GONDWANA UNIVERSITY, GADCHIROLI
Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Credit Grade System
Third Semester B.E. (Instrumentation Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours Per Week			Number of Credits	THEORY						PRACTICAL			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional		Total	Min . Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min . Passing Marks
								MSE	IE						
IN301	Mathematics-III	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN302	Electronic Devices & Circuits	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN303	Network Theory	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN304	Sensors & Transducers -I	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN305	Electronics Measurements	3	1	0	3	3	80	10	10	100	40	--	--	--	--
Laboratories															
IN306	Electronic Devices & Circuits	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN307	Sensors & Transducers -I	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN308	Electronics Measurements	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN309	Programming Practice - I C++	0	0	2	2							50	--	50	25
Total		**15**	**5**	**11**	**25**					**500**				**200**	
Semester Total		**31**													**700**

Appendix A

GONDWANA UNIVERSITY, GADCHIROLI

Four Year Degree Course in Engineering and Technology

Course and Examination Scheme with Credit Grade System

Fourth Semester B.E. (Instrumentation Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours Per Week			Number of Credits	THEORY						PRACTICAL			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional		Total	Min . Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min . Passing Marks
								MSE	IE						
IN401	Mathematics-IV	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN402	Feedback Control Systems	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN403	Sensors and Transducers-II	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN404	Linear Integrated Circuits	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN405	Digital Circuits	3	1	0	3	3	80	10	10	100	40	--	--	--	--
Laboratories															
IN406	Sensors and Transducers-II	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN407	Linear Integrated Circuits	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN408	Digital Circuits	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN409	Programming Practice II: ORCAD	0	0	2	2							50	--	50	25
Total		**15**	**5**	**11**	**25**					**500**				**200**	
Semester Total		**31**													**700**

Appendix A

GONDWANA UNIVERSITY, GADCHIROLI
Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Credit Grade System
Fifth Semester B.E. (Instrumentation Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours Per Week			Number of Credits	THEORY						PRACTICAL			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional		Total	Min . Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min . Passing Marks
								MSE	IE						
IN501	Process Automation	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN502	Signals & Systems	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN503	Power Electronics	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN504	Microprocessors and Interfacing	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN505	Control System Components	3	1	0	4	3	80	10	10	100	40	--	--	--	--
Laboratories															
IN506	Process Automation	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN507	Power Electronics	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN508	Microprocessors and Interfacing	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN509	Programming Practice III: MATLAB/SCILAB	0	0	2	2							50	--	50	25
Total		**15**	**5**	**11**	**26**					**500**				**200**	
Semester Total		**31**													**700**

Appendix A

GONDWANA UNIVERSITY, GADCHIROLI
Four Year Degree Course in Engineering and Technology
Course and Examination Scheme With Credit Grade System
Sixth Semester B.E. (Instrumentation Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours Per Week			Number of Credits	THEORY						PRACTICAL			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional		Total	Min . Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min . Passing Marks
								MSE	IE						
IN601	Industrial Organization & Management	3	0	0	3	3	80	10	10	100	40	--	--	--	--
IN602	Bio-Medical Instrumentation I	3	1	0	4	3	80	10	10	100	40	--	--	--	--
IN603	Control System Design	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN604	Microcontroller and Applications	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN605	Digital Signal Processing	3	1	0	3	3	80	10	10	100	40	--	--	--	--
Laboratories															
IN606	Control System Design	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN607	Microcontroller and Applications	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN608	Digital Signal Processing	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN609	Programming Practice IV: LabVIEW	0	0	2	2							25	--	25	12
IN610	Case Study / Industrial Visit	0	0	2	2							25	--	25	12
Total		**15**	**4**	**13**	**26**					**500**				**200**	
Semester Total		**32**													**700**

Appendix A

GONDWANA UNIVERSITY, GADCHIROLI
Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Credit Grade System
Seventh Semester B.E. (Instrumentation Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours Per Week			Number of Credits	THEORY						PRACTICAL			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional		Total	Min . Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min . Passing Marks
								MSE	IE						
IN701	Instrumentation System Design	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN 702	Bio-Medical Instrumentation II	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN 703	Intelligent Systems	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN 704	Elective-I i i) Opto Electronic Instrumentation ii) Power Plant and Unit Operation iii) Robotics and Automation	3	1	0	4	3	80	10	10	100	40	--	--	--	--
Laboratories															
IN 705	Instrumentation System Design	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN 706	Bio-Medical Instrumentation II	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN 707	Intelligent Systems	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN 708	Project Seminar	0	0	4	4							100	--	100	50
Total		**12**	**4**	**13**	**23**					**400**				**250**	
Semester Total		**29**													**650**

Appendix A

GONDWANA UNIVERSITY, GADCHIROLI
Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Credit Grade System
Eighth Semester B.E. (Instrumentation Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme									
		Hours Per Week			Number of Credits	THEORY						PRACTICAL			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional		Total	Min . Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min . Passing Marks
								MSE	IE						
IN 801	Pollution Control and Analytical Instrumentation	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN 802	Process Modelling and Optimization	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN 803	Project Planning Estimation and Assessment	3	1	0	3	3	80	10	10	100	40	--	--	--	--
IN804	Elective II:	3	1	0	4	3	80	10	10	100	40	--	--	--	--
	i) Digital Control System														
	ii)Embedded Systems														
	iii) Agriculture Instrumentation														
Laboratories															
IN 805	Pollution Control and Analytical Instrumentation	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN 806	Process Modelling and Optimization	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN 807	Project Planning Estimation and Assessment	0	0	3	2	--	--	--	--	--	--	25	25	50	25
IN 808	Project	0	0	6	6							50	50	100	50
Total		**12**	**4**	**15**	**25**					**400**				**250**	
Semester Total		**31**													**650**

Appendix A

GONDWANA UNIVERSITY, GADCHIROLI

FACULTY OF ENGINEERING AND TECHNOLOGY

CONSLIDATED STATEMENT OF VARIOUS PARAMETERS IN TEACHING & EXAMINATION SCHEME OF B.E. (INSTRU ENGINEERING)

SR.NO.	SEMESTER	NO. OF THEORY SUBJECTS	NO OF LABS/PRACT	TEACHING HOURS(TH) (L+T)	TEACHING HOURS (PRACT)	TOTAL CREDIT	MAX. THEORY MARKS	MAX.PRACT MARKS	MAX. MARKS TOTAL
1	I								
2	II								
3	III	5	4	20	11	25	500	200	700
4	IV	5	4	20	11	25	500	200	700
5	VI	5	4	20	11	26	500	200	700
6	VI	5	4	19	13	26	500	200	700
7	VII	4	4	16	13	23	400	250	650
8	VIII	4	4	16	15	25	400	250	650
		28	**24**	**111**	**74**	**150**	**2800**	**1300**	**4100**

***Audit course. It is neither considered as passing head nor considered for earning some credit(s). However, this is mandatory to be taken up at the respective college level**

Subject wise Board of Studies Affiliation

Board of Studies	Subject Codes
APPLIED SCIENCES & HUMANITIES	IN301, IN401, IN601
ELECTRICAL ENGINEERING	IN503
INSTRUMENTATION ENGINEERING	Rest all ,except above enlisted

III Semester B.E. Instrumentation Engineering

Course Code : IN301

Title of the Course : APPLIED MATHEMATICS - III

Common for B.E Electronics/Electrical Engineering/Instrumentation Engg.

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Units	Contents	Hours
1	**Laplace Transform** Definition, Properties (statements only). Periodic functions and unit step function, Inverse Laplace transform by partial fractions and convolution theorem. Solution of ordinary linear differential equations with constant coefficients by Laplace transform	10
2	**Matrices** Inverse of matrix by adjoint and partitioning method, Rank of a matrix and consistency of system of linear simultaneous equations. , Linear dependence, Linear and orthogonal transformation , Eigen values and eigen vectors, Reduction to diagonal form	08
3	**Matrices** Cayley-Hamilton Theorem , Sylvester's Theorem (statements only) Solution of second order linear differential equation with constant coefficient by matrix method. Largest eigen value and corresponding eigen vector by iteration.	08
4	**Partial Differential Equations** Linear Partial Differential Equations first order and first degree i.e. Lagrange's form, Linear homogeneous equations of higher order with constant coefficients Method of separation of variables.	09
5	: **Fourier series and Fourier Transforms** Periodic functions and their Fourier series expansion, Fourier Series for even and odd functions, Change of interval, Half range expansions, Fourier integrals and Fourier Transforms.	10
		45

TEXT BOOKS:

1. Higher Engineering Mathematics By B.S.Grewal
2. Probability and Statistics by Murray R Spiegel
3. Higher Engineering Mathematics By H.K.Dass

Reference Book:

A Text Book of Engineering Mathematics by N.P. Bali and Manish Goyal

III Semester B.E. Instrumentation Engineering

Course Code : IN302

Title of the Course : Electronic Devices and Circuits

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Units	Contents	Hours
1	**SEMICONDUCTOR DIODES AND POWER SUPPLIES :-** PN junction diode, Zener diodes, varactor diodes, Tunnel diodes, photo diode, LED, LCD –V-I characteristics, Clipper & Clamper Circuits using Diode, Power supplies-1Φ & 3Φ - Half wave & full wave Rectifiers, ripple factors & regulation, Filters (L, C, LC & Π)	09
2	**JUNCTION TRANSISTORS :-** Theory of operation, characteristics (CE, CB, and CC), break down voltage, current voltage power limitations of BJT, Different biasing arrangement. Stability factor. Thermal runway, Power Transistors. DC load line, AC load line.	10
3	**FET ANALYSIS :-** Introduction to FET characteristics and configurations, DC Analysis of FET, Power considerations, FET as Amplifier, Amplifier step response and frequency response, MOSFET – construction, characteristics, biasing and Load line.	09
4	**POWER AMPLIFIERS :-** Classification A, B, AB, C classes efficiency, push pull configuration (A, B, AB) Complimentary symmetry, Distortions and cross over distortion.	07
5	**FEEDBACK AMPLIFIER** 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 and crystal oscillator	10
		45

TEXT BOOK:-

1. Principal of Electronics, R.S. Sedha, S. Chand Publication
2. Electronics Device & Circuits, Schaum's Outline Series TMH, JIMMIE J. CATHEY

REFERENCE BOOKS:-

1. Integrated Electronics, McGraw Hill: - Millman & Halkias
2. Electronics Device & Circuits McGraw Hill: - Millman & Halkias

III Semester B.E. Instrumentation Engineering

Course Code : IN303

Title of the Course : Network Theory

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Units	Contents	Hours
1	**Circuit elements, Kirchhoff's laws and methods of analyzing circuits:** voltage, current, power and energy, circuit, Resistance parameter, Inductance parameter, Capacitance parameter, Energy sources, Kirchhoff's voltage law, Voltage division, power in a series circuit, Kirchhoff's current law, Parallel resistance, current division, Power in parallel circuits, Tree and co-tree, Twings and links, Incidence matrix and KCL, Tie-set matrix, cut-set and Tree Branch Voltages, Mesh analysis, Mesh equation by inspection method, Super mesh analysis, Nodal analysis, Nodal equations by inspection method, super node analysis, source transformation techniques.	08
2	**Useful theorems in circuit analysis**: Star-Delta transformation, Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Compensation theorem, Maximum power Transfer Theorem, Duals and duality, Tellegen's theorem, Millman'e theorem	07
3	**Alternating currents and voltages:** Phase relations in a pure resistor, inductor, and capacitor. **Complex impedance:** Series circuits, parallel circuits, compound circuits **Power and power factor**: Average power, Apparent power and power factor, Reactive power, Power triangle **Steady state AC analysis**: Mesh analysis, Nodal Analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Compensation theorem, Maximum power Transfer Theorem	13
4	**Transients**: Steady state and transient response, DC response of a R-L , R-C, R-L-C circuit, sinusoidal response of a R-L , R-C, R-L-C circuit, Analysis of transient and steady state responses using Classical technique.	07
5	**Fourier method of waveform analysis:** Compact trigonometric Fourier series, Complex Fourier Series, Amplitude and phase spectrum, Frequency spectrum, Fourier transform, Energy spectrum, Fourier transform of power signals, Fourier transform of periodic signals, Properties of Fourier transform, Applications in circuit analysis.	10
		45

Text Book:

1. Circuits and Networks: Analysis and Synthesis by Sudhakar and Shyammohan, Tata McGraw Hill Publication ISBN:978-0-07-069972-4 ISBN 0-07-069972-0

Reference Books:

1. Network analysis by Van Velkenburg
2. Network and system by D. P. RoyChaudhari
3. Network analysis by G. K.Mittal
4. Electrical Circuit by Del tore, Prentice Hall
5. Modern Network analysis by Reza and Seely, McGraw Hill

III Semester B.E. Instrumentation Engineering

Course Code : IN304

Title of the Course : Sensors and Transducers - I

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Units	Contents	Hours
1	**Introduction--** Concepts and terminology of measurement system, Definition of transducer and sensor. range and span, classification of transducers, static and dynamic characteristics, selection criteria, sources of errors and their statistical analysis, standards and calibration.	05
2	**Strain, Force and torque measurement--** Strain measurement: principle, strain gauge, types, gauge factor, gauge wire properties, rosettes and measurement circuits. Basic methods of force measurement, elastic force traducers, strain gauge, load cells, shear web, piezoelectric force transducers, vibrating wire force transducers, Strain gauge torque meter, Inductive torque meter, Magneto-strictive transducers, torsion bar dynamometer, etc. Dynamometer (servo control and absorption) instantaneous power measurement and alternator power measurement.	10
3	**Displacement Measurement -** working principle, types, construction, and typical applications of 1) Resistive: Potentiometer, Linear and rotary, Loading Effect types of strain gauges. 2) Inductive: LVDT, RVDT and Eddy current type Transducers. 3) Capacitive: Capacitance pickups, Differential capacitive cells. Piezoelectric, Ultrasonic transducers and Hall effect transducers Optical transducers. Precision measuring instrument (gauges), Angular measurement: Combination protractor, universal bevel protractor, sine bar, clinometers, optical prism method. Thickness measurement - magnetic, dielectric, LASER, capacitive, ultrasonic and LVDT	10
4	**Velocity and speed measurement--**working principle, types, construction,typical applications of: Moving magnet and moving coil, Electromagnetic tachometer, Photoelectric tachometer, Toothed rotor variable reluctance tachometer. Magnetic pickups, Encoders, Photoelectric pickups, stroboscopes and stroboscopic method, Shaft speed measurement. Vibration and acceleration measurement: working principle, types, construction, typical applications of: Eddy current type, piezoelectric type, Seismic Transducer, Accelerometer: Potentiometric type, LVDT type, Piezo-electric type, jerk meter	12
5	**Allied Sensors**--working principle, types, construction, typical applications of : leak detector, flame detector, smoke detector, density, viscosity sensors. Sound sensors and Proximity sensors. Chemical sensors -pH and conductivity.	08
		45

TEXT BOOK:-

1. "Instrumentation Measurement and Analysis", Nakra- Chaudhary, Tata McGraw Hill Publications.
2. Transducers and Instrumentation by D. V. S. Murty (PHI)
3. "Electrical and Electronic Measurements and Instrumentation", A. K. Sawhney, Dhanpat Rai and Sons Publications.

REFERENCE BOOKS:-

"Measurement System Application and Design", E.O. Doebelin, McGraw-Hill International Publications.

III Semester B.E. Instrumentation Engineering

Course Code : IN305

Title of the Course : Electronic Measurements

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Units	Contents	Hours
1	**Measurement and Error:** Definitions, Accuracy and precision, Significant figures, Types of error, Statistical analysis, Probability of Errors, Limiting Errors **Systems of units of measurement:** Fundamental and derived units, System of Units, Electric and magnetic units, International system of units, other systems of unit, conversion of units	5
2	**Electromechanical Indicating instruments:** Suspension Galvanometer, Torque and deflection of the galvanometer, Permanent-Magnet Moving-coil mechanism, DC Ammeters, DC Voltmeters, Voltmeter sensitivity, series-Type ohmmeter, Shunt-Type ohmmeter, Multimeter or volt-ohm-milliammeter, Calibration of DC Instruments, Introduction to Electrodynamometer	7
3	**Measurement of resistance:** Classification of resistances, Measurement of Medium resistances- Ammeter Voltmeter method, Substitution method, Wheatstone bridge, Sensitivity of Wheatstone bridge, Precision measurement of medium resistances with Wheatstone bridge, Limitations of Wheatstone Bridge. Methods for Measurement of Low resistance, Kelvin's Double Bridge, Kelvin Bridge Ohmmeter, Unbalanced Kelvin's Bridge **AC Bridges:** Introduction, sources and detectors, General equation for bridge balance, General form of an A.C. Bridge, Measurement of self inductance: Maxwell's inductance bridge, Maxwell's inductance-capacitance bridge, Hay's bridge Measurement of capacitance: De Sauty's Bridge, Schering Bridge, High voltage Schering Bridge, Measurement of relative Permittivity with Schering Bridge	13
4	**Electronic Instruments for measuring basic parameters:** Amplified DC Meter, AC voltmeter using rectifiers, True RMS-Responding Voltmeter, Electronic multimeter, Digital Voltmeters, Component Measuring Instruments, Q meter, RF power and voltage measurement.	10
5	**Oscilloscope**: Oscilloscope block diagram, Cathode ray tube (CRT), Electrostatic deflection, Vertical Deflection system, Delay sweep, Horizontal deflection system, Oscilloscope techniques, Introduction to Digital storage oscilloscope.	10
		45

Text Books:

1. Modern Electronic Instrumentation and Measurement Techniques by Albert D. Helfrick and William D. Cooper, PHI Learning ISBN-978-81-203-0752-0
2. A course in Electrical and Electronic Measurements and Instrumentation by A. K. Sawhney and Puneet Sawhney, Dhanpat Rai and Co. ISBN-81-7700-016-0

Reference Books:

1. Electronic instrumentation by Terman and Petil
2. Electronic Instrumentation by Kalsi (TMH publication)
3. Electronic Measurement and Instrumentation by Oliver (TMH publication)
4. Measurement analysis by Barnest Frank.
5. Electric Measurement and Measuring Instrument by Drydat and Jolley
6. Electric and Electronic Measurement and Measuring Instrument by Ramabhadra (Khanna publication)

III Semester B.E. Instrumentation Engineering

Course Code : IN306

Title of the Course : Electronic Devices and Circuits Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Objectives:

1) To understand and analyze the theoretical concepts in Electronic Devices and Circuits through experimentation.
2) To learn and use the proper methods while gathering experimental data.
3) To get familiar with the proper use of basic instruments in EDC laboratories.

Term Work (TW) & POE:

Term work and practical/Oral examination shall consist of at least ten experiments based on contents of syllabi given in the course code IN302 in the form of a journal and necessary documentation.

Suggested list of Experiments

1. To plot the forward and reverse characteristics of PN junction diode.
2. To study the half wave and full wave rectifier with and without filter.
3. To study zener diode and its VI characteristics.
4. To plot the forward and reverse characteristics of zener diode.
5. To plot the characteristics of transistor in CE,CB AND CC configuration
6 To plot the frequency response of single stage CE amplifier.
7 To plot the transfer and drain characteristics of JFET and MOSFET.
8. To study the class B push pull amplifier..
9. To study the circuit of RC phase shift oscillator.
10. To study the LC and crystal oscillator circuits.

Course Outcomes:

- Students will be able to do experiments based on syllabus using proper methodology and derive scientific conclusion/s based on experiments conducted.

III Semester B.E. Instrumentation Engineering

Course Code : IN307

Title of the Course : Sensors and Transducers - I Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Objectives:

1) To understand and analyze the practical concepts about different sensors and transducers which are useful for measuring process parameters through experimentation
2) To learn and use the proper experimental methods while gathering experimental data.
3) To get familiar with the proper characterization of sensors and transducers.

Maximum ten (10) experiments are to be performed from the list given below. (at least 08 experiments are to be performed in addition to 02 demonstration experiments).

Term Work (TW) & POE:

Term work and practical/Oral examination shall consist of at least ten experiments based on contents of syllabi given in the course code IN304 in the form of a journal and necessary documentation.

Suggested list of Experiments:

1. Measurement of linear and angular displacement using Potentiometers
2. Characteristics of Piezoelectric measurement system
3. Measurement of displacement using LVDT
4. Measurement of strain using strain gauges
5. Measurement of torque using Strain gauges
6. Measurement using proximity sensors
7. Characteristics of capacitive measurement systems
8. Loading effects of Potentiometer
9. Design of Opto-coupler using photoelectric transducers
10. Characteristics of Micro pressure and Micro accelerometer sensing device
11. Study of speed measuring devices
12. Study of sound sensors
13. Measurement of pH and conductivity

Course Outcomes:

Students will be able to do experiments based on syllabus using proper methodology and derive scientific conclusion/s based on experiments conducted.

III Semester B.E. Instrumentation Engineering

Course Code : IN308

Title of the Course : Electronic Measurements Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Objectives: After completing this course, the students will be able

1. Understand concept of Measurement and standards
2. Know various terms used in Measurement and Instrumentation
3. Know theoretical concept of PMMC Galvanometer
4. Know Ammeter and Voltmeter
5. Understand concept and use of other electrical measuring devices
6. Know various bridges and their working concept
7. To acquire knowledge of various electronic measurement devices and its applications
8. Know theoretical concept of Oscilloscope and use it for various parameter measurement.

Term Work (TW) & POE:

Term work and practical/Oral examination shall consist of at least ten experiments based on contents of syllabi given in the course code IN305 in the form of a journal and necessary documentation.

Course Outcomes: Students are

1. Able to define and explain concept of measurement and standards
2. Able to define various terms used in measurement and instrumentation
3. Able to draw circuit diagram and explain working concept of PMMC Galvanometer
4. Able to design Ammeter and Voltmeter for required specifications
5. Able to explain working concepts of various electrical measurement devices
6. Able to draw and identify various bridge circuits and able to express working and applications of various bridges. Practically use it.
7. Able to explain working of various other electronic measurement devices and state their applications
8. Able to explain working of Oscilloscope and state their applications and also practically us it

III Semester B.E. Instrumentation Engineering

Course Code : IN309

Title of the Course : Programming Practice –I C++ Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	2	2	50	0	50

Course Objectives:

- To understand difference between procedural & object oriented programming concepts.
- To understand different object oriented concept such as Data abstraction, Classes and objects, References, Inheritance, Polymorphism, Function and operator, overloading.
- To design and Implement various programs using different object oriented concepts.
- To understand practical applications object oriented programming concepts by doing one mini project.

Unit	Contents	Hours
I	**Introduction to OOPS:** Differences with Procedural Languages, Tour of C++: Types and declarations, Expressions and statements. Decision making and loops, Pointers, arrays and structures. Functions	12
II	**Object Oriented Concepts:** Data abstraction, Classes and objects, References, Inheritance, Polymorphism, Function and operator, overloading, Virtual functions, Templates, Exception handling, file handling, Name spaces.	12
	Total	24

Term Work (TW):

Term work shall consist of at least ten exercises/programs and one mini project on programming in C++ software's in the form of a journal and necessary documentation. This exercises/programs are based on contents of syllabi given above and shall be used as a guideline for solving problem statements specified within the scope of this laboratory course.

Text Books

1. Object Oriented Programming in C++ by Robert Lafore, Techmedia Publication.

Reference Books

1. The complete reference C – by Herbert shield, Tata McGraw Hill Publication.
2. "Object oriented Programming with C++" by E. Balguruswamy, Tata McGraw-Hill Education, Edition: 2008

IV Semester B.E. Instrumentation Engineering

Course Code : IN401

Title of the Course : APLIED MATHEMATICS IV

Common for B.E Electronics/Electrical Engineering/Instrumentation

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Unit	Contents	Hours
1	**Z- Transform** Definition and properties , Inverse Z-transform by partial fractions and convolution theorem. Application to solve difference equation with constant coefficients.	08
2	**Complex Variables** Analytic functions Cauchy Riemann conditions, Conjugate functions, Singularities, Cauchy's Integral theorem and Cauchy's Integral Formula (statements only) Laurent's Theorem (statement only) Residue Theorem and application of residuals to evaluate Real integral of the form $\int_0^{2\pi} f(sin\theta, cos\theta)d\theta$ and $\int_{-\infty}^{\infty} \frac{f(x)}{F(x)}dx$ where F(x) has no zeros on real axis.	10
3	**Numerical Methods** Solution of algebraic and transcendental equations by False position method, Newton-Raphson method. Non linear simultaneous equations by Newton-Raphson Method. Solution of system of simultaneous linear equations by Gauss Jordan method, Gauss Seidel method, Crouts method.	08
4	**Numerical Methods** Solution of ordinary first order first degree differential equation by Taylor's series method, Runge-Kutta 4th order method, Euler's modified method, Milne's Predictor Corrector method. Largest eigen values and corresponding eigen vector by iteration method.	09
5	**Random Variables, and Probability Distribution** Random variables Distribution functions of discrete and continuous random variables, Joint distributions, Mathematical Expectations, Moments, Moments generating function and Characteristic function. Coefficient of skewness and Kurtosis.	10
	Total	45

TEXT BOOKS:
1. Higher Engineering Mathematics By B.S.Grewal
2. Probability and Statistics by Murray R Spiegel
3. Higher Engineering Mathematics By H.K.Dass

Reference Book:

A Text Book of Engineering Mathematics by N.P. Bali and Manish Goyal

IV Semester B.E. Instrumentation Engineering

Course Code : IN402

Title of the Course : Feedback Control Systems

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Unit	Contents	Hours
1	**Systems and their representation:** Introduction to control systems, Examples of control systems, Open- loop (non feedback) and closed loop (Feedback) control systems, Differential equations and transfer functions of physical systems such as Mechanical, Electrical, Electromechanical, Thermal, Pneumatic and liquid-level systems, Analogous systems, Electrical analogy of control systems.	07
2	**Mathematical Modeling of dynamic systems:** Block diagram representation of control system, Rules and reduction techniques, Signal Flow graph: Elements, definition, properties, Masons gain formula, Application of gain formula to block diagrams.	10
3	**Time- domain Analysis:** Standard test signals, Time response of first and second order systems and transient response specifications, Effect of adding poles and zeros to transfer functions, dominant poles of transfer function, Steady state errors for unity feedback systems, Static error constants and system type, Steady state errors for disturbances, Design system parameters from steady state errors.	08
4	**Stability of Linear Control systems:** Concept of stability, Characteristic equation, location of roots in s-plane for stability, Asymptotic stability and relative stability, Routh-Hurwitz stability criterion, Basic properties of the root loci, General rules for constructing root loci, Root- locus analysis of control systems, Transient response and stability from root locus.	11
5	**Frequency domain analysis:** Frequency domain design limitations, Frequency response analysis, Bode plot, asymptotic approximations, Stability, Gain Margin, and Phase Margin via Bode plot, Polar plot, Nyquist plot.	09
	Total	45

Text Books:

1. Nagrath and Gopal , "Control System Engineering", New Age International Publication, Fourth ed., 2006.
2. B.C Kuo, "*Automatic control systems*", 7th Edition, Prentice Hall, New Delhi, 2002.
3. Norman Nise , "Control System Engineering", Wiley International, Fifth ed., 2010.
4. K. Ogata- Modern Control Engineering, Fourth edition, Pearson education India, 2002.

IV Semester B.E. Instrumentation Engineering

Course Code : IN403

Title of the Course : Sensors and Transducers - II

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Unit	Contents	Hours
1	**Temperature Measurement** Temperature scales, units and relations, classification of temperature sensors. Mechanical Type: Principle, working and construction of Bimetallic thermometer, Filled system thermometers. SAMA classifications of Filled system thermometer, sources of errors and their remedies Electrical Type: Resistance temperature detectors, its types and comparison, circuits for lead wire compensation, Thermistor: its types (NTC, PTC), measuring circuits, thermopiles, Non contact type sensors-Pyrometers. Thermocouple: laws of thermoelectricity, terminologies, types (B, E, J, K, R, S, T), characteristics, study of thermocouple tables, lead wire compensation, cold junction compensation techniques, protection (Thermo well), EMF Measurement methods.	09
2	**Pressure measurement** Pressure scales units and relations, manometers – U tube, well type, inclined tube, ring balance and micro manometer. Elastic – bourdon, diaphragm, capsule, bellows and their types. High pressure measurement – bulk modulus cell, Bridgman type Differential pressure measurement: force balance, motion balance, capacitance delta cell. Vacuum measurement: Units and relations, McLeod gauge, thermal conductivity (Pirani Gauge), Molecular momentum (Knudsen) gauge. Introduction to Calibrating Instruments like Dead Weight Tester (Pressure, Vacuum), Digital Manometer etc. Electronic – LVDT, strain gauge, capacitive, piezoelectric, thin film, variable reluctance, vibrating element (diaphragm and wire)	09
3	**Flow Measurement** A. Fundamentals of flow : Units, Newtonian and non-Newtonian fluids, Reynolds's number, laminar and turbulent flows, velocity profile, Bernoulli's equation for incompressible flow, density, Beta ratio, Reynolds's number correction, square root relation. Head type flow meters: Orifice (eccentric, segmental, concentric), venture-meter, Flow nozzle, Dahl tube, different pressure taps, pitot tube, annubar, Variable area type: Rotameter. Other flow meters: Turbine, target, electromagnetic, ultrasonic (Doppler, transit time), vortex shedding, positive displacement, anemometers (hot wire, laser), Coriolis. Open channel flow measurement: Notches and weirs Mass flow meters	09
4	**Chemical Measurements** A. Moisture measurement Moisture in gases and liquids: Electrolytic hygrometer, capacitance, Piezoelectric, Impedance. Moisture in Solids: Nuclear moisture gauge, Infra Red Absorption or Reflection, NMR, Humidity measurement : Terminology, Psychrometer, Hygrometer (Hair wire, Electrolysis), Dew point meter , Piezoelectric , Infrared absorption, Polystyrene surface resistivity cell (Pope cells), Solution Resistance element, Solution Resistance element, Thin film capacitance humidity sensor. B. Moisture in Gases and Liquids: Head of Adsorption, Infra Red. Moisture in Solids: Microwave solid moisture analyser. Humidity measurement : Dry bulb and Wet bulb Psychrometer, Dew point hygrometer, Piezo-electric etc. Smart Sensors: Introduction to IC sensors, Bio Sensors	09
5	**Level Measurement**	09

	Direct (Gauges): Hook type, sight glass: tubular, transparent and reflex, float and tape. Indirect: Hydrostatic pressure, Air bubbler. Float, displacer (torque tube unit), ultrasonic, radioactive, radar, thermal, fiber optic level sensors. Solid level detection methods.	
	Total	45

TEXT BOOK:-

1. "Instrumentation Measurement and Analysis", Nakra- Chaudhary, Tata McGraw Hill Publications.
2. "Electrical and Electronic Measurements and Instrumentation", A. K. Sawhney, Dhanpat Rai and Sons Publications.

REFERENCE BOOKS:-

1. "Measurement System Application and Design", E.O. Doebelin, McGraw-Hill International Publications

IV Semester B.E. Instrumentation Engineering

Course Code : IN404

Title of the Course : Linear Integrated Circuits

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Unit	Content	Hours
1	**Basic operational amplifier circuits:** Classification of ICs and their comparison. Study of data sheets of 741, 324, OP-07. ac and dc analysis of differential amplifier, Op-amp ideal characteristics and op-amp parameter. Differential amplifier stages current sources, level shifting technique, Common mode and differential mode gains and impedances of differential stages.	08
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.	08
3	**Active filters and oscillators:** Frequency response of op-amp. Low pass, high pass first and second order, band pass, band reject and all pass Butterworth filters. Introduction to Oscillator using op-amps: Phase shift oscillator, Wein bridge oscillator, square wave, triangular wave and saw tooth wave generators.	09
4	**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.	08
5	**Study of important IC's:** The 555 timer and its applications, functional diagram monostable and astable multivibrator The PLL IC's 565 and its applications, DAC 0808, ADC 0809. Regulated power supply, Series op-amp regulator, switching regulator , IC 723 and 78xx and 79xx voltage Regulator IC'	12
		45

Text Book:

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuit", New Age International Pvt. Ltd2000
2. Sergio Franco, Design with Op-amp and Analog Integrated circuits, Tata McGraw Hill Edition New Delhi.

Reference Books:

1. Ramakant A. Gaikwad, Op-amp and Integrated circuits, Fourth edition, PHI Publication, 2002
2. Robert F. Coughlin and Frederick F. Driscoll, Operational Amplifiers and Linear Integrated Circuits.

IV Semester B.E. Instrumentation Engineering

Course Code : IN405

Title of the Course : Digital Circuits

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Unit	Contents	Hours
1	Introduction: Analog vs Digital system, Transistor as a switch, Boolean algebra, Boolean identities, logic problems, binary, gray, octal, hex and ASCII codes, Gates and their truth tables, Demorgan's Law, Sum of product and product of sum.	07
2	Logic families: TTL, ECL, CMOS, etc. Fan-in, fan-out, propagation delay properties. Concept, SSI, MSI and VLSI circuits classification, standard TTL, CMOS.	08
3	Combinational Logic: K-map, decoder, encoder, multiplexers, demultiplexer, code converter, arithmetic circuits– half and full adders, ripple adders, subtractors, carry look ahead adders.	10
4	Sequential Circuits: Introduction to flip flop, latches, concept of clock, master Slave,Combination and conversion of one type to another type flip-flop. Excitation table and introduction to sequential circuits counters-synchronous, asynchronous.	10
5	Sequential Circuits : Different modulo counters with reset/clear facility, design of counters of arbitrary modulo with k maps, lock free counters Introduction to FPGA,PLD & VHDL	10
	Total	45

Text Books:

1. Modern Digital Electronics by R.P.Jain., Publication : Tata McGraw Hill Education. Edition : Fourth Ed., 2010.
2. Ronald J. Toccii, "Digital Systems: Principles and Applications", Pearson LPE, Fourth ed. 2009.

Reference Books:

1. Digital Logic and Computer Design by Morris Mano Publication : Pearson Education India(PHI), Edition : 10^{th} Impression 2008
2. Digital integrated Electronics by Herbert Taub & Donald L.Schilling , Publication : McGraw Hill Edition : 1997
3. Digital Principles and Applications by Donald P. Leach & Albert P. Malvino Publication : Glencoe Edition : 5^{th} , 1995
4. Digital Systems Principle & Design by Raj Kamal. Publication:Pearson Education India. Edition: October 26, 2006
5. Fundamentals of Digital Logic withVHDL Design, Stephan Brown, Zvonko Vranesic,McGraw Hill, Second Edition, 2005.

IV Semester B.E. Instrumentation Engineering

Course Code : IN406

Title of the Course : Sensors and Transducers - II Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Objectives:

1. To understand and analyze the practical concepts about different sensors and transducers which are useful for measuring process parameters through experimentation
2. To learn and use the proper experimental methods while gathering experimental data.
3. To get familiar with the proper characterization of sensors and transducers.

Term Work (TW) & POE:

Term work and practical/Oral examination shall consist of at least ten experiments based on contents of syllabi given in the course code IN403 in the form of a journal and necessary documentation.

Suggested list of experiments:

1. Characterization and calibration of temperature measurement system. (Thermocouple, RTD and thermistor).
2. Identify the suitable sensor for temperature measurement application under study (characteristics for consideration: Accuracy, Resolution, and Response Time)
3. Calibration of pressure gauge using dead weight tester
4. Find the static and dynamic characteristics of the pressure sensor under test.
5. Characterization and calibration of level measurement system. (Capacitive, resistive, and bubbler methods)
6. Characterization and calibration of level measurement system. (Ultrasonic and fiber optic level detector).
7. Characterization and calibration of flow measurement system. (Orifice and venturi)
8. Characterization and calibration of variable area flow meter.
9. Characterization and calibration of flow measurement system. (Turbine, electromagnetic and ultrasonic).
10. Characterization and calibration of chemical sensors.

Course Outcomes:

- Students will be able to do experiments based on syllabus using proper methodology and derive scientific conclusion/s based on experiments conducted.

IV Semester B.E. Instrumentation Engineering

Course Code : IN407

Title of the Course : Linear Integrated Circuits Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Objectives:

1. To understand and analyze the theoretical concepts in linear electronic circuit through experimentation.
2. This course is basically a study of the characteristics, operations, stabilization, testing, and feedback techniques of linear integrated circuits.
3. The course includes applications in computation, measurements, instrumentation, and active filtering.

Term Work (TW) & POE:

Term work and practical/Oral examination shall consist of at least ten experiments based on contents of syllabi given in the course code IN404 in the form of a journal and necessary documentation.

Suggested list of experiments:

1. Measurement of Opamp parameters: Input offset voltage, input bias current, Input offset current, CMRR and skew rate.
2. Inverting amplifier using IC 741 and its frequency response.
3. Noninverting amplifier using IC 741 and its frequency response.
4. Study of comparator, Schmitt trigger.
5. Summing and difference amplifier; To build summing amplifier in inverting and noninverting mode.
6. Square wave, triangular wave and sawtooth generators using opamp; to build and observe waveform on CRO
7. Instrumentation amplifier study and construction of instrumentation amplifier and to use it as a temperature controller, indicator etc.
8. Precision rectifiers; to build precision rectifiers and to observe the output waveforms.
9. Voltage limiter; to build Voltage limiter and to observe the output waveforms.
10. Differentiating circuits using opamp; to build and to observe the output waveforms for various values of R and C.
11. Integrating circuits using opamp – to build and to observe the output waveforms for various values of R and C.
12. Butter worth filter; to build High pass and low pass Butter worth filter to analyse the circuit and to observe the output waveforms for various values of R and C.

Course Outcomes:

- Students will be able to do experiments based on syllabus using proper methodology and derive scientific conclusion/s based on experiments conducted.

IV Semester B.E. Instrumentation Engineering

Course Code : IN408

Title of the Course : Digital Circuits Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	3	2	25	25	50

Course Objectives:

- To understand digital logic families, logic gates, various combinational and sequential circuits.
- To study different types of programmable logic devices.
- To design and Implement various combinational and sequential circuits.
- To understand practical applications of digital circuits.

Term Work (TW) & POE:

Term work and practical/Oral examination shall consist of at least ten experiments based on contents of syllabi given in the course code IN405 in the form of a journal and necessary documentation.

Suggested list of experiments:

1. Study of basic gates using TTL, CMOS: 7432, 4011,4050, 4070,4071,40106
2. Study of Static I/O and transfer Characteristic of TTL.
3. Study of Static I/O and transfer Characteristic of CMOS.
4. Study of Universal gates (NAND, NOR)
5. K map based implementation of combinational logic
6. Half and Full Adder, Half and Full Subtractor
7. 4 bit Adder subtracor using IC 7483
8. Code Converters (Binary to Gray, Excess 3 to Binary)
9. Comparator using IC 7485
10. Implementation of combinational logic using MUX
11. Study of Decoder and DEMUX (IC 74138)
12. Study of 7 segment decoder driver. (IC 7447)
13. Study of Flip Flops (SR FF, D FF, JK FF, T FF)
14. Design Built and test MOD N counter
15. Design Built and test Shift Register

Course Outcome:

- Ability to apply Boolean algebra and other minimization techniques to digital circuits.
- Ability to design combinational and sequential circuits for a given problem / case studies related to digital circuits.
- Ability to select the appropriate hardware and software tools for combinational and sequential circuit design.

IV Semester B.E. Instrumentation Engineering

Course Code : IN409

Title of the Course : Programming Practice –II OrCAD Laboratory

Course Scheme				Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Credits	TW	POE	Total
0	0	2	2	50	0	50

*Note: The objective of this laboratory is to provide hands-on experience with programming in electronic circuit design software's. It is expected that the students should design any electronic, network and control circuits on any one of the circuit design software (OrCAD/PSPICE) and test that circuit on it. It is also expected that, the students should convert that designed circuit into the PCB layout.

Unit	Contents	Hours
I	Getting started with Or-CAD, The Capture work environment , Starting a project , Setting up your project, Design structure, Placing, editing, and connecting parts and electrical symbols, Adding and editing graphics and text, Changing your view of a schematic page.	12
II	About libraries and parts, Creating and editing parts, About the processing tools, Preparing & Creating a net lists, Creating reports, Exporting and importing schematic data, Using Capture with OrCAD Layout, Using Capture with OrCAD PSpice, Industrial Projects.	12
	Total	24

Term Work (TW):

Term work shall consist of at least ten exercises/programs and one mini project on programming in electronic circuit design software's (OrCAD/PSPICE) in the form of a journal and necessary documentation. This exercises/programs are based on contents of syllabi given above and shall be used as a guideline for solving problem statements specified within the scope of this laboratory course.

Text Books:

1. Introduction To PSpice Using OrCAD For Circuits And Electronics, 3rd Edition by Muhammad H Rashid
2. "ORCAD PSpice for Windows, Vol. 1: DC and AC circuit," 3rd Edition by Goody
3. OrCAD Software manual.

Note: *Syllabus for the V to VIII Semester courses shall be prescribed in due course of time.*