Revised S. Y. B. Tech (Instrumentation Engineering) Curriculum
Academic year 2019-20

SGGS INSTITUTE OF ENGINEERING & TECHNOLOGY, VISHNUPURI, NANDED

CONTENTS

Program Education Objectives (PEOs)

PEO1. To provide students with the strong foundations in mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems related to industry, research and development. (Fundamentals)

PEO2. To impart the state of the art technology to the students in the field of Instrumentation and Control Engineering to prepare them with the technical and managerial skills necessary to enter careers in project planning, design, manufacturing, operations, and maintenance in the fields of measurement, signal processing, control, and industrial automation. (Core Competence)

PEO3. To foster innovation, invention and entrepreneurship by enabling the students to transform their ideas to proof-of-concepts for modern instrumentation, control and allied field applications. (Core Competence)

PEO4. To provide opportunity for the students to work as part of teams on multi-disciplinary projects. (Breadth)

PEO5. To inculcate in the students professional and ethical attitude, communication skills and the life-long learning skills needed for the successful professional career. (HSS and Life Long Learning)

Program Outcomes (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. The graduate will have ability to apply knowledge of mathematics, science, and engineering in the field of industrial measurement, control, automation, signal processing and biomedical Instrumentation.
2. The graduate will be competent to outstand (build a career) in the core instrumentation industry or also as an entrepreneur or researcher.
3. The graduate will have ability to function with multidisciplinary teams in the area of chemical, mechanical, electrical, and electronics for effective process planning, design and operation.
4. The graduate will have understanding of professional responsibility, effective communication skills and competent technical skills in the field of instrumentation.

Correlation between the PEOs and the POs

PO/PSO → ↓ PEO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PEO1	✓	✓	✓	✓	✓							✓	✓	✓		
PEO2	✓	✓	✓		✓					✓	✓	✓	✓	✓		
PEO3	✓		✓			✓		✓				✓		✓		
PEO4						✓		✓	✓	✓					✓	
PEO5								✓	✓	✓	✓	✓			✓	✓

Note: The cells filled in with ✓ indicate the fulfillment /correlation of the concerned PEO with the PO.

SGGS INSTITUTE OF ENGINEERING & TECHNOLOGY, NANDED

(An Autonomous Institute of Government of Maharashtra)

S.Y. B. Tech (Instrumentation Engineering) Curriculum Structure: CBCS - I

(Effective from Academic year 2019-20)

Semester I						
Course Code	**Name of the course**	**L**	**T**	**P**	**Credits**	
					Th	**Pr**
BSC272	Mathematics-III: Numerical Methods and Differential Equations	3	--	--	3	--
PCC-IN201	Sensors and Transducers	3	--	2	3	1
PCC-IN202	Electronics Devices and Circuits	3	--	2	3	1
PCC-IN203	Circuit Theory	3	--	2	3	1
PCC-IN204	Electrical Machines	3	--	2	3	1
BSC261	Mathematical Foundation for Engineering*	2	--	--	Audit	
MAC277	Indian Constitution	2	--	--	Audit	
	Total	**19**	--	**8**	**19**	
Semester II						
Course Code	**Name of the course**	**L**	**T**	**P**	**Credits**	
					Th	**Pr**
BSC275	Mathematics-IV: Statistical Methods and Complex Analysis	3	--	--	3	--
PCC-IN205	Linear Integrated Circuits	3	--	2	3	1
PCC-IN206	Digital Electronics and Logic Design	3	--	2	3	1
PCC-IN207	Signals and Systems	3	--	--	3	--
PCC-IN208	Electrical and Electronics Measurements	3	--	2	3	1
HMC278	Human Values and Professional Ethics	2	--	--	2	--
	Total	**17**	--	**6**	**20**	

L – No. of Lecture Hours/week, T – No. of Tutorial Hours/week, P – No. of Practical Hours/week

* This Audit course is only for Direct Second Year students and a MANDATORY course.

Semester-I

BSC272 Mathematics-III: Numerical Methods and Differential Equations

Teaching scheme:			**Examination scheme:**
Category: Basic Science Course			**Course Title:** Numerical Methods and Partial Differential Equations
Lectures	3	hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks
Tutorials	0	hrs/week	
Credits	3		

Course Objectives:

1.	To understand Number representation and errors. Locating roots of polynomial and transcendental equations.
2.	To understand the interpolation and approximation, Numerical differentiation and numerical integration.
3.	To learn various numerical techniques to solve differential equations.
4.	To understand the concepts of Fourier Series.
5.	To understand the methods of solving partial differential equations such as wave equation, heat equation and Laplace equation.

Course Outcomes: On successful completion of this course students will be able to

1.	Develop the numerical skills for error analysis.
2.	Find roots of polynomial and transcendental equations using numerical techniques
3.	Evaluate numerical integration and differentiation.
4.	To use numerical methods to solve ordinary and partial differential equations and other engineering problems.
5.	Develop the skills of finding Fourier series.
6.	Develop the skills of solving Partial differential equations using separation of variables and Fourier series.

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSC272.1	3	3	-	2	-	-	-	-	-	-	-	2
BSC272.2	3	3	-	2	-	-	-	-	-	-	-	2
BSC272.3	3	3	-	-	-	-	-	-	-	-	-	2
BSC272.4	3	3	1	2	-	-	-	-	-	-	-	2
BSC272.5	3	3	1	2	-	-	-	-	-	-	-	2
BSC272	15	15	2	8	-	-	-	-	-	-	-	10
	3	3	1	1	-	-	-	-	-	-	-	2

Syllabus:	
Unit 1	**Numerical Methods – 1 (12 hours)** Round-off Error, Truncation Error, Errors in Scientific and Engineering Computation, Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formula. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.
Unit 2	**Numerical Methods – 2 (18 hours)** Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution to two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods).
Unit 3	**Fourier Series (07 hours)** Expansion of a function in Fourier series for a given range - Half range sine and cosine expansions.
Unit 4	**Partial Differential Equations (08 hours)** Method of separation of variables for solving partial differential equations, first and second order one dimensional wave equation, heat equation and two dimensional Laplace equation.
References:	
1.	Erwin Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, 2015.
2.	R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Fifth Edition, Narosa Publishing House, 2016.
3.	I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications, Inc. Mineola New York.
4.	Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, 7th Edition, McGraw Hill.
5.	S.S. Sastry, Introductory Methods of Numerical Analysis, PHI learning Pvt. Ltd.
6.	B.S. Grewal, Numerical Methods in Engineering & Science, Khanna Publication, Ed. 9th.

PCC-IN201 Sensors and Transducers

Teaching scheme:			Examination scheme:
Lectures	3	hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks
Tutorials	-	hrs/week	
Practicals	2	hrs/week	
Credits	4		

Course Objectives:	
1.	To introduce the students for the purpose of measurement.
2.	To provide the knowledge of fundamentals and types of all the sensors and transducers and their signal conditioning used in the industry.

3.	To understand the sensors and transducers concept and its applications in the process measurement.
4.	To give the analysis of various sensors characteristics and their selections in applications in controlling various parameters.
Course Outcomes: On successful completion of this course students will be able to	
1.	To identify, list, define verity of sensors, signal conditioning devices, transducer (Primary and secondary). [PO1] [PEO4]
2.	To describe, draw, classify and produced sketches, drawings to explain working principles of various sensors and transducers. [PO1] [PEO1]
3.	To analyze the problem using basic principles for development of project for agriculture, biomedical, Automobiles, Environmental, Petrochemical or other process industries. [PO1, PO3, PO5] [PEO1]
4.	To monitor and evaluate asses and compare of various sensors and transducers and came to conclusion for the best selection for the desired applications. [PO1] [PEO1]
5.	To create, design, formulate, generate and deliver the solutions for given applications using best applicable sensors and transducers. [PO3] [PEO2, PEO3]

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-IN201.1	3	-	-	-	-	-	-	-	-	-	-	2	3	3	2	3
PCC-IN201.2	3	2	-	-	2	-	2	-	-	2	-	2	3	3	2	3
PCC-IN201.3	3	3	1	2	1	2	-	-	-	-	-	2	3	3	3	2
PCC-IN201.4	3	1	2	1	2	-	-	-	-	-	-	2	3	2	2	2
PCC-IN201.5	3	2	3	3	3	-	-	-	-	1	-	2	3	3	2	2
PCC-IN201	15	8	6	6	8	2	2	-	-	3	-	10	15	14	11	12
	3	2	2	2	2	2	2	-	-	2	-	2	3	3	2	2

Syllabus:	
Unit 1	**General measurement system**
	Measurement system-purpose, structure and elements. Generalized performance characteristics: static characteristics of measurement system elements, dynamic characteristics of measurement systems.
Unit 2	**Variable resistance transducers**
	Potentiometer, strain gauge, types of strain gauge, derivation of gauge factor, bridge configurations, compensation, applications of strain gauges.
Unit 3	**Variable capacitive transducers**
	Capacitance principles, capacitive displacement transducers, capacitive level transducers, capacitive hygrometer, and capacitive proximity transducers.
Unit 4	**Variable inductive transducers:**
	Linear variable differential transformer, rotary variable differential transformer.
Unit 5	**Temperature transducers**
	Resistance temperature detector, thermistor, thermocouple, pyrometers, IC temperature transducers.

Unit 6	**Pressure transducers**
	Manometers, Electrical pressure transducers, Vacuum pressure measurements.
Unit 7	**Flow measurement systems**
	Essential principles of fluid mechanics, measurement of velocity at a point in a fluid: pitot-static tube, measurement of volume flow rate: differential pressure, mechanical and vortex flow meters, measurement of mass flow rate: inferential and direct methods, measurement of flow rate in difficult situations: electromagnetic and cross –correlation flow meters.
Unit 8	**Level measurement**
	Level formulae; level sensing devices, direct level sensing, indirect level sensing, and application considerations.
Text Books:	
1.	Arun Ghosh, Introduction to Measurements and Instrumentation, PHI Learning Pvt. Ltd., 16-Oct-2012.
2.	Bentley J. P., Principles of measurement systems, Third Edition, Pearson education Asia pvt.ltd, 2000.
3.	A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Co. (P) Ltd.,1998
Reference Books:	
1.	Doebelin, E.O., Measurement Systems, McGraw Hill Book Co., 1998
2.	Patranabis D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997.
3.	Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
4.	Neubert, H.K.P., Instrument Transducers, Clarenden Press, Oxford, 1988.
5.	Process Measurement and Analysis- B. G. Liptak- Butterworth Heinemann- 3rd Edition.
Term Work:	
1.	To determine the LVDT characteristics.
2.	To determine the characteristics of capacitive displacement transducer.
3.	To determine strain gauge characteristics.
4.	To determine thermocouple characteristics.
5.	To determine RTD characteristics.
6.	To determine thermister characteristics.
7.	To determine Rotameter characteristics.
8.	To determine level transducer characteristics.
9.	To determine flow using orifice or venturimeter or rotameter and compare the accuracy
10.	To determine distance using ultrasound transducer.

PCC-IN202 Electronic Devices and Circuits

Teaching scheme:			**Examination scheme:**
Lectures	3	hrs/week	Theory
Tutorials	-	hrs/week	In Semester Evaluation : 20 Marks
Practicals	2	hrs/week	Mid Semester Examination: 30 marks

Credits	4	End Semester Examination : 50 marks

Course Objectives:

1.	To train the students the operational principle, analysis, design and application of the diode, transistors.
2.	An understanding of how complex devices such as semiconductor diodes and transistors are modeled and how the models are used in the design and analysis of useful circuits.
3.	Understand the application of different electronic devices and simple circuits.
4.	To develop the students' ability on conducting engineering experiments, analyze experimental observations scientifically.
5.	To analyze simple electronic circuits using simulation software.

Course Outcomes: On successful completion of this course students will be able to

1.	To remember the basic electronic components and observe various characteristics of the same. [PO1] [PEO1]
2.	To understand the various theorems, utilizing equivalent circuits or developing models and applying the fundamental circuit theorems rather than memorizing the equations. [PO3] [PEO1]
3.	To practice different biasing circuits using equivalent models to illustrate various circuit parameters. [PO5] [PEO1]
4.	To analyze and design basic electronic circuits, particularly with application to diodes, MOS field-effect transistors, bipolar junction transistors. [PO3] [PEO4]
5.	To measure the characteristics of two port network. [PO5] [PEO1]
6.	To design and construct different electronic circuitry like single-stage amplifier, multi-stage amplifier, oscillator circuits, multivibrators, feedback amplifiers. [PO3] [PEO3]

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-IN202.1	3	-	-	-	-	-	-	-	-	-	-	2	3	3	3	2
PCC-IN202.2	3	1	1	1	-	-	-	-	-	-	-	2	3	2	2	1
PCC-IN202.3	3	-	2	2	2	-	-	-	-	-	-	2	3	2	1	1
PCC-IN202.4	3	2	2	1	2	-	-	-	-	-	-	2	3	2	2	2
PCC-IN202.5	3	-	-	-	-	-	-	-	-	-	-	2	3	1	1	1
PCC-IN202.6	3	1	3	-	-	1	-	-	-	-	2	2	3	2	3	2
PCC-IN202	18	4	8	4	4	1	-	-	-	-	2	12	18	12	12	9
	3	1	1	1	1	1	-	-	-	-	1	3	3	3	3	2

Syllabus:

Unit 1	**Semiconductor diodes and applications**
	Introduction to semiconductors, P-N junction diode, forward and reverse biased junctions, V-I characteristics, equivalent circuits, transition and diffusion capacitance. SPICE diode model. Diode rectifier circuits: half-wave, full-wave, and bridge type, rectification efficiency, ripple factor, filter circuits, clipper and clamper circuits. Metal semiconductor contacts, hetero junctions, zener diodes, schottky diode, Photo diode, light-emitting diode (LED), varactor diode, breakdown diodes, Zener diode as a voltage regulator.

Unit 2	**Transistors**
	Introduction to BJT and FET, characteristics and configurations, different modes of operation and configurations. Transistor current components. Ebers – Moll model and Gummel – Poon model of BJTs. Bipolar transistor switch, SPICE BJT model, Punch through and other breakdown mechanisms, photo-voltaic effect, n Photo-cell transistors. DC analysis of BJT and FET, power considerations. DC Load line analysis, operating point, biasing methods, transistor as an amplifier, Single stage CE amplifier, phase reversal, dc and ac equivalent circuits, ac load-line analysis. Amplifier step response and frequency response.
Unit 3	**Multi stage amplifier**
	Classification, distortion, noise, low frequency response of RC coupled and transformer coupled amplifiers.
Unit 4	**Large signal (power) amplifiers and output stages**
	Power amplifiers, power transistors, classes of amplifiers, class-A B, AB and C, class AB push-pull and complementary symmetry amplifier.
Unit 5	**Feedback amplifiers**
	Classification, feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifier, Input and output resistance, method of analysis of feedback amplifier, voltage-series, current-series, voltage–shunt, current-shunt feedback. Positive feedback in amplifiers, Barkhausen's criterion and stability of oscillators, sinusoidal oscillators – RC, LC, Hartley, Colpitt's and crystal oscillators. Multivibrators: Astable, bistable and monostable multivibrators, Commutating Capacitors, Triggering methods, Schmitt trigger.
Unit 6	**MOSFETs**
	Device structure and physical operation, current – voltage characteristics, DC circuit analysis, MOSFET as an amplifier and as a switch, small signal model, amplifier configurations, DC analysis and small signal analysis. Enhancement and depletion modes of MOSFET, SPICE MOSFET model, CMOS structure, operation, BiCMOS operation, CCDs.
Text/ Reference Books:	
1.	J. Millman and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Tata McGraw-Hill Publishing Company, 1988.
2.	Donald A. Neamen, Electronic Circuit Analysis and Design, Tata McGraw-Hill.
3.	Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, Eighth edition, PHI publishers, 2004.
4.	J. Millman and Taub, Pulse and Digital Circuits, Tata McGraw Hill.
5.	N. C. Goyal and R. K. Khetan, A Monograph on Electronic Design Principles, Khanna Publishers.
6.	Horowitz and Hill, The Art of Electronics, 2nd edition, Cambridge 1989. 7. Rashid, Spice for Circuits and Electronics Using PSPICE, 2nd edition, 1995.
7.	B.G. Streetman, "Solid state devices", 4th Edition, PHI, 1995.
Term work:	
1.	Study of electronic instruments: Regulated power supply, Function generator, Multimeter, Cathode Ray Oscilloscope (CRO), other instruments: LCR meter, frequency counter, voltmeter, and ammeter.
2.	Study of Electronic components: Resistor, Potentiometer, Trimmer, Capacitors, Inductors, Diodes: P-N junction diode, Zener diode, light emitting diode (LED), Transistors: BJT and FET, transformers, Probes and connecting wires, Breadboard.
3.	To verify diode characteristics: P-N junction diode, zener diode, tunnel diode.

4.	To study IV characteristics of JFET and MOSFET.
5.	To design and implement rectifier circuits: Half wave and full wave rectifier circuits.
6.	To design and implement passive filters: C, RC, LC, CLC etc.
7.	To design and implement zener diode voltage regulator.
8.	To design and implement wave shaping circuits: Clipper circuits.
9.	To design and implement clamper circuits.
10.	To verify input and output characteristics of BJT / FET in various configurations.
11.	To design and implement Transistor BJT / FET amplifier circuit and to study its frequency response.
12.	To design and implement two stages RC coupled amplifier and study its frequency response.
13.	To design and implement emitter follower/Darlington emitter follower and study its performance.
14.	To design and implement class AB push-pull power amplifier.
15.	To design and implement RC phase shift oscillator, Hartley / Colpitts oscillator.
Mini-projects:	
1.	Design and implementation of Regulated DC power supply / Signal generator
2.	Simulation of Electronic circuits using SPICE.

PCC-IN203 Circuit Theory

Teaching scheme:			**Examination scheme:**
Lectures	3	hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks
Tutorials	-		
Practicals	2	hrs/week	
Credits	4		

Course Objectives:	
1.	To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems.
2.	To develop an understanding of the fundamental laws and elements of electric circuits.
3.	To understand waveforms, signals, and transient, and steady-state responses of RLC circuits.
4.	To develop the ability to apply circuit analysis to DC and AC circuits.
5.	To understand advanced mathematical methods such as Laplace and Fourier transforms along with linear algebra and differential equations techniques for solving problems.
Course Outcomes: On successful completion of this course students will be able to	
1.	To remember basic concepts and principles of electrical circuits. [PO1] [PEO1]
2.	To explain network theorems and their applications. [PO5] [PEO1]
3.	To solve network problems using mesh current and node voltage equations. [PO2] [PEO1]
4.	To investigate initial conditions and obtain circuit response using Laplace Transform. [PO5] [PEO1]
5.	To evaluate network functions and two port parameters for electrical networks. [PO5] [PEO1]
6.	To analyze electrical circuits using network theorems. [PO1] [PEO1]

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PO12	PSO1	PSO2	PSO3	PSO4
PCC-IN203.1	3	-	2	-	-	-	-	-	-	-	-	2	3	2	1	1
PCC-IN203.2	2	2	1	-	-	-	-	-	-	-	-	1	3	-	-	-
PCC-IN203.3	2	3	2	1	-	-	-	-	-	-	-	-	2	2	2	-
PCC-IN203.4	2	3	3	2	1	-	-	-	-	-	-	-	2	1	-	-
PCC-IN203.5	2	3	3	1	-	-	-	-	-	-	-	-	2	1	-	-
PCC-IN203.6	1	3	2	1	-	-	-	-	-	-	-	-	3	2	2	-
PCC-IN203	12	14	13	5	1	-	-	-	-	-	-	3	15	8	5	1
	3	3	3	1	1	-	-	-	-	-	-	1	3	1	1	1

Syllabus:	
Unit 1	**Development of circuit concepts**
	Charge, current, voltage, energy, introduction to basic passive circuit parameters. Reference direction for current and voltage, active element convention, source transformation, dot convention for coupled circuits, Topological description of networks.
Unit 2	**Network equations**
	Kirchoff's laws, number of network equations, loop variable analysis, node variable analysis, duality, formation of network equation in matrix form, Use and study of initial conditions in various elements, a procedure for evaluating initial conditions. Solution of network equations by Laplace Transformation technique.
Unit 3	**Transform of other signal waveform**
	Shifted unit step function, ramp and impulse function, waveform synthesis, initial and final value theorem, convolution integral, convolution as a summation.
Unit 4	**Impedance functions and network theorems**
	Concept of complex frequency, transform impedance and transform circuits, series and parallel combination of elements, Thevenin's, Superposition, Millman's, Tellegen's, Reciprocity, Norton and Maximum power transfer theorems. Sinusoidal steady-state analysis.
Unit 5	**Network functions**
	Network functions for one port and two-port network, calculation of network functions, Ladder networks, general networks. Poles and zeros of network functions, restriction on poles and zeros locations for driving point functions and transfer functions, Time domain behavior from pole and zero plot**.**
Unit 6	**Two-port parameters**
	Relationship of two port variables, short circuit admittance parameters, opens circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameters sets, and parallel connection of two port networks**.**
Text /Reference Books:	
1.	M. E. Van Valkenberg, Networtk analysis, Third Edition, Prentice Hall of India Publication, 1996.
2.	C. P. Kuriakose, Circuit Theory: Continuous and Discrete Time Systems, Elements of Network Synthesis, Prentice Hall of India Publication, New Delhi, 2005.
3.	L. P. Huelsman, Basic Circuit Theory, Third Edition, Prentice Hall of India, New Delhi,

	2002
4.	W. H. Hayt. Jr. and J. E. Kemmerly, Engineering Circuit Analysis, Fifth Edition, Tata-McGraw Hill Edition, 2000
Term Work:	
1.	Verification of Maximum power transfer theorem.
2.	Verification of Thevenin's theorem.
3.	Verification of Superposition theorem.
4.	Plotting of behavior of RC circuit for step input.
5.	Plotting of behavior of RL circuit for step input.
6.	Plotting of behavior of RLC circuit for step input.
7.	Determination of hybrid and impedance parameters of a given network.
8.	Sinusoidal study of RC and RL series networks.

PCC-IN204 Electrical Machines

Teaching scheme:			**Examination scheme:**
Lectures	3	hrs/week	Theory
Tutorials	-	hrs/week	In Semester Evaluation : 20 Marks
Practicals	2	hrs/week	Mid Semester Examination : 30 marks
Credits (Th)	4		End Semester Examination : 50 marks

Course Objectives:	
1.	To introduce students with classification of electrical machines.
2.	Introduction of working principle and operation of AC and DC machines.
3.	To teach students different speed control methods of electrical machines.
4.	Helping students in understanding performances of machines under different operating conditions and their testing methodology.
Course Outcomes: On successful completion of this course students will be able to	
1.	To know the basic fundamentals of different electrical machines and transformers. [PO1] [PEO1]
2.	To introduce the different characteristics of DC machines. [PO1] [PEO1]
3.	Investigation of motors starting problems. [PO4]
4.	To analyse and investigate the major performance characteristics of different types of motors. [PO2, PO4] [PEO2]
5.	To decide what type of motor is selected for this applications and test the motor from the students to gain the proficiency to differentiate between the different types of motors, with the capability to select the proper motor for the proper application. [PO2] [PEO2]
6.	To construct the machines from the students with the proficiency to conduct and benefit from the testing procedures of electric motors with the ability to analyse data and to solve the problems. [PO3] [PEO1]

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-IN204.1	3	-	-	-	-	-	-	-	-	-	-	2	3	2	3	2

PCC-IN204.2	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**2**	**-**
PCC-IN204.3	**3**	**2**	**1**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**-**
PCC-IN204.4	**3**	**2**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**2**	**-**
PCC-IN204.5	**3**	**-**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**2**	**-**
PCC-IN204.6	**3**	**1**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**3**	**3**	**2**
PCC-IN204	**18**	**5**	**6**	**9**	**9**	**2**	**-**	**-**	**-**	**2**	**-**	**12**	**18**	**7**	**15**	**4**
	3	**1**	**1**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**3**	**3**	**1**	**3**	**1**

Syllabus:	
Unit 1	**Single phase transformers**
	Transformer construction and practical consideration, transformer reactance and equivalent circuits, testing, polarity test, open – circuit(O.C.) and short circuit (S.C.) Test, instrument transformers-current transformer and potential transformer, pulse transformer and application.
Unit 2	**Three phase transformers**
	3-Ø transformer, 3-Ø transformer connectivity, star/star-delta/delta –star/delta-delta/star open-delta or V-V connection–Scott connection. Three phase to two-phase conversion and vice-versa, parallel operation of 3-Ø transformer.
Unit 3	**D.C. generator**
	Principle, construction and working of D.C. generator, pole cores and pole shoe, armature core, armature windings, commutator, lap and wave winding, types of generator, EMF equation of a D.C. generator, Iron losses in armature, total losses in Generator, condition for maximum efficiency, characteristics of generator.
Unit 4	**D.C. motor**
	Principle, comparison of generator and motor action significance of back emf, voltage equation of a motor, condition for maximum power, torque armature torque of a motor , shaft torque , speed of d.c. motor, speed regulation, motor characteristics, characteristics of shunt motors, compound motors, comparison, speed control of D.C. shunt motor ,types of starter.
Unit 5	**Induction motor**
	General principle, construction, stator squirrel cage, rotor, rotor rotation, slip, frequency of rotor current, starting torque for squirrel cage motor, slip-ring motors, condition for maximum starting torque. Relation between torque and slip, effect of changes in supply voltage on torque & speed, full load torque and maximum torque. Equivalent circuits of rotor, and an induction motor, single phase I.M. revolving theory, equivalent circuit of single-phase motor, types of single phase motors.
Unit 6	**Synchronous machines**
	Alternators: Basic principles, construction, star and delta connection, equation of induced EMF, alternator on load, vector diagram, voltage regulation, parallel operation of two alternators. **Synchronous motor:** Principle of operation, method of starting, motor on load, effect of increase in load.
Text /Reference Books:	
1.	B. L. Theraja, A. K. Theraja, A Textbook of Electrical Technology, Vol-II, S.Chand& Co., New Delhi, 2005.
2.	I. J. Nagrath, D. P. Kothari, Electric Machines, Tata McGraw Hill Publication. Second Edition,

	2003.
3.	A. E. Fitzgerald, C. Kingsley, S. D. Umans, Electrical Machinery, Tata McGraw Hill. Sixth Edition 2002.
4.	J. B. Gupta, Electrical Machines, SK Kataria and Sons, New Delhi.
5.	Ashfaq Hussein, Electrical Machines, Dhanpat Rai Publication, 2012.
6.	P.S. Bhimbra, Electrical Machines, Khanna Publication, 2011.
Term Work:	
1.	To perform Short circuit test of transformer.
2.	To perform open circuit test of transformer.
3.	To determine the characteristics of D.C. Generator.
4.	Study of D.C. Motor starter.
5.	To determine the characteristics of D.C. Motor.
6.	Study of Speed control of D.C. motor.
7.	Load test of Induction motor.
8.	Study of induction motor starters.
9.	Determination of Squirrel cage induction motor performance from Circle diagram.
10.	Direct loading test on three phase Alternator.
11.	Study of Alternator.
12.	Study of synchronous motor.

MAC277 Indian Constitution

Teaching scheme:			
Lectures	2	hrs/week	
Tutorials	-	hrs/week	
Credits	-	-	

Course Objectives:	
1.	To understand the basic foundation and the basic law for the governance of our nation, the history and the different types of Constitutions.
2.	To understanding the importance and the different aspects of the Constitution. To know and understand the different rights enshrined in the Constitution and understand the rights and duties of the government.
3.	To understand the basis and procedure of amendments.
4.	To know the different aspects of the Union and the State Executive.
5.	To know how our country was founded, who founded it, what are our rights are, what life was like, how life has changed, how the rights still apply today.
Course Outcomes: On successful completion of this course students will be able to	
1.	Student will be able to understand how India has come up with a Constitution which is the combination of the positive aspects of other Constitutions.
2.	Student will be able to understand the interpretation of the Preamble.
3.	Student will be able to understand the basics of governance of our nation.
4.	It helps in understanding the different aspects covered under the different important Articles.
5.	Student will be able to understand the basic law and its interpretation. Understand the important amendments which took place and their effects.

6.	Student will be able to understand our Union and State Executive better.
7.	Student will be able to that along with enjoying the rights one needs to fulfill one's duties.
Syllabus:	
Unit 1	Meaning of the constitution law and constitutionalism. Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India
Unit 2	Scheme of the fundamental rights. The scheme of the Fundamental Duties and its legal status
Unit 3	The Directive Principles of State Policy –Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and States.
Unit 4	Parliamentary form of Government in India. The constitution powers and status of the President of India.
Unit 5	Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India.
Unit 6	Emergency Provisions: National Emergency, President Rule, Financial Emergency.
Unit 7	Local Self Government – Constitutional Scheme in India.
Unit 8	Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19. Scope of the Right to Life and Personal Liberty under Article 21.
Text Books:	
1.	Introduction to the Constitution of India by Durga Das Basu (Students Edn.) Prentice-Hall EEE, 19th /20th Edition, 2001.
2.	An Introduction to Constitution of India by M. V. Pylee, Vikas Publishing, 2002.

BSC261 Mathematical Foundation For Engineering

Teaching scheme:			**Examination scheme:**
Lectures	2	hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks
Tutorials	-	hrs/week	
Credits	-	-	

Course Objectives:	
1.	To develop the sound conceptual understanding of Algebra, coordinate geometry, complex numbers, vectors, matrices, Calculus and Differential Equations.
2.	To develop the foundation for engineering mathematics and other engineering courses.
Course Outcomes: On successful completion of this course students will be able to	
1.	Analyze the structure of complex numbers, quadratic equations, vectors and matrices and their uses.
2.	Find the standard and general equations of lines, circles, conic sections, and their properties.
3.	Sketch the graphs of functions and can evaluate limit, continuity, derivatives, integrations.
4.	Formulate and solve first order differential equations.

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO → ↓CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSC261.1	3	3	1	2	-	-	-	-	-	-	-	2
BSC261.2	3	3	1	2	-	-	-	-	-	-	-	1
BSC261.3	3	3	-	-	-	-	-	-	-	-	-	1

BSC261.4	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
BSC261	**12**	**12**	**4**	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**6**
	3	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Syllabus:	
Unit 1	**Complex Numbers (05 hours)** Complex numbers as ordered pairs. Argand's diagram. Triangle inequality. Powers and roots of complex numbers, De Moivre's Theorem.
Unit 2	**Algebra (05 hours)** Quadratic equations and express-ions. Permutations and Combinations. Binomial theorem for a positive integral index.
Unit 3	**Coordinate Geometry (07 hours)** Coordinate Geometry: Locus. Straight lines. Equations of circle, parabola, ellipse and hyperbola in standard forms. Parametric representation.
Unit 4	**Vectors and Matrices (08 hours)** Addition of vectors. Multiplication by a scalar. Scalar product, cross product and scalar triple product with geometrical applications. Matrices and Determinants: Algebra of matrices. Determinants and their properties. Inverse of a matrix. Cramer's rule.
Unit 5	**Differential Calculus (10 hours)** Function. Inverse function. Elementary functions and their graphs. Limit. Continuity. Derivative and its geometrical significance. Differentiability. Rules of derivatives, Applications of Derivatives: Tangents and Normals, Increasing and decreasing functions. Maxima and Minima.
Unit 6	**Integral calculus (10 hours)** Integration as the inverse process of differentiation. Integration by parts and by substitution. Definite integral and its application to the determination of areas (simple cases). Solving first order differential equations: Exact differential equations and first order linear differential equations.
References:	
1.	Bernard and Child, Higher Algebra, Macmillan and Co. Pvt. Ltd, New York.
2.	J.V. Uspensky, Theory of equations, macGraw Hill Publications.
3.	S. L. Loney, The Elements of Coordinate Geometry, Macmilliams and Co., New York.
4.	G. B. Thomas, M. D. Weir, J. Hass, Thomas' calculus, 12th edition, Pearson Publications.
5.	H. Anton, C. Rorrers, Elementary Linear Algebra Applications version, 9th edition, Wiley publications.

Semester-II

BSC275 Mathematics-IV: Statistical Methods and Complex Analysis

Teaching scheme:		**Examination scheme:**
Category: Basic Science Course		**Course Title:** Statistics, Probability and Complex Analysis
Lectures	3 hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks
Tutorials		
Credits	3	

Course Objectives:	
1.	To provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
2.	To understand probability distributions and their properties.
3.	To learn the statistical parameters for different distributions, correlation and regression.
4.	To understand the method of curve fitting, testing of hypothesis, goodness of fit.
5.	Identify and construct complex-differentiable functions and use conformal mapping.
6.	Use the general Cauchy integral theorem and formula, Residue Theorem, and Express functions as infinite series or products.
Course Outcomes: On successful completion of this course students will be able to	
1.	To develop techniques of data interpretation.
2.	Develop problem solving techniques needed to accurately calculate probabilities and describe the properties of discrete and continuous distribution functions.
3.	Use statistical tests in testing hypotheses on data.
4.	Compute covariances, and correlations, Apply the tests of goodness of fit.
5.	Determine whether a given function is analytic and apply analyticity on harmonic functions and conjugates of harmonic functions.
6.	Transform a region to another region using conformal mapping.
7.	To evaluate contour integrals using Cauchy's integral theorem and formula.
8.	Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSC275.1	3	3	-	-	-	-	-	-	-	-	-	2
BSC275.2	3	3	2	-	-	-	-	-	-	-	-	2
BSC275.3	3	3	2	3	-	1	-	-	-	-	-	2
BSC275.4	3	3	2	2	-	1	-	-	-	-	1	1
BSC275.5	3	3	2	1	-	-	-	-	-	-	-	2
BSC275	15	15	8	6	-	2	-	-	-	-	1	9
	3	3	1	1	-	1	-	-	-	-	1	2

Syllabus:

Unit 1	**Analysis of Statistical Data (03 hours)** Frequency distribution; Frequency curve and histogram; Measure of central tendency and dispersion.
Unit 2	**Random variables and Probability Distributions (08 hrs)** Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, Mean and variance of Binomial, Poisson and Normal distributions and applications.
Unit 3	**Sampling Distributions and Interval of Estimation (08 hours)** Sampling Distributions: t distribution, Chi-square distribution, F-distribution,; Interval of estimation.
Unit 4	**Testing of Hypothesis (08 hours)** Relation between confidence interval and testing of hypothesis; testing of hypothesis, classification of hypothesis tests; large sample tests, small sample tests.
Unit 5	**Complex Variable- Differentiation (08 hours)** Functions of complex variables, Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, elementary analytic functions; Conformal mappings.
Unit 6	**Complex Variable – Integration (10 hours)** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Residue theorem and evaluation of real integrals.
References:	
1.	E. Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, 2015.
2.	V. K. Rohatgi and A.K. Md. Ehsanes Saleh, An Introduction to Probability and Statistics, 2nd Edition.
3.	D. C. Montgomery and G.C. Runger, "Applied Statistics and Probability for Engineers", 5th edition, John Wiley & Sons, (2009).
4.	P. S. Mann, Introductory Statistics, Wiley Publications, 7th edition (2013).
5.	J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.

PCC-IN205 Linear Integrated circuits

Teaching scheme:			**Examination scheme:**
Lectures	3	hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks
Tutorials	-		
Practicals	2	hrs/week	
Credits	4		

Course Objectives:	
1.	To introduce the basic building blocks of linear integrated circuits.
2.	To teach the linear and non-linear applications of operational amplifiers.
3.	To introduce the theory and applications of analog multipliers and PLL.
4.	To teach the theory of ADC and DAC.
5.	To introduce a few special function integrated circuits.

Course Outcomes: On successful completion of this course students will be able to	
1.	To understand the operational amplifiers with linear integrated circuits. [PO1] [PEO1]
2.	To design circuits using operational amplifiers for various applications. [PO3] [PEO2]
3.	To infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques. [PO5] [PEO1]
4.	To Classify and comprehend the working principle of data converters. [PO1]
5.	To illustrate the function of application specific ICs such as Voltage regulators, PLL and its application in communication. [PO2,PO10] [PEO5]
6.	To compare the working of multivibrators using special application IC 555 and general purpose Op-amp. [PO1] [PEO2]

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-IN205.1	3	-	-	-	-	-	-	-	-	-	-	2	3	3	2	2
PCC-IN205.2	3	1	3	3	3	-	-	-	-	-	-	2	3	3	3	2
PCC-IN205.3	3	-	-	2	-	-	-	-	-	-	-	2	3	2	2	1
PCC-IN205.4	3	-	-	-	-	-	-	-	-	-	-	2	3	2	2	1
PCC-IN205.5	3	2	2	2	3	-	-	-	-	-	-	2	2	2	3	1
PCC-IN205.6	3	1	1	1	2	-	-	-	-	-	-	2	3	3	3	2
PCC-IN205	18	4	6	8	8	-	-	-	-	-	-	12	17	15	15	9
	3	1	1	1	1	-	-	-	-	-	-	3	3	3	3	2

Syllabus:	
Unit 1	**Integrated circuits**
	An over view of IC design technology, Introduction to wafer cleaning, photolithography, Ion implantation. Classification of IC families and their comparison. Study of data sheets of 741, 301, OP-07 and 324. Op-amp ideal characteristics and op-amp parameters.
Unit 2	**OP-amp with positive and negative feedback**
	Inverting, Non inverting and differential amplifier configuration and their special cases. Summing, scaling, averaging, instrumentation amplifier, integrator and differentiator, V to I and I to V converters.
Unit 3	**Active filters**
	Frequency response of op-amp. Low pass, high pass first and second order, band pass, band reject and all pass Butterworth filters.
Unit 4	**Introduction to oscillator using op-amps**
	Phase shift oscillator, Wein bridge oscillator, square wave, triangular wave and saw tooth wave generators.
Unit 5	**Comparators and converters**
	Basic comparators, zero crossing detector, schmitt trigger, voltage limiters, V/F and F/V converter, clippers and clampers, absolute value o/p circuit, sample and hold circuit, D/A converters- resisting divider and ladder networks. A/D converters, counters- Ramp type, dual slope, integration techniques, successive approximation, parallel comparison techniques.
Unit 6	**Study of some important IC's**
	555 timer and its applications, The 723 and 78xx and 79xx voltage regulator IC's, PLL

	IC's 565 and its applications, DAC 0808, ADC 0809.
Unit 7	**Analog computation and simulation**
	Introduction to analysis of linear differential equations, time and magnitude scaling, applications to transfer function simulations.
Text/ Reference Books:	
1.	Ramakant A. Gaikwad, Op-amp and Integrated circuits, Fourth edition, PHI Publication, 2002.
2.	Sergio Franco, Design with Op-amp and Analog Integrated circuits, Tata McGraw Hill Edition, New Delhi.
3.	V. Rajaram, Analog Computation and Simulations, Prentice Hall of India, New Delhi.
4.	Robert F. Coughlin and Frederick F. Driscoll, Operational Amplifiers and Linear Integrated Circuits.
5.	L. K. Maheshwari and M.M. S Anand, Analog Electronics, Prentice Hall of India, New Delhi.
6.	S. M. Sze, Physics of Semiconductor Devices, John Wiley Publications.
Term Work:	
1.	Measurement of op-amp parameters and comparison with op-amp data sheets.
2.	Assembling of op-amp inverting, noninverting and differential circuit to measure an input in the range of mill volts to few volts.
3.	Design and signal conditioning circuits using RTD and thermister with an instrumentation amplifier to read a temperature of water bath and calibration.
4.	Design of signal conditioning circuit to operate a relay or to generate timing delays (e.g.10 sec., or 20 or 20 sec. or 1 minute) using IC 555.
5.	Design of a circuit to work as a current source using IC 78xx.
6.	Design of a circuit to work as voltage regulator of 10 or 20 volts using IC 723.
7.	Precision rectifier to rectify few volts as input.
8.	Use of 565 PLL as a frequency multiplier.
9.	Design of Oscillators using op-amp. and testing.
10.	Design of single stage differential amplifier and testing.
11.	Design of low and high pass filters with a cut off frequency of 1 KHz or 2 KHz and testing for frequency response.
12.	Design of instrumentation amplifier using 3 op-amps and testing for gain, frequency response.
13.	Design of cascade amplifier system using op-amp and testing for gain and frequency response.
14.	Study of A/D and D/A convertors.
15.	Design of attenuator circuit using amplifier and testing for gain.
16.	Testing of faulty analog instrument and finding faults.
17.	Design of band pass filter using op-amp and testing for frequency response.

PCC-IN206 Digital Electronics and Logic Design

Teaching scheme:			Examination scheme:
Lectures	3	hrs/week	Theory
Tutorials	-	hrs/week	In Semester Evaluation : 20 Marks
Practicals	2	hrs/week	Mid Semester Examination : 30 marks
Credits	4		End Semester Examination : 50 marks

Course Objectives:

This course covers topics in the design and analysis of digital circuits. The primary goal is to provide in depth understanding of logic and system synthesis.

1.	To introduce the number systems, codes and logic families.
2.	To introduce the basic postulates of Boolean algebra, correlation between Boolean expressions and methods for simplifying Boolean expressions.
3.	To analyze the logic processes and implement logical operations using combinational logic circuits.
4.	To understand the concepts of sequential circuits and to outline the formal procedures for analysis and design and sequential circuits.
5.	To understand the characteristics of memory and their classification, concept of Programmable Devices, PLA, PAL, CPLD and FPGA.

Course Outcomes: On successful completion of this course students will be able to

1.	Represent numerical values in various number systems and perform number conversions between different number systems. [PO1] [PEO1]
2.	Understand the various logic families and characteristics of digital ics. [PO1] [PEO1]
3.	Simplify the logic expressions using Boolean laws and postulates, K-map. [PO1] [PEO1]
4.	Analyse, design and implement the combinational logic circuits using Logic gates, MSI chips. [PO2, PO3] [PEO3]
5.	Analyze, design and implement the sequential digital logic circuits using flip flops, registers, counters. [PO2, PO3] [PEO3]
6.	Design A/D and D/A converters. [PO3] [PEO3]
7.	Classify different semiconductor memories, analyze digital system design using PLD and design ROM as PLD. [PO3] [PEO3]
8.	Design, implement and troubleshoot the digital circuits. [PO3] [PEO3]

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-IN206.1	3	1	-	-	-	-	-	-	-	-	-	2	3	3	2	3
PCC-IN206.2	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2	2
PCC-IN206.3	3	3	3	2	3	-	-	-	-	-	-	1	3	2	3	2
PCC-IN206.4	3	2	-	-	2	-	-	-	-	-	-	1	3	3	2	2
PCC-IN206.5	3	1	3	2	3	-	-	-	-	-	-	2	3	3	3	2
PCC-IN206.6	3	1	3	3	3	-	-	-	-	-	-	2	3	3	3	2
PCC-IN206	18	11	12	9	11	-	-	-	-	-	-	9	18	16	15	13
	3	2	3	2	2	-	-	-	-	-	-	2	3	3	3	3

Syllabus:	
Unit 1	**Fundamentals of digital systems and logic families**
	Digital Signals, digital circuits, NAND and NOR operations, EX-OR operation, Boolean algebra, examples of IC Gates, number systems-binary, signed binary, Octal, hexadecimal numbers, binary and BCD arithmetic, one's and two's complement arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families-RTL, DCPL, I2L, DTL, HTL, TTL, schottky TTL, ECL, MOS Logic, CMOS Logic, interfacing CMOS and TTL, Tri-state logic.
Unit 2	**Combinational digital circuits**
	Standard representation for logical functions, K-map representation. Simplification of logical functions using four, five and six variable K-maps. minimization of logical functions- don't care conditions, logic design using MSI chips- multiplexer, de-Multiplexer/decoders, adders, subtractors, carry look ahead adder, elementary ALU design, popular MSI chips, digital comparator, parity checker /generator, code converters, priority encoders, decoder/drivers for display devices, Quine-McClusky method of function realization.
Unit 3	**Sequential circuits and systems**
	1-Bit memory cell, properties of bistable latch, clocked SR flip flop, J-K, T and D types of flip flop, applications of flip-flops- shift register and counter types, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, serial adder, ripple (asynchronous) counters, synchronous counters, counter design using flip-flops, special counter ICs and applications.
Unit 4	**A/D and D/A converters**
	Digital to analog converter types: weighted resistor and R-2R ladder, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit. Analog to digital converters: quantization and encoding, parallel comparator A/D converter, types: successive approximation, counting type, single slope and dual Slope A/D converters, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.
Unit 5	**Semiconductor memories and programmable logic devices (PLDs)**
	Memory organization and operation, expanding memory size, classification and characteristics of memory, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge-coupled device memory (CCD), commonly used memory chips, ROM as a PLD, programmable logic array, programmable array logic (PAL) and generic array logic (GAL) devices, complex programmable logic devices (CPLDs)- field programmable gate array (FPGA).
Text Books:	
1.	Jain R.P., Modern Digital electronics, Tata McGraw Hill Edition, 6th Edition2006.
2.	Anand Kumar, Fundamentals of Digital Circuits Prentice-Hall India, 2003.
Reference Books:	
1.	Anand Natrajan, Digital Design, PHI Publication, 2011.
2.	Morris M., Mano, Digital Design, Tata McGraw Hill, 4th edition, 2006.
3.	An Engineering Approach to Digital Design, Fletcher W. I., Prentice Hall of India, New Delhi.1997.
4.	Wakerly J. F., Digital design- Principles and Practices, P H International /Pearson India, 4th edition, 2005.
5.	Samuel C. Lee, Digital Circuits and Logic Design, Prentice Hall of India, New Delhi, 1976.

Term Work:	
1.	Study and verify the truth tables of basic and universal logic gates.
2.	Verification of Boolean Laws & D Morgan's theorem.
3.	Design and implement code converters.
4.	Design and implement arithmetic circuits: Half Adder and Full Adder, Substractor, BCD Adder/ Substractor.
5.	Design and implement logical functions using logic gates, multiplexer, demultiplexer, encoders, decoders.
6.	Design and implement Flip Flops: S-R, J-K, D, T, master slave J-K.
7.	Design and implement counters: Up, down, up-down, decade, binary, BCD counter.
8.	Study of D/A & A/D converters: R-2R ladder, weighted register method, successive approximation.
9.	Study of Memories.
10.	Design of Decoder driver to drive 7 segment LED display.

PCC-IN207 Signals and Systems

Teaching scheme:			Examination scheme:
Lectures	3	hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks
Tutorials	-	hrs/week	
Practicals	-		
Credits	3		

Course Objectives:	
1.	Understanding the fundamental characteristics of signals and systems.
2.	Development of the mathematical skills to solve problems involving convolution, filtering and sampling.
3.	Coverage of continuous and discrete-time signals and systems, their properties and representations and methods that is necessary for the analysis of continuous and discrete-time signals and systems.
4.	Knowledge of time-domain representation and analysis concepts as they relate to difference equations, impulse response and convolution, etc.
5.	Knowledge of frequency-domain representation and analysis concepts using Fourier Analysis tools, Z-transform.

Course Outcomes: On successful completion of this course students will be able to	
1.	To know different types of signals and systems and demonstrate an understanding of characteristics of continuous and discrete -time signals and LTI systems. [PO1] [PEO1]
2.	To understand fundamental properties and behavior of LTI systems and be able to determine response of the system for given input. [PO1] [PEO1]
3.	To use the tools (e.g. orthogonal transforms: Fourier transform, Laplace transform, z-transform etc.) for analysis and design of an LTI systems. [PO5] [PEO1]
4.	To analyze the behavior of LTI systems in time and frequency domain using impulse response and transfer function respectively. [PO1, PO5] [PEO1]
5.	To understand the sampling theorem and the limitations of processing the signals digitally. [PO1, PO5] [PEO1]
6.	To design a simple LTI system like low-pass or high-pass filters. [PO3] [PEO1]

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-IN207.1	1	-	-	-	-	-	1	-	-	-	-	2	2	2	1	-
PCC-IN207.2	3	-	-	-	1	-	1	-	-	-	-	2	2	2	1	-
PCC-IN207.3	3	2	-	-	3	-	1	-	-	-	-	2	3	2	2	2
PCC-IN207.4	3	2	2	-	-	1	-	-	-	-	-	2	3	2	2	2
PCC-IN207.5	2	1	-	-	1	-	-	-	-	-	-	2	3	2	1	1
PCC-IN207.6	3	1	3	-	-	-	-	-	-	-	-	2	3	2	2	2
PCC-IN207	15	6	5	-	5	1	3	-	-	-	-	12	16	12	9	7
	3	1	1	-	1	1	1	-	-	-	-	3	3	3	2	1

Syllabus:	
Unit 1	**Continuous–Time and Discrete –Time Signals**
	Various classifications; Mathematical Representation; Signal Energy and Power. Transformations of the Independent Variable; Periodic Signals; Even and Odd Signals; Arithmetic Operations on Sequences; Continuous-Time and Discrete-Time Complex Exponential. The continuous-Time Unit Step and Unit Impulse Functions. The Discrete Time Unit Impulse and Unit Step Sequences; Representation of Discrete Time Signals in Terms of impulse.
Unit 2	**Continuous-time and discrete-time systems**
	Interconnections of Systems; Basic System Properties (Causality, Stability, Time-Invariance, Linearity, Invertibility, systems with and without, memory).
Unit 3	**Linear time –invariant systems**
	Discrete–time and continuous-time LTI systems; Unit impulse response; convolution sum and convolution integral representation. Properties of LTI systems (commutative, distributive, associative properties, invertibility, causality, Stability). Unit step response of an LTI system; LTI systems described by differential and difference equations; block diagram representations; singularity functions.
Unit 4	**Fourier series representation of periodic signals**
	Response of LTI systems to complex exponential; Fourier series representation of continuous-time and discrete–time periodic signals; convergence of the Fourier series; properties of discrete time and continuous-time Fourier series; Fourier series and LTI systems.
Unit 5	**Continuous-time Fourier transform**
	Representation of continuous-time aperiodic signals and continuous time Fourier transform; the Fourier transform for periodic signals; properties of continuous-time Fourier transform; Fourier transform and LTI systems.
Unit 6	**Discrete- time Fourier transform**
	Representation of discrete-time a periodic signals and the discrete time Fourier transform; Fourier transform for periodic signals; properties of the discrete-time Fourier transform; discrete-time LTI systems and discrete-time Fourier transform.
Unit 7	**Sampling**
	Representation of a continuous–time signal by its samples; sampling theorem; reconstruction of signals from its samples using interpolation; effect of under sampling

	(frequency domain aliasing); discrete time processing of continuous–time signals.
Unit 8	**Laplace transform**
	Laplace transform; region of convergence for Laplace transform; properties of Laplace transform; geometric evaluation of the Fourier transform from the pole-zero Plot; properties of Laplace transform; analysis and characterization of LTI systems using the Laplace transform; system transfer function; block diagram representations; unilateral Laplace transform; solution of differential equations using the unilateral Laplace transform.
Unit 9	**Z-Transform**
	Z-Transform; region of convergence for the z-Transform; geometric evaluation of the Fourier transform from the pole-zero plot; properties of Z-Transform; analysis and characterization of discrete-time LTI Systems using Z-Transform; system transfer function; block diagram representation; unilateral Z-transform; solution of difference equation using the unilateral Z-Transform.
Text Books/ Reference Books:	
1.	A. V. Oppenheim, A. S. Wilsky with S. H. Nawab, Signals and Systems, Prentice- Hall of India Private Limited, Second Edition, 1997.
2.	S. Haykin and B. V. Veen, Signals and Systems, John Wiley and Sons, Inc., Second Edition, 1999.
3.	M. J. Roberts, Signals and Systems: Analysis using, Transform Methods and MATLAB, Tata McGraw-Hill Publishing Company Limited, Second Edition, 2003.

PCC-IN208 Electrical and Electronic Measurements

Teaching scheme:		**Examination scheme:**
Lectures	3 hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks
Tutorials	-	
Practicals	2 hrs/week	
Credits	4	

Course Objectives:	
1.	To reveal knowledge of measurement of electrical quantities.
2.	Understanding the construction and operating principles of electrical instruments.
3.	To understand all electrical equipments used for measuring various parameters.
Course Outcomes: On successful completion of this course students will be able to	
1.	Recall the basics of measurement, state the purpose of measurement and identify the error sources and minimize its effect in particular measurement. [PO1, PO2, PO4, PO6]
2.	Understanding the operation and usage of various analyzing instruments. [PO1][PEO1]
3.	Demonstrate the working principles of instruments for power and energy measurements. [PO4] [PEO2]
4.	Explain the basic features of oscilloscope and different types of oscilloscope. [PO1, PO3, PO4]
5.	Identify and evaluate AC and DC bridges for measurement of R, L, C network. [PO1, PO2]

6.	Choose appropriate electronic instrument to measure, display and record electrical quantities. [PO1]

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO/PSO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-IN208.1	3	-	-	-	-	-	-	-	-	-	-	2	3	3	2	2
PCC-IN208.2	3	2	-	2	-	1	-	-	-	-	-	2	3	2	2	2
PCC-IN208.3	3	2	1	2	2	-	-	-	-	-	-	2	3	2	2	1
PCC-IN208.4	3	-	1	1	-	-	-	-	-	-	-	2	3	3	3	2
PCC-IN208.5	3	2	2	3	2	1	-	-	-	-	-	2	3	2	2	1
PCC-IN208.6	3	-	2	2	2	2	2	-	-	-	-	2	2	2	2	1
PCC-IN208	18	6	6	10	6	4	2	-	-	-	-	12	17	14	13	9
	3	1	1	2	1	1	1	-	-	-	-	3	3	3	3	2

Syllabus:	
Unit 1	**Introduction to measurements**
	Measurement, purpose of measurement, experimental data and errors: measurement recording and reporting, graphical representation of data, precision and accuracy, resolution and sensitivity, errors in measurement, statistical evolution of measurement data and errors.
Unit 2	**DC and AC bridges**
	D.C bridges: low, medium and precise resistance measurement. Inductance and capacitance measurements. Detectors in bridge measurement, Wagner ground connections, transformer ratio bridges, digital RCL meter, Q meter.
Unit 3	**Analog DC and AC meters**
	PMMC, galvanometer, DC ammeter, DC voltmeter, electrodynamometer type of instruments, analog multimeter, special purpose analog meters, how to use basic meters and meter errors.
Unit 4	**Power and Energy Measurements**
	Electrodynamic wattmeters, Hall effect wattmeter, thermal type wattmeter, compensated wattmeter, single and three phase power measurement, calibration of wattmeter. Energy measurement, maximum demand meter, P.F meter, Megger.
Unit 5	**Cathode ray oscilloscope**
	Introduction, block diagram of a general purpose CRO, cathode ray tube, focusing device, post deflection acceleration, beam transit time and frequency limitations, oscilloscope time base, oscilloscope amplifiers, attenuators, basic controls, types of sweeps, delay line, display of electrical signals by oscilloscope, basic oscilloscope patterns, measurement of voltage, frequency and phase.
Unit 6	**Electronic Instruments**
	Digital voltmeter, digital multimeter, digital frequency meter system, frequency meter accuracy, time and ratio measurement, counter/time/frequency meter, phase measurement. **Display devices and recorders:**

	LED, LCD display, strip-chart recorder, X-Y recorder, 3-D printers.
Term work:	
1.	Measurement of resistance (high, medium, low).
2.	Measurement of inductance.
3.	Measurement of capacitance.
4.	Phase and frequency measurement on CRO using Lissajous pattern.
5.	Study of digital voltmeter, digital multimeter.
6.	Digital measurement of phase and frequency.
7.	Study of AC and DC meters.
8.	Measuring current and voltage.
9.	Study of recorders.
Text Books:	
1.	David A. Bell, Electronic Instrumentation and Measurements, Second Edition, Prentice Hall, New Jersy, 1994.
2.	Stanley Wolf, Richard Em. Smith, Student Reference Manual for Electronic Instrumentation Laboratories, Prentice-Hall, 1990.
3.	Golding, E. W. and Widdis, F. C., Electrical Measurements and Measuring Instruments, Fifth edition, A. H. Wheeler and Co, 1993.
4.	Baldwin, C.T., Fundamentals of electrical measurements – Lyall Book Depot, New Delhi, 1973.
Reference Books:	
1.	A. K. Sawhney, A course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Sons, 2002.
2.	J. B. Gupta, Electrical and Electronic Measurements & Instrumentation, S. K. Katariya & Sons, 1969.
3.	Kalsi. H.S., Electronic Instrumentation, Tata McGraw Hill, New Delhi, 1995.

HMC278 Human Values and Professional Ethics

Teaching scheme:			**Examination scheme:**	
Lectures	2	hrs/week	Theory In Semester Evaluation : 20 Marks Mid Semester Examination : 30 marks End Semester Examination : 50 marks	
Tutorials	-			
Practicals	-	hrs/week		
Credits	2		Credits(P)	1

Course Objectives:	
1.	To create an awareness on Professional Ethics and Human Values.
2.	To help students understand the Harmony for life.
3.	To understand co-existence.
4.	To study the moral issues and decisions confronting individuals and organizations In profession.
Course Outcomes: On successful completion of this course students will be able to	
1.	Understand the core human values that shape the ethical behavior of a person.
2.	Understand how values act as an anchor of actions for life.

3.	Learn the need of Human values and Professional ethics in life.
4.	Understand Harmony at Four levels of life.
5.	Learn the moral issues and problems in profession and find the solution to those problems.
6.	Understand the core human values that shape the ethical behavior of a person.

Course Articulation Matrix: Mapping of Course outcome and Program outcome

PO → ↓ CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HMC278.1	-	-	1	-	-	2	-	3	-	-	-	-
HMC278.2	-	-	-	-	-	-	-	3	-	-	-	-
HMC278.3	-	-	-	-	-	-	-	3	-	-	-	3
HMC278.4	-	-	-	-	-	2	-	3	-	-	-	-
HMC278.5	-	-	1	-	-	2	-	3	2	-	-	3
HMC278	-	-	2	-	-	6	-	15	2	-	-	6
	-	-	1	-	-	1	-	3	1	-	-	1

Syllabus:	
Unit 1	**Course Introduction**
	Need, basic guidelines, content and process for value education, Moral values, Social, Environmental, Economic values, Purusharth, Duty, Justice, Equality. A look at basic aspirations: self exploration, happiness and prosperity, Fulfillment of human aspirations.
Unit 2	**Understanding the harmony**
	Thoughtful human being harmony, sentient, attitude and its importance in relationship, significance of restraint and health *(Yama and Niyama)*, Egoism, Altruism, Universalism (idea of Sarvodaya and Vasudevkutumbakam), The problem of hierarchy of values and their choice (View of Pt Madan Mohan Malviya and Mahatma Gandhi), human goal settings and life management techniques.
Unit 3	**Understanding professional ethics**
	Harmony at various levels and understanding professional ethics, creating environmentally aware engineers, humanistic universal education, humanistic universal education, natural acceptance of human values, ethical human conduct.
Unit 4	**Competence of professional ethics**
	Management models for present technologies, strategies for integrating humans in family and at all levels of existence, relevance of the above strategies in becoming responsible engineers, technologists and managers.
Unit 5	**Motivation**
	Contribution of ancestors in science and technology development to raise self esteem in Indian context.
Text Books/ Reference Books	
1.	R. R. Gaur, R. Sangal, G. P. Bagaria, A Foundation Course in Value Education, 2009.
2.	A. Nagraj, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak, 1998.
3.	Sussan George, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4.	P. L. Dhar, R. R. Gaur, Science and Humanism, Commonwealth Purblishers, 1990.
5.	A. N. Tripathy, Human Values, New Age International Publishers, 2003.

6.	Subhas Palekar, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati, 2000.
7.	Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, Limits to Growth – Club of Rome's report, Universe Books, 1972.
8.	E. G. Seebauer & Robert L. Berry, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press, 2000.
9.	M. Govindrajran, S. Natrajan & V. S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
10.	Subroto Bagchi, The Professional.
11.	B. P. Banerjee, Foundations of Ethics and Management, Excel Books, 2005.
12.	B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow, 2004, Reprinted 2008.
13.	Dr. Nityanand Mishra Niti Shastra ,Motilal Banarasidas 2005
14.	Dr. Avdesh Pradhan Mahatma ke Vichar , BHU Varanasi 2007