS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To familiarize and able to understand Op-amps.
- To understand the different linear and non-linear applications of op-amp
- To understand the voltage regulators and active filters by using op-amps.

Course Outcomes

- Design and use op-amps for various linear and non-linear applications.
- Ability to design and use voltage regulators and active filters

UNIT – l

Operational amplifiers : Characteristics, Open loop voltage gain, Output impedance, Input impedance, Common Mode Rejection Ratio - Offset balancing techniques - Slew rate, Frequency response - Basic applications - Inverter summer, Analog integrator, Differentiator, Current to voltage converter, Voltage to current converter, Voltage follower, a.c. amplifier.

UNIT – II

Circuits using Op-amps : Voltage limiter, Clipper and damper, Precision rectifier-full wave and half wave, Peak detector, Comparator, Zero crossing detector, Schmitt trigger, Monostable, astable and bistable multivibrators, Multiplier, Divider, Difference amplifier, Instrumentation amplifier.

UNIT – III

Waveform generation using Op-amps: Sine, Square, Triangular and Quadrature oscillators, 555 timer - Functional diagram, Operation as monostable and astable, Voltage to frequency converter using 555, 565.

UNIT – IV

Voltage regulators using Op-amp : Series voltage regulators - Shunt regulators using Op-amp - Switching regulators using Op-amp, Buck, Boost, Buck-boost regulators- Regulators using IC 723 - Dual voltage regulator - Fixed voltage regulators - Current sensing and current fold back protection.

UNIT – V

RC active filters : Butterworth - First order - Second order for low pass - High pass - Band pass - Band reject - Notch - State variable filter - Switched capacitor filter - Universal filter - Power amplifiers - Power boosters, Monolithic power amplifier features.

Suggested Reading:

1. Gayakwad W.A., **Op-Amps and Linear Integrated Circuits**, 4th Edition, Prentice Hall of India, 2002.
2. Malvino Albert Paul, **Electronic Principles**, 6th Edition, Tata McGraw Hill, 1999.
3. Roy Choudhury, Shail Jam, **Linear integrated Circuits**, New Age International, 2nd Edition, 2003.
4. William D. Stanley, **OP Amps with Linear Integrated Circuits**, Pearson, 2000.

Course Code	Course Title						Core / Elective
PC406EE	TRANSDUCER ENGINEERING						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	0	0	0	30	70	3

Course Objectives

- To be able to understand different types of Transducers, their characteristics and applications.
- To learn and understand the standards of calibration of measuring devices.

Course Outcomes

- Describe various static and dynamic characteristics of measuring system
- Classify transducers.
- Use inductive and capacitive transducer for various sensing applications
- Discuss temperature and pressure standards for calibrations
- Use temperature and pressure transducer for various sensing applications

UNIT-I

Introduction to measurement system (MS) static characteristics of MS - linearity, Hysteris, Threshold, Repeatability, Reliability and maintainability, Span, Calibration. Dynamic characteristics of M.S. - Zero order, first order instruments and their responses for impulse, step, ramp & sinusoidal Inputs and frequency response of above Instruments.

UNIT-Il

Classification of transducers, Basic requirements of transducers, Variable resistance transducers; Potentiometers, Strain gauge (SG), types of SG, derivation of gauge factor, Bridge Configuration, compensation, Application of SGs.

UNIT-Ill

Variable capacitive transducers; Capacitance, Principles, Capacitance displacement transducers, Capacitive hygrometer, and capacitive proximity transducers. Variable inductive transducers; Linear variable differential transformer, Rotary variable differential transformer.

UNIT-IV

Measurement of temperature — Standards for calibration of temp. Temperature measuring devices, types of filled in system thermometers — liquid in glass, vapour pressure, bimetallic on solid rod thermometer Resistance temperature detectors, thermistor thermocouple, pyrometers, IC temp. Detectors.

UNIT-V

Measurement of pressure — various elastic elements for pressure measurement. Diaphragms — flat and corrugated type — deflection of diaphragm due to pressure — Bourdan tube — bellows — capsule — Transduction method — Potentiometric, SG,

variable reluctance type, LVDT type transducers for measuring pressure. Non-electrical type of measurements — dead weight gauges and manometers force balance transducers, High pressure measurements, vacuum measurements, MC Leod gauge, Ktudcn gauge, thermal conductivity gauge & Ionization gauge.

Suggested Reading:

1. C.S.Rangan, G.R. Sarma, V.S.V. Mani, **Instrumentation Devices Systems**, Tata McGraw Hill Publication, 1983.Mani Sharma.
2. DVS Murthy, **Transducers and Instrumentation**, Prentice Hall of India (P) Ltd., 2000.
3. A.H. Sawhney**, A Course in Electrical; & Electronics Measurement and Instrumentation,** Dhanpat Rai & Co., Delhi, 1999.
4. B.Nakra and Chowdary, **Instrumentation Measurement and Analysis** Tata Mc-Graw Hill Publication, 2nd Edition, 2003.

Course Code	Course Title						Core / Elective
PC407EE	ELECTRICAL MACHINES						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	0	0	30	70	3

Course Objectives

- To learn and understand Construction, principle of operation , performance characteristics of DC generators and applications of DC motors.
- To be able to understand concept of transformer operation ,equivalent circuit

Course Outcomes:

- Understand construction, operating principle and characteristics of different types of DC motors and generators
- test and calculate performance parameters of DC motors and generators
- select appropriate DC machines for a specific application

UNIT – I

D.C. Generators and Motors: Principle of energy conversion, generator action, Constructional features of D.C. Machines, Functions of various parts. Methods of excitation. Elementary ideas of Armature winding, Armature reaction, Commutation. Characteristics of shunt, series and compound generators. D.C. Motor. Principle of operation, Back E.M.F., Torque equation, characteristics of shunt, series and compound motors. Losses and efficiency calculations. Applications of D.C. Motors, Motor starters, speed control of D.C. shunt motors.

UNIT – II

Single phase transformer: EMF equation, No-load and on load operation. Open and short circuit tests. Equivalent circuit, regulation and efficiency calculations. Auto transformer. 3 phase transformer connections. Conversion of 3-phase to two phase scott connection calculations.

UNIT – III

Synchronous Generator: Construction and principle of operation. EMF equation. Armature reaction. Determination of regulation by synchronous impedance method.

Synchronous motor: Theory of operation, Phasor Diagram. Variation of current and power factor with excitation. Synchronous condenser and P.F. improvement.

UNIT – IV

Polyphase Induction Motor: Constructional Features – Principle of operation – rotating magnetic field theory. Torque equation. Torque slip characteristics, starting methods and speed control.

UNIT – V

Single phase Induction Motor: Principle of operation of shaded pole. Single phase and capacitor motors and their characteristics.– Stepper Motors – Micro motors.

Suggested Reading:

1. Nagrath I.J.and Kothari D.P. – **Electrical Machines** – Tata McGraw Hill, 1995.
2. Dr. P.S.Bimbhra – **Electrical Machinery** – Khanna Publishers, 1997.

Course Code	Course Title						Core / Elective
PC408EE	SIGNALS & SYSTEMS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	0	0	30	70	3

Course Objectives

- To understand the classification of signals and systems.
- To acquire knowledge of time-domain representation and analysis concepts as they relate to differential equations, difference equations, impulse and step response and convolution.
- To acquire knowledge of frequency-domain concepts using Fourier analysis (Fourier series and Fourier Transform), Laplace transform, and Z-transform..

Course Outcomes

- Classify and analyze continuous and discrete time signals and systems.
- Analyze Fourier series for obtaining the frequency response of continuous time periodic signals.
- Analyze Fourier Transform for obtaining the frequency response of continuous time Aperiodic signals.
- Apply Laplace transform for solution of differential equations and discuss properties of Laplace transform.
- Analyze discrete time signals and apply Z-transform for solution of difference equations and discuss properties of Z-transform.

UNIT – I

Definition and Classification and systems, continuous time Unit-step Unit-impulse, exponential and sinusoidal. Discrete time unit step, unit impulse, exponential and sinusoidal Linear time invariant systems, properties of LTI system, impulse response, convolution sum, convolution integral, system described by difference and differential equation.

UNIT - II

Signal representation by a discrete set of orthogonal functions, orthonormailty and completeness. Trigonometric and exponential Fourier series, convergence, Dirichlets conditions, discrete spectrum, symmetry conditions.

UNIT – III

Signal representation by continuous exponentials – the direct and inverse Fourier transform continuous spectrum, properties of Fourier Transform, Singularity function, parseval theorem.

UNIT – IV

Signal representation by exponentials – the Laplace transform, properties of Laplace transform-initial and final value theorems, Laplace transform of periodic function,

waveform synthesis, partial fraction expansion, solution of networks by Laplace transform method.

UNIT – V

Discrete time signals, sampling of continuous time signals, sampling theorem, reconstruction of the signal from its samples, analysis, discrete time system Z- transform, its properties , Inverse Z- transform , Difference equations ,simple problems using Z-transforms.

Suggested Reading:

1. A.V. Oppenheium, A.S.Willsky, I.J.Young, **Signals and System**, Prentice Hall of India, 1983.
2. B.P.Lathi, **Signals Systems and Communication**, John Wiley,1967.
3. C.T.Chen, **Systems and Signal Analysis**, Oxford University Press, India, 3rd Edition, 2004, ISBN 100195156617
4. Gabel R.A. and Robert R.A, **Signals and Linear Systems**, 3rd Edition, John Wiley and Sons, New York, 1987.
5. Ziemer R.E., Tranter W.H., and Fannin D.R., **Signals and Systems**, 4th Edition, Pearson Education Asia, Singapore, 1998.

Course Code	Course Title						Core / Elective
HS401BM	**MANAGERIAL ECONOMICS AND ACCOUNTANCY** (Common to all branches)						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To learn important concepts of Managerial Economics and apply them to evaluate business decisions.
- To understand various parameters that determines the consumers' behavior.
- To evaluate the factors that affect production.
- To understand the concepts of capital budgeting and payback period.
- To study the concepts of various book-keeping methods.

Course Outcomes

- Determine the objectives, nature, scope, role & responsibilities of a manager of a business undertaking.
- Predict the demand for a product or product mix of a company & to analyze various factors influencing demand elasticity.
- Forecast & compute the future sales level of a product by using various quantitative & qualitative techniques and with the help of past sales data.
- Discuss the process & principles of accounting and prepare Journal, Ledger, Trial Balance, Manufacturing A/c, Trading A/c., Profit & Loss A/c. and Balance Sheet of an enterprise

Unit-I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

Unit-II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked)

Unit - III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly (theory and problems can be asked)

Unit-IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked)

Unit-V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.

(Theory questions and numerical problems on preparation of final accounts, cash book, petty cash book, bank reconciliation statement, calculation of some ratios)

Suggested Reading:

1. Mehta P.L., **Managerial Economics – Analysis, Problems and Cases**, Sulthan Chand & Sons Educational Publishers, 2011.
2. Maheswari S.N., **Introduction to Accountancy**, Vikas Publishing House, 2005.
3. Pandey I.M., **Financial Management**, Vikas Publishing House, 2009.

Course Code	Course Title						Core / Elective
PC451EE	**DIGITAL ELECTRONICS AND INTEGRATED CIRCUITS LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2	**25**	**50**	**1**

Course Objectives

- To Train the Students for acquiring practical knowledge in time response and frequency response of series / parallel RC, RL and RLC Circuits.
- To prepare the students for finds out parameters of a given two port network.
- To make the students for understanding the verification of theorems.

Course Outcomes

- Evaluate the time response and frequency response characteristics of R,L,C series and parallel circuits.
- Able to validate the network theorems.
- Able to find various parameters of a two-port network.
- Able to simulate electrical circuits using spice.
- Able to synthesize networks from a given transfer function

LIST OF EXPERIMENTS:

1. Generation of triangular, sine and square wave using IC's.
2. Voltage regulator IC **(Included instead of PLL)**
3. Design of astable multivibrator using 555 timer.
4. Active filters.
5. Instrumentation amplifier Sample and hold circuit.
6. Design of integrator and differentiator using Op-Amp.
7. Multiplexer application for logic realization and parallel to serial Conversions.
8. Synchronous counters.
9. Asynchronous counters.
10. Clippers and clampers using Op-Amps.
11. Monostable operation using IC's.
12. Bootstrap sweep circuit using Op-Amp.
13. Half adder, full adder and subtractor and realization of combinational logic.
14. A / D converters.
15. D / A converters.

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

Course Code	Course Title						Core / Elective
PC453EE	**COMPUTER AIDED INSTRUMENTATION DRAWING**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
NIL	**0**	**0**	**0**	**2**	**25**	**50**	**1**

Course Objectives

- To understand the terminology of electrical circuit with components and Process Instrumentation (P&ID) diagram.
- To be able to familiarize with P and ID symbols.
- To acquire knowledge on various Electrical and Instrumentation Engineering Software's.

Course Outcomes

- Identify and draw different components of electrical and Instrumentation systems
- Draw different control and wiring diagrams
- Draw PI diagrams of process instrumentation system.

Drawing of the following using Electrical CADD / Corel Draw / MS Word / PPT/Visio

LIST OF EXPERIMENTS:

1. Lines, Arcs, Curves, Shapes, Filling of objects, Object editing & Transformation.
2. Electrical, Electronic & Electro – mechanical symbols.
3. House – wiring diagrams and layout.
4. Simple power and control circuit diagrams.
5. P& ID symbols (seven main groups are: equipment, piping, vessels, heat exchangers, pumps, instruments, and valves)
6. A typical Flow control system
7. A typical Pressure control system.
8. A typical Temperature control system.
9. A typical Level control system
10. Instrument Line Symbols for: Instrument and device connections at process measurement points/ Connections to instrument power supplies/ Signals between measurement and control instruments and functions.

Suggested Reading:

1. KB. Raina, S.K. Bhattacharya, **Electrical Design, Estimating and Costing**, Wiley Eastern Ltd., 1991.
2. Nagrath, Kothari, **Electrical Machines**, Tata McGraw Hill Publishing Company Ltd., 2000.
3. A.K. Sawhney, A **Course in Electrical Machines Design**, Dhanpat Rai and Sons, 1996.
4. B. G. Lipták, **Instrument Engineers Handbook: Process measurement and Analysis Volume 1**, CRC Publication, 2003