B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

THIRD SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22NES306	Thermodynamics and Fluid Mechanics	ES	40	60	100	4	0	0	4
2	22NPC301	Electrical Circuits and Networks	PC	40	60	100	3	1	0	4
3	22NPC302	Analog Electronics	PC	40	60	100	3	0	0	3
4	22NPC303	Sensors and Transducers	PC	40	60	100	3	0	0	3
5	22NPC304	Electrical and Electronic Measurement Techniques	PC	40	60	100	3	0	0	3
6	22NMC3Z2	Constitution of India (Common to All Branches)	MC	40	60	100	3	0	0	0
PRACTICAL										
7	22NES307	Engineering Exploration	ES	60	40	100	0	0	3	1.5
8	22NPC305	Sensors and Measurements Laboratory	PC	60	40	100	0	0	3	1.5
9	22NPC306	Electrical and Electronic Circuits Laboratory	PC	60	40	100	0	0	3	1.5
TOTAL				**420**	**480**	**900**	**19**	**1**	**9**	**21.5**

FOURTH SEMESTER

Sl. No	Course Code	Course Title	Category	CA Marks	End Sem Marks	Total Marks	Hours/Week			
							L	T	P	C
THEORY										
1	22NBS408	Fourier Series and Transform Calculus (Common to EEE & EIE Branches)	BS	40	60	100	3	1	0	4
2	22NES408	Electrical Machines	ES	40	60	100	3	0	0	3
3	22NPC407	Electronics for Analog Signal Processing	PC	40	60	100	3	0	0	3
4	22NPC408	Digital Electronics	PC	40	60	100	3	0	0	3
5	22NPC409	Industrial Instrumentation	PC	40	60	100	3	0	0	3
6	22NPC410	Fundamentals of Signals and Systems	PC	40	60	100	3	0	0	3
PRACTICAL										
7	22NPC411	Analog and Digital Circuits Laboratory	PC	60	40	100	0	0	3	1.5
8	22NPC412	Virtual Instrumentation Laboratory	PC	60	40	100	0	0	3	1.5
Total				**360**	**440**	**800**	**18**	**1**	**6**	**22**

22NES306	THERMODYNAMICS AND FLUID MECHANICS	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	4	0	0	4

A) THERMODYNAMICS

COURSE OBJECTIVE	To expose thermodynamic concepts, processes and cycles for analyzing the thermodynamic systems.	
UNIT - I	**CONCEPT OF THERMODYNAMICS**	**10 Periods**
Basic definitions - Microscopic and Macroscopic approach - Types of systems - State, Process, Path and Cycle - Quasi-static process - Thermodynamic Properties - Zeroth law - Thermodynamic concept of energy - Heat and work - First law of thermodynamics - PMM 1 - Thermodynamic process of closed and open systems – Steady Flow Energy Equation.		
UNIT - II	**SECOND LAW OF THERMODYNAMICS AND ENTROPY**	**10 Periods**
Limitations of First law -Thermal energy reservoirs – Kelvin, Plank and Clausius statements - PMM 2 - Heat engines - Refrigerators and Heat pumps - efficiency and COP - Carnot cycle - Entropy - Clausius Inequality - principle of increase in entropy - Second law efficiency - Exergy analysis of closed and open system - Thermodynamic relations.		
UNIT - III	**THERMAL SYSTEMS AND COMPONENTS**	**10 Periods**
Boilers – Fire Tube Boilers & Water Tube Boilers, Boiler accessories and components. Turbines – Impulse Turbine and Reaction Turbine, Velocity Triangles, Compounding of Turbines. Air Compressor - Classification and comparison, working principle, work of compression, with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling.		
Contact Periods: **Lecture: 30 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 30 Periods**		

TEXT BOOKS:

1	*Nag. P.K., "**Engineering Thermodynamics**", Tata McGraw Hill Company, 5th Edition, 2013.*
2	*Mahesh M Rathore., "**Thermal Engineering**" , TATA McGraw Hill Education, 1st Edition, 2010*

REFERENCES:

1	*Kothandaraman C.P., **"Thermal Engineering",** Dhanpat Rai & Sons, 1998.*
2	*YunusA Cengel, **"Thermodynamics"**,Tata McGraw Hill Company, 8th Edition, 2014*
3	*R.K. Rajput **"Engineering Thermodynamics"**, Laxmi Publications (P) Ltd, 5th Edition, 2016.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		Bloom's Taxonomy Mapped
CO1	Acquire knowledge on Thermodynamic laws	K2
CO2	Analyze the principles of entropy generation.	K4
CO3	Apply the concepts on thermodynamic systems.	K2

B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	1	-
22NES306 (A)	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4, 2.3.1, 2.4.1, 2.4.2, 3.1.4,4.1.1
CO2	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.3,2.2.4,2.3.1,2.4.1,2.4.2,3.1.4,4.1.1
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.3, 2.2.4,2.3.1,2.4.1,2.4.2,3.1.4,4.1.1

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing (K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	40	10	-	-	100
CAT2	20	30	40	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	60	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	60	10	-	-	100
ESE	20	30	40	10	-	-	100

B) FLUID MECHANICS

COURSE OBJECTIVE	To acquire knowledge on the concepts of fluids, its properties ,flow equation and Hydraulic machines	
UNIT - I	**FLUID PROPERTIES AND MEASUREMENT**	**10 Periods**
Fluid: Units and dimension – Fluid Properties - Density, Specific weight, Specific gravity, viscosity, compressibility, capillarity, surface tension, vapour pressure. Pressure: Laws of pressure-Types of pressure-Pressure measurement-Manometer.		
UNIT - II	**EQUATIONS OF FLUID FLOW**	**10 Periods**
Fluid kinetics and kinematics: Types of flow - Types of flow lines - Continuity equation 1D & 3D - Euler's equation - Bernoulli's Equation and its application. Impulse momentum equation (Principle only).		
UNIT - III	**HYDRAULIC MACHINES**	**10 Periods**
Pumps: Classification, Construction and working principle, performance curve – centrifugal pump and reciprocating pump, submersible pump. Turbines: Classification, Construction and working principle, specific speed, and performance curve – Pelton wheel, Francis and Kaplan turbine.		
Contact Periods: **Lecture: 30 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 30 Periods**		

TEXT BOOKS:

1	*Rajput.R.K., "**A Text Book of Fluid Mechanics and Hydraulic machines**", S. Chand and Company, New Delhi,2011*
2	*Kumar.K.L. "**Engineering Fluid Mechanics**", Eurasia Publishing House (P) Ltd. New Delhi,2000*
3	*Ramamurtham.S and Narayanan. R. "**Fluid Hydraulics and Fluid Machines**", Dhanpat Rai Publishing House (P) Ltd. New Delhi, 2000*

REFERENCES:

1	*P.N.Modi & S.M. Seth , "**Hydraulic & Fluid Mechanics including hydraulic machines**", Standard book 2010.*
2	*Natarajan.M.K.,* "**Fluid Machines**", *Anuradha Agencies, Vidayal Karuppur, Kumbakonaam, 1995.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Gain knowledge on fluid properties and pressure measurement.	K2
CO2	Apply the fluid flow equation for solving fluid flow problems in real situation.	K3
CO3	Analyze the performance of various fluid machines	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	-	-	1	-
CO2	3	2	1	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	2	1	1	1	-	-	-	-	-	-	-	-	1	-
22NES306(B)	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.2.1, 3.2.3, 4.1.4, 5.3.1
CO2	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.2.1, 3.2.3, 4.1.4, 5.3.1
CO3	1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 3.1.1, 3.2.1, 3.2.3, 4.1.4, 5.3.1

ASSESSMENT PATTERN – THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40	-	-	-	100
CAT2	20	40	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	40	40	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	20	40	40	-	-	-	100
ESE	20	40	40	-	-	-	100

22NPC301	ELECTRICAL CIRCUITS AND NETWORKS	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	1	0	4

COURSE OBJECTIVE	To teach the fundamental concepts of D.C and A.C circuits, coupled and polyphase circuits, two port networks and impart the methods of analysis of linear electric circuits.	
UNIT - I	**DC CIRCUITS**	**9 +3 Periods**
Basic concepts – Resistors, Inductors, Capacitors – Voltage and Current Sources – Ohm's law - Kirchhoff's Laws – Voltage Division and Current Division– Star/Delta Conversion - Source Transformations. Steady state Analysis: Nodal Analysis, Mesh Analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Compensation Theorem, Reciprocity Theorem, Millman's theorem, Telegen's Theorem.		
UNIT - II	**TRANSIENT ANALYSIS OF CIRCUITS**	**9 +3 Periods**
Source-Free RC, RL, RLC Circuits – Standard test inputs – Response of RC, RL and RLC Circuits for step and sinusoidal excitation.		
UNIT - III	**AC CIRCUITS**	**9 +3 Periods**
Sinusoids– Phasors – Phasor Relationship of Circuit Elements - Impedance and Admittance–Sinusoidal Steady-State Analysis: Nodal Analysis, Mesh Analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem. Power Analysis – Instantaneous and Average Power– Complex Power - Power Factor and Power Factor Correction.		
UNIT - IV	**RESONANCE AND COUPLED CIRCUITS**	**9 +3 Periods**
Series and Parallel Resonant Circuits –Half power frequencies - Bandwidth – Quality factor. Coupled circuits-Self and Mutual inductance - Dot convention - Coefficient of coupling – Series and parallel connection of coupled coils – Tuned circuits – Ideal Transformer.		
UNIT - V	**POLYPHASE CIRCUITS AND TWO PORT NETWORKS**	**9 +3 Periods**
Polyphase circuits – Line voltage - Phase voltage – Phasor diagram – Balanced and Unbalanced Loads – Analysis using Star and Delta. Two-Port Networks – Z and Y Parameters –Transmission Parameters – h and g parameters – Inter-connection of Two-Port Networks – T and π representation - Lattice Networks.		
Contact Periods: 60 Periods **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOKS:

1	*Charles K. Alexander, Matthew N.O. Sadiku, "**Fundamentals of Electric Circuits**", McGraw-Hill, Seventh Edition, 2021.*
2	*A Sudhakar and Shyammohan S. Palli, "**Circuits and Networks Analysis and Synthesis**", Tata McGraw- Hill, Fifth Edition, 2015.*

REFERENCES:

1	*Robert .L Boylsted, "**Introductory Circuit Analysis**", Pearson Education, Thirteenth Edition, 2016.*
2	*William Hayt, Jack. E. Kemmerley and Steven. M. Durbin, "**Engineering circuit Analysis**", Tata McGraw- Hill, Seventh Edition, 2012.*
3	*Joseph. A Edminister, Mahmood Navhi, "**Electric Circuits**", Schaum's Outline Series, McGraw-Hill, Seventh Edition, 2018.*
4	*Richard. C, Dorf, James. A. Svoboda, "**Introduction to Electric Circuits**", John Wiley & Sons, Ninenth edition, 2014.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Solve basic DC and AC circuits using network theorems.	K4
CO2	Analyze the transient behavior of first and second order circuits.	K4
CO3	Analyze and solve single and three phase circuits	K4
CO4	Examine the parameters of resonance and coupled circuits.	K4
CO5	Simplify complex network into simple network and obtain the parameters of a network.	K4

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO4	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
CO5	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-
22NPC301	3	2	1	2	-	-	-	-	-	-	-	-	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 2.4.1, 2.4.4, 3.1.1, 3.1.6, 4.1.2, 4.1.4, 4.3.1, 4.3.2, 4.3.4
CO2	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 2.4.1, 2.4.2, 2.4.4, 3.1.1, 3.1.6, 4.1.2, 4.1.4, 4.3.1, 4.3.2, 4.3.4
CO3	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 3.1.1, 3.1.6, 4.1.4, 4.3.1, 4.3.2, 4.3.4
CO4	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 3.1.1, 3.1.6, 4.1.4, 4.3.1, 4.3.2, 4.3.4
CO5	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.1, 3.1.1, 3.1.6, 4.1.4, 4.3.1, 4.3.2, 4.3.4

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	40	20	-	-	100
CAT2	10	30	40	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	40	40	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	40	40	20	-	-	100
ESE	10	30	40	20	-	-	100

B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

22NPC302	ANALOG ELECTRONICS	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

COURSE OBJECTIVE	To impart knowledge on the working of semiconductor devices and the operation of electronic circuits.	
UNIT - I	**PN JUNCTION DEVICES**	**9 Periods**
PN Junction Diode: Structure, Operation, V-I Characteristics, Diffusion and Transition Capacitance - Rectifiers: Half Wave, Full Wave Rectifier - Filters- Regulators - Power Supply– Clipper – Clamper - Zener Diode Characteristics - Zener as Regulator - Schottky Diode - Varactor Diode - Tunnel Diodes – LED - Laser Diodes - Photo Diode - Solar Cell.		
UNIT - II	**BIPOLAR JUNCTION TRANSISTORS**	**9 Periods**
BJT: Structure, Operation of NPN and PNP Transistor, Input and Output Characteristics of CE, CB and CC Configurations - DC Load Line and Operating Point - Need for Biasing - Bias Stabilization - Fixed and Voltage Divider Biasing - Single Stage BJT Amplifiers - AC Analysis of CE and CC Amplifier with Voltage Divider Bias using h-Parameters - Gain and Frequency Response.		
UNIT - III	**FIELD EFFECT TRANSISTORS AND THYRISTORS**	**9 Periods**
Structure, Operation and Characteristics of JFET, MOSFET - JFET Biasing: Self and Voltage Divider Biasing - Operation and Applications of UJT, SCR, DIAC and TRIAC		
UNIT - IV	**MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER**	**9 Periods**
Cascade Amplifier - BJT Differential Amplifier: Common Mode and Difference Mode Analysis – Single Tuned Amplifiers – Power Amplifiers: Class A, Class B, Class C and Class AB amplifiers (Qualitative analysis).		
UNIT - V	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	**9 Periods**
Feedback Concepts - Feedback Topologies: Voltage / Current, Series/ Shunt Feedback - Effect of Negative Feedback in Amplifiers - Positive Feedback – Condition for Oscillations – Types of Oscillators: RC Phase Shift, Wien Bridge, Hartley, Colpitts and Crystal Oscillators - Multivibrator: Monostable, Bistable, Astable Multivibrator.		
Contact Periods: **45 Periods** **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Thomas L Floyd, "**Electronic Devices**", Pearson Education, Tenth Edition, 2017.*
2	*S Salivahanan, N Suresh Kumar, "**Electronic Devices and Circuits**", McGraw Hill Education (India) Private Limited, Fourth Edition, 2017.*

REFERENCES:

1	*Robert Boylestad, Louis Nashelsky, "**Electronics Devices and Circuit Theory**", Prentice Hall of India, Tenth Edition, 2012.*
2	*David A Bell, "**Fundamentals of Electronic Devices and Circuits**", Oxford Higher Education, Fifth Edition, 2012.*
3	*Albert Malvino, David J Bates, "**Electronic Principles**" McGraw Hill, Ninth Edition, 2021.*
4	*Allen Mottershead, "**Electronic Devices and Circuits: An Introduction**", Prentice Hall of India, Second Edition, 2013.*
5	*Jacob Millman, Christos C Halkias, Satyabrata, "**Electronic Devices and Circuits**", McGraw Hill, Fourth Edition, 2015.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Explain the operation and applications of different diodes	K2
CO2	Describe the working and biasing of transistor and FET	K2
CO3	Analyze the parameters of amplifier circuits	K4
CO4	Compare multistage amplifiers, power amplifiers, and differential amplifiers	K2
CO5	Identify the different topologies of feedback amplifiers	K2

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	1	2	-	-	-	-	-	-	-	-	3	-	-
CO4	2	1	1	1	-	-	-	-	-	-	-	-	3	-	-
CO5	2	2	1	2	-	-	-	-	-	-	-	-	3	-	-
22NPC302	**3**	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.2.1,1.3.1,1.4.1, 2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.4.2
CO2	1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,2.4.4,3.1.1,3.4.1, 3.4.2
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3, 2.4.4,3.1.1,4.1.2,4.1.3,4.1.4,4.3.4
CO4	1.2.1,1.3.1,1.4.1,2.1.2,2.2.2,2.2.4,3.4.1,4.1.2,4.1.3,4.3.1
CO5	1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.4.2,3.4.1,4.1.2,4.1.3,4.2.1,4.3.1

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing (K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	70	-	20	-	-	100
CAT2	-	70	20	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	50	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	50	20	-	-	100
ESE	10	60	20	10	-	-	100

22NPC303	SENSORS AND TRANSDUCERS	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
PHYSICS OF MATERIALS	PC	3	0	0	3

COURSE OBJECTIVE	To introduce students the principle involved in the operation, selection, calibration of sensors/transducers and signal conditioning circuits used to measure a range of common physical parameters.	
UNIT - I	**CHARACTERISTICS OF TRANSDUCERS**	**9 Periods**
Structure of a general measurement systems and examples – Errors in a measurement system- Classification of errors - Statistical analysis of errors – Sensors and Transducers –- Classification of transducers - Static and Dynamic characteristics of Transducers - Mathematical model of a transducer:Zero, First, and Second-order transducers – Selection of transducers – Calibration		
UNIT - II	**VARIABLE RESISTANCE TRANSDUCERS**	**9 Periods**
Principle, Operation, Characteristics and Applications of Potentiometer – Strain gauge – Load cell – Piezo resistive sensor – Loading effect - Signal conditioners- Application E.g.: Measurement of Force, Torque		
UNIT - III	**VARIABLE INDUCTANCE AND CAPACITANCE TRANSDUCERS**	**9 Periods**
Operation, Characteristics and Applications of Transducers working on the principle of: Variation of Self Inductance, Variation of reluctance, Variation of Mutual Inductance, Production of Eddy currents – LVDT and RVDT– Tachogenerators – Capacitive transducers – Inductive and Capacitive Proximity Switches – Application E.g.: Measurement of Pressure, Length, Displacement, Position, Vibration, Thickness, Liquid Level, and Sound, Noise.		
UNIT - IV	**LIGHT, SEISMIC, OCCUPANCY AND MOTION DETECTION**	**9 Periods**
Operation, Characteristics and Applications of: Photo electric transducers - Piezoelectric transducers, Tactile Sensors, Hall effect sensors - Magnetostrictive sensors – Accelerometers – Gyroscope –- Geophones- Ultrasonic sensors- Microwave sensors- Infra-red – PIR sensors.		
UNIT - V	**OTHER TRANSDUCERS**	**9 Periods**
Principle, Operation, Characteristics and Applications of: Digital Transducers - Fiber optic sensor – MEMS – Nano sensors – Smart Sensors - Biochemical Sensors:Enzyme Sensors, Multisensor Arrays, Electronic Noses and Tongues.		
Contact Periods: **45 Periods** **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*J. P. Bentley, **"Principles of Measurement Systems"**, Addison Wesley Longman Ltd., UK, 2010*
2	*Jacob Fraden, "**Handbook of Modern Sensors- Physics, Designs, and Applications",** Springer; 4th ed. 2010 edition*

REFERENCES:

1	*A.K. Sawhney, Puneet Sawhney, "**A Course In Electrical And Electronic Measurements And Instrumentation",** Dhanpat Rai, 2012.*
2	*E. O. Doeblin, **"Measurement Systems: Applications and Design"**, Tata McGraw-Hill Book Co,2017*
3	*D. Patranabis, **"Sensors and Transducers"**, Prentice Hall India Pvt. Ltd, 2007*
4	*Bela G. Liptak, **"INSTRUMENT ENGINEERS' HANDBOOK - Process Measurement and Analysis"**, CRC PRESS, Boca Raton London New York Washington, D.C, Fourth Edition, 2003*

5	*H. K. P. Neubert,* ***"Instrument Transducers – An Introduction to their Performance and Design",*** *Oxford University Press, Cambridge, 2009*
6	*W.Bolton,* ***"Engineering Science"****, Elsevier Newnes, Fifth edition, 2006.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Discuss the function and characteristics of transducers and measurement system.	K2
CO2	Comprehend the underpinning knowledge on the operation of a resistive type transducers and their selection for a range of real-world applications.	K2
CO3	Pick suitable inductive and capacitive transducers for a specific application.	K2
CO4	Familiarize themselves with selection of transducers for light, seismic, occupancy and motion detection.	K2
CO5	Demonstrate the understanding of the operation of modern transducers like digital, fibre optic, and range of smart sensors	K2

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	3	2	-	-	-	-	3	2	-	-	2	2	2
CO2	2	-	3	2	-	-	-	-	3	2	-	-	2	2	2
CO3	2	-	3	2	-	-	-	-	3	2	-	-	2	2	2
CO4	2	-	3	2	-	-	-	-	3	2	-	-	2	2	2
CO5	2	-	3	2	-	-	-	-	3	2	-	-	2	2	2
22NPC303	**2**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**2**	**2**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.2.1 1.4.1, 2.2.2, 2.2.4, 2.3.2, 3.1.1, 4.1.1, 4.1.3, 4.1.4, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.3.1, 9.3.2, 10.1.1.1, 10.1.2
CO2	1.2.1 1.4.1, 2.2.2, 2.2.4, 2.3.2, 3.1.1, 4.1.1, 4.1.3, 4.1.4, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.3.1, 9.3.2, 10.1.1.1, 10.1.2
CO3	1.2.1 1.4.1, 2.2.2, 2.2.4, 2.3.2, 3.1.1, 4.1.1, 4.1.3, 4.1.4, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.3.1, 9.3.2, 10.1.1.1, 10.1.2
CO4	1.2.1 1.4.1, 2.2.2, 2.2.4, 2.3.2, 3.1.1, 4.1.1, 4.1.3, 4.1.4, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.3.1, 9.3.2, 10.1.1.1, 10.1.2
CO5	1.2.1 1.4.1, 2.2.2, 2.2.4, 2.3.2, 3.1.1, 4.1.1, 4.1.3, 4.1.4, 9.1.1, 9.1.2, 9.2.1, 9.2.2, 9.3.1, 9.3.2, 10.1.1.1, 10.1.2

B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

ASSESSMENT PATTERN - THEORY							
Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K 4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	90	-	-	-	-	100
CAT2	10	90	-	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	40	10	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	40	10	-	-	100
ESE	10	90	-	-	-	-	100

22NPC304	ELECTRICAL AND ELECTRONIC MEASUREMENT TECHNIQUES	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

COURSE OBJECTIVE	To impart knowledge on various electrical, electronic and waveform analyzing instruments.

UNIT - I	VOLTAGE AND CURRENT MEASUREMENTS	9 Periods

Introduction to Electrical Measurements - Construction, Principle of Operation, Torque Equation, Errors and Applications: Moving Coil, Moving Iron and Dynamometer Type Instruments - Thermal Type Instruments - Rectifier Type Instruments - Extension of Instrument Range - Calibration of Instruments - AC and DC Current Probes.

UNIT - II	POWER AND ENERGY MEASUREMENTS	9 Periods

Power Measurement: Constructional Details, Derivation of Power, Errors and Compensation of Electro-Dynamic Wattmeter - Thermal Wattmeter - Single and Three Phase Power Measurements - Low Power Factor Wattmeter - Calibration of Wattmeter - Energy Measurement: Construction, Working Principle, Energy Equation of Single Phase Induction Type Energy Meter - Three Phase Energy Meters - Phantom Loading - Calibration of Energy Meter.

UNIT - III	MEASUREMENT USING BRIDGES	9 Periods

DC Bridges: Wheatstone Bridge, Modified Wheatstone Bridge, Kelvin Double Bridge - Megger - AC Bridges: Maxwell's Inductance bridge, Maxwell's Inductance Capacitance bridge, Hay's bridge, Anderson's bridge, Wien's bridge and Schering bridge.

UNIT - IV	ELECTRONIC MEASUREMENTS	9 Periods

Digital Meters: Voltmeter, Wattmeter and Multimeter - True RMS Meter - Q Meter - Signal Generator: Sine, Step and Ramp Generation - Function Generator - Digital Methods of Measuring Time, Frequency, Period, Phase Difference, Pulse Width - Digital Display: LED, LCD, Segmented and Dot Matrix Displays.

UNIT - V	WAVEFORM ANALYZING INSTRUMENTS	9 Periods

Cathode Ray Oscilloscopes: Block Diagram, Waveform Generation - Measurement of Electrical Quantities using CRO – Digital Storage Oscilloscopes - Wave Analyzer - Spectrum Analyzer –Harmonic Distortion Analyzer – Elements of Data Acquisition System - Introduction to Virtual Instrumentation : Hardware and Software, VI for Test, Control and Design, VI in Engineering.

Contact Periods: **45 Periods**

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1	*A.K. Sawhney, Puneet Sawhney**, "A Course in Electronic and Electrical Measurements and Instrumentation"** ,S.K.Kataria & Sons, Delhi, 2014.*
2	*J. B. Gupta, "**Electronics Measurements and Instrumentation**", S.K.Kataria & Sons, Delhi, 2013.*

REFERENCES:

1	*Kalsi.H.S, **"Electronic Instrumentation"**, Tata McGraw Hill Education Private Limited, Fourth Edition, 2019.*
2	*David.A.Bell, **"Electronic Instrumentation and Measurement Techniques"** Prentice Hall, Third Edition, 2013.*
3	*E.W. Golding and F.C. Widdis, **"Electrical Measurements and Measuring Instruments"** A.H.Wheeler and Co, Fifth Edition, 2011.*
4	*Jovitha Jerome, "**Virtual Instrumentation using Labview**", PHI Learning Private Limited, New Delhi, 2010.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Describe the construction and operation of various analog instruments.	K2
CO2	Analyze the methods for the measurement of power and energy.	K4
CO3	Determine circuit parameters using AC and DC bridges.	K2
CO4	Identify suitable electronic instruments for the measurement of electrical parameters.	K2
CO5	Interpret the operation and application of oscilloscopes and waveform analyzing instruments.	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	2	-	-	-	-	-	-	3	2	-
CO2	3	1	2	-	1	2	-	-	-	-	-	-	3	2	-
CO3	2	2	2	-	1	-	-	-	-	-	-	-	3	2	-
CO4	1	1	1	-	1	2	-	-	-	-	-	-	3	2	-
CO5	2	1	1	-	-	-	-	-	-	-	-	-	3	2	-
22NPC304	**2**	**2**	**2**	**-**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.2.1,1.3.1,2.1.2,2.1.3,3.1.1
CO2	1.1.1,1.2.1,1.3.1,1.4.1,2.1.1,2.2.3,2.3.1,2.4.1,3.1.1,3.1.2
CO3	1.2.1,1.3.1,2.1.2,2.1.3,2.2.1,2.3.2,2.4.1,3.1.1,3.4.1
CO4	1.2.1,2.1.3,3.1.1,3.1.2
CO5	1.2.1,1.4.1,2.2.2,2.1.3,3.1.1,3.1.2

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing (K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20	-	-	-	100
CAT2	20	60	10	10	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	60	40	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	60	40	-	-	-	100
ESE	10	50	20	20	-	-	100

B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

22NMC3Z2	CONSTITUTION OF INDIA (Common to All Branches)	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	MC	3	0	0	0

COURSE OBJECTIVE	To familiarize the students on the role, powers and functions of Indian government and also understand the recent acts in India.	
UNIT - I	**INTRODUCTION AND EMERGENCY PROVISIONS**	**9 Periods**
Historical Background: The Company rule, The Crown rule - Constituent Assembly: Composition, Objectives - Preamble and Salient features of the Indian Constitution - Fundamental Rights, Fundamental Duties, Directive Principles of state policy, Emergency Provisions - National Emergency, President Rule, Financial Emergency.		
UNIT - II	**SYSTEM OF GOVERNMENT**	**9 Periods**
Parliamentary system: merits, demerits, reasons for adopting parliamentary system – Federal system: Evaluation of federal features –Centre-State relations: Legislative, Administrative and Financial relations – Local Government: Panchayat Raj and urban local government.		
UNIT - III	**UNION AND STATE GOVERNMENT**	**9 Periods**
President of India: Election, Powers and functions - Prime Minister and Cabinet: Structure and functions – Governor: Powers and functions - Chief Minister and Council of Ministers: Functions.		
UNIT - IV	**ORGANS OF GOVERNANCE AND RECENT ACTS**	**9 Periods**
Parliament: Lok Sabha and Rajya Sabha, Composition and powers - State Legislative Assembly and Legislative Council: Composition and powers - Judicial System in India: Structure and features - Supreme Court and High Court: Composition, Jurisdiction, Recent acts in significance-RTI, Citizenship act, POCSO Act.		
UNIT - V	**POLITICAL DYNAMICS**	**9 Periods**
Political parties: Party system, Recognition of National and State parties – Elections: Electoral system and reforms – Pressure groups – National Integration: Obstacles, National Integration Council – Foreign Policy: Principles and Objectives.		
Contact Periods: **45 Periods** **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*National portal of India, "**The Constitution of India"** (Full Text), https://legislative.gov.in/constitution-of-india*
2	*Dr.B.R.Ambedkar, "**The Constitution of India",** Sudhir Prakashan, 2020.*

REFERENCES:

1	*Durga Das Basu, "**Introduction to the Constitution of India**, LexisNexis, 2022*
2	*P.M.Bakshi, "**The Constitution of India"**, LexisNexis, 2020*
3	*Subash C Kashyap, "**Our Parliament"**, National Book Trust, 2021*
4	*Subash C Kashyap, "**Our Political System**", National Book Trust, 2011*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Know the evolution of Indian Constitution and its basic premises.	K1
CO2	Explain the system of governance in India.	K2
CO3	Describe the structure of Union and State Governments	K2
CO4	Obtain the knowledge of functions of Legislature and Judiciary	K1
CO5	Know the political system of India	K1

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	2	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	-	1	2	-	-	-	-	-	-
CO5	-	-	-	-	-	2	-	2	1	-	-	-	-	-	-
22NMC3Z2	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	6.1.1,6.2.1,8.1.1,8.2.1,8.2.2,9.1.2
CO2	6.1.1,6.2.1,8.1.1,8.2.1,8.2.2,9.1.2
CO3	6.1.1,6.2.1,8.1.1,8.2.1,8.2.2
CO4	6.1.1,6.2.2,9.1.2,9.2.1
CO5	6.2.2,8.1.1,8.2.2,9.1.2,9.2.1

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50	-	-	-	-	100
CAT2	50	50	-	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	50	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	50	50	-	-	-	-	100
ESE	50	50	-	-	-	-	100

22NES307	ENGINEERING EXPLORATION	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	0	0	3	1.5

COURSE OBJECTIVE	The objective of the course is to provide an introduction to the engineering field. It is designed to help the student to learn about engineering and how it is useful in our everyday life.	
UNIT - I	**INTRODUCTION**	**15 Periods**
Introduction to Engineering and Engineering study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, expectation for the 21st century engineer and Graduate Attributes.		
UNIT - II	**ENGINEERING DESIGN**	**15 Periods**
Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements , Problem definition , Idea generation through brain storming and researching, solution creation through evaluating and communicating , text/analysis, final solution and design improvement.		
UNIT - III	**ENGINEERING DISCIPLINES**	**15 Periods**
Electronics and Instrumentation Engineering: Reading analog multimeter, Measuring current, voltage and resistance, resistor colour code, electricity from chemicals, solar cells, magnets. Ohm's law and Watts law, Breadboard connections - Series and Parallel combination - circuit identification and circuit power consumption calculation, basic troubleshooting and continuity check. Ring main wiring - Troubleshooting Electrical wiring - Dismantling and reassembling of Appliances (eg. Fans, motors etc.,) Functionalities and operational procedures of RPS/AFO/CRO/DMM/LCR meter - Functionalities and Selection of Analog and Digital meters Interpretation of Datasheets - Overview of simulation and design tools Identifying electronic components and understanding PCB glossary - Conversion of schematic into PCB layout and PCB fabrication - Practicing of soldering and desoldering - PCB trouble shooting		
Contact Periods: **45 Periods** **Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods**		

REFERENCES:

1	*Ryan A Brown, Joshua W. Brown and Michael Berkihiser: "**Engineering Fundamentals: Design, Principles, and Careers**", Goodheart-Willcox Publisher, Second edition, 2014.*
2	*Saeed Moaveni, "**Engineering Fundamentals: An Introduction to Engineering**", Cengage learning, Fourth Edition, 2011.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		Bloom's Taxonomy Mapped
CO1	Explain technological and engineering development , change and impacts of engineering	K2
CO2	Complete initial steps (Define a problem list criteria and constraints , Brainstorm potential solutions and document ideas) in engineering designs	K3
CO3	Communicate possible solutions through drawings and prepare project reports.	K3
CO4	Draw sketches to a Design problem.	K3
CO5	Apply the concept of engineering fundamentals in Electronics and Instrumentation Engineering.	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	1	3	1	2	-	1	2	1	1	1	3	-	-
CO2	2	-	1	3	1	2	-	1	2	1	1	1	3	-	-
CO3	2	-	1	3	1	2	-	1	2	1	1	1	3	-	-
CO4	2	-	1	3	1	2	-	1	2	1	1	1	3	-	-
CO5	2	-	1	3	1	2	-	1	2	1	1	1	3	-	-
22NES307	2	-	1	3	1	2	-	1	2	1	1	1	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO2	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO3	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO4	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO5	1.2.1, 1.3.1, 3.1.1, 3.1.4, 3.1.6, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 6.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1

22NPC305	SENSORS AND MEASUREMENTS LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
• SENSORS AND TRANSDUCERS • ELECTRICAL AND ELECTRONIC MEASUREMENT TECHNIQUES	PC	0	0	3	1.5

COURSE OBJECTIVE	To involve students in performing experiments with a range of sensors and measurement systems by selecting appropriate tools and equipment and complying with all occupational health and safety procedures.

LIST OF EXPERIMENTS

1. Characteristics of Photodiode and LDR
2. Characteristics of RTD, Thermistor,Theromcouple and IC sensors.
3. Characteristics of Linear Variable Displacement Transducer (LVDT)
4. Characteristics of Strain Gauge and Load Cell
5. Loading effect of Potentiometer
6. Angle measurement using Digital Transducer – Shaft Angle Encoder
7. Characteristics of Pressure Transducer
8. Measurement of resistance using Wheatstone and Kelvin's bridges
9. Measurement of capacitance using Schering Bridge
10. Measurement of inductance using Anderson and Maxwell Bridges
11. Measurement of frequency using Wien's bridge
12. Measurement of electrical quantities using the oscilloscope

Contact Periods: **45 Periods**
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES Upon Completion of the course, the students will be able to		Bloom's Taxonomy Mapped
CO1	Demonstrate the ability to characterize temperature and light transducers individually by performing experiments	K3
CO2	Show the skill to characterize Displacement transducers, and load cells by performing experiments	K3
CO3	Analyze the effect of transducer loading on the circuit by conducting a suitable experiment	K4
CO4	Perform individually necessary experiments to measure select physical variables like shaft angle and pressure	K3
CO5	Exhibit competency in measuring electrical parameters like resistance, capacitance and inductance by selecting suitable transducers and instruments.	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	3	3	-	3	3	2	-
CO2	3	2	-	-	-	-	-	-	3	3	-	3	3	2	-
CO3	3	2	-	-	-	-	-	-	3	3	-	3	3	2	-
CO4	3	2	-	-	-	-	-	-	3	3	-	3	3	2	-
CO5	3	2	-	-	-	-	-	-	3	3	-	3	3	2	-
22NPC305	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**	**3**	**2**	**-**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.2.1,1.4.1,2.2.2,2.2.4,2.3.2,9.1.1,9.1.2, 9.2.1,9.2.2, 9.2.3, 9.3.1, 10.1.1., 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1., 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO2	1.2.1, 1.4.1, 2.2.2, 2.2.4, 2.3.2, 9.1.1,9.1.2, 9.2.1, 9.2.2, 9.2.3, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO3	1.2.1, 1.4.1, 2.2.2, 2.2.4, 2.3.2, 9.1.1,9.1.2, 9.2.1 , 9.2.2, 9.2.3, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO4	1.2.1, 1.4.1, 2.2.2, 2.2.4, 2.3.2, 9.1.1,9.1.2, 9.2.1 , 9.2.2, 9.2.3, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2
CO5	1.2.1, 1.4.1, 2.2.2, 2.2.4, 2.3.2, 9.1.1,9.1.2, 9.2.1 , 9.2.2, 9.2.3, 9.3.1, 10.1.1, 10.1.2, 10.1.3, 10.2.1, 10.2.2, 10.3.1, 10.3.2, 12.1.1, 12.1.2, 12.2.1, 12.2.2, 12.3.1, 12.3.2

22NPC306	ELECTRICAL AND ELECTRONIC CIRCUITS LABORATORY	SEMESTER III

PREREQUISITES	CATEGORY	L	T	P	C
• ELECTRICAL CIRCUITS AND NETWORKS • ANALOG ELECTRONICS	PC	0	0	3	1.5

COURSE OBJECTIVE	To provide hands on experience on working with basic electrical components and semiconductor devices

LIST OF EXPERIMENTS

1. Verification of Ohm's law and Kirchhoff's law
2. Circuit analysis using Mesh and Nodal analysis
3. Experimental verification of Norton's and Thevenin theorems
4. Experimental verification of Superposition and Maximum Power Transfer theorems
5. Transient analysis of RL, RC and RLC circuits
6. Analysis of parallel and series resonant circuits
7. Characteristics of diode and application as clipper circuits
8. Characteristics of Zener diode and application as a voltage regulator
9. Characteristics of BJT
10. Characteristics of UJT
11. Application of BJT as an amplifier and switch
12. Design of Multivibrator using BJT
13. Simulation of circuits using software tools

Contact Periods: **45 Periods**

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES Upon Completion of the course, the students will be able to		Bloom's Taxonomy Mapped
CO1	Measure voltages and currents in electric circuits	K3
CO2	Analyze electric circuits using basic laws and theorems	K4
CO3	Obtain the characteristics of semiconductor devices	K2
CO4	Calculate the hybrid parameters of transistor using its input-output characteristics	K3
CO5	Design application circuits like amplifiers, switch, multivibrators	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	2	-	-	1	2	1	1	1	3	-	-
CO2	3	3	1	1	2	-	-	1	2	1	1	1	3	-	-
CO3	-	2	-	1	2	-	-	1	2	1	1	1	3	-	-
CO4	3	3	1	1	1	-	-	1	2	1	1	1	3	-	-
CO5	3	3	1	1	2	-	-	1	2	1	1	1	3	-	-
22NPC306	**3**	**3**	**1**	**1**	**2**	-	-	**1**	**2**	**1**	**1**	**1**	**3**	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping	
CO1	1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,2.4.4,3.4.2,4.1.2,4.1.3, 4.1.4,5.1.1,5.1.2,5.2.1,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO2	1.1.1,1.2.1,1.3.1,1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.2.3, 3.4.2, 4.1.2, 4.1.3, 4.1.4, 5.1.1,5.1.2,5.2.1,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3, 11.3.1,12.1.2,12.3.1
CO3	2.1.1,2.1.3,2.2.2,2.3.2,2.4.1,2.4.2,2.4.3,2.4.4,4.1.2,4.1.3,4.1.4,5.1.1,5.1.2,5.2.1,8.1.1,9.1.1,9.2.2, 9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3, 2.4.4,3.4.2,4.1.2,4.1.3,4.1.4,5.1.1,5.2.1,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2, 12.3.1
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1, 2.3.2, 2.4.1,2.4.2,2.4.3, 2.4.4,3.2.2,3.4.1,3.4.2,4.1.1,4.1.2,4.1.3,5.1.1,5.1.2,5.2.1,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3, 11.3.1,12.1.2,12.3.1

B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

22NBS408	FOURIER SERIES AND TRANSFORM CALCULUS *(Common to EEE & EIE Branches)*	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	BS	3	1	0	4

COURSE OBJECTIVE	The main objective of this course is to provide students with the foundations of Fourier series and transforms methods and analysis techniques mostly used in various applications in engineering and technology.	
UNIT - I	**FOURIER SERIES**	**9 + 3 Periods**
Dirichlet's Conditions – General Fourier series –Odd and even functions- Half range Sine and Cosine series – Parseval's Identity on Fourier series–Harmonic Analysis.		
UNIT - II	**BOUNDARY VALUE PROBLEMS**	**9 + 3 Periods**
Classification of partial differential equations – Method of separation of variables–One dimensional wave equation–One dimensional heat equation –Transient and Steady state conditions–Fourier series solution.		
UNIT - III	**LAPLACE TRANSFORMS**	**9 + 3 Periods**
Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Inverse Laplace transform. Convolution theorem. Evaluation of integrals by Laplace transform, solving ordinary differential equations by Laplace Transform method		
UNIT - IV	**FOURIER TRANSFORMS**	**9 + 3 Periods**
Statement of Fourier integral Theorem–Fourier transform pair–Fourier Sine and Cosine Transforms–Properties –Transforms of Simple functions-Convolution Theorem–Parseval's Identity-Finite Fourier transforms.		
UNIT - V	**Z-TRANSFORMS**	**9 + 3 Periods**
Z-transforms - Elementary properties-Inverse Z-transforms - Initial and Final value theorems - Convolution theorem – Formation of difference equations-Solution to difference equations of second order with constant coefficients using Z- transform.		
Contact Periods: **Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods**		

TEXT BOOKS:

1	*Kandasamy, Thilagavathy and Gunavathy., "**Engineering Mathematics**" for III Semester, S.Chand & Co, Ramnagar, New Delhi, Revised edition 2017.*
2	*Veerarajan.T.,"**Transforms and partial Differential equations**",Tata Mc Graw Hill Publishing Co.,New Delhi, 2015*

REFERENCES:

1	*J.Ray Hanna And John H. Rowland, " **Fourier Series , Transforms and Boundary Value Problems**", Dover Publication Inc, Mineola, New York, Second Edition , 2008.*
2	*B.S.Grewal, **" Higher Engineering Mathematics"**, Khanna Publishers, New Delhi, 44th Edition,2018.*
3	*Ray Wylie C and Louis C Barrett, "**Advanced Engineering Mathematics**", McGraw Hill Education(India)Pvt Ltd., New Delhi, 6th Edition 2014.*
4	*N.P.Bali and Manish Goyal., "**Transforms and partial Differential equations**",University Science Press, New Delhi, 2010.*
5	*S. Larsson, V. Thomee, **"Partial Differential Equations with Numerical Methods"**, Springer,2003.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Express the periodic functions arising in the study of engineering problems as trigonometric series.	K5
CO2	Solve the partial differential equation arising in engineering problems as wave and heat flow in steady state (Cartesian coordinate) using Fourier series.	K5
CO3	Apply Laplace Transform technique to solve the given integral equation s and ordinary differential equations.	K5
CO4	Find Fourier transforms, finite and infinite Fourier sine and cosine transforms.	K5
CO5	Apply the Z transform methods to find solutions of difference equations in engineering problem.	K5

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	1	2	-	-
CO3	3	2	2	3	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	2	3	-	-	-	-	-	-	-	1	2	-	-
CO5	3	2	2	3	-	-	-	-	-	-	-	1	2	-	-
22NBS408	3	2	2	3	-	-	-	-	-	-	-	1	2	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 11.2.1, 11.3.1, 12.1.2, 12.3.2.
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 11.2.1, 11.3.1, 12.1.2, 12.3.2.
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 11.2.1, 11.3.1, 12.1.2, 12.3.2.
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 11.2.1, 11.3.1, 12.1.2, 12.3.2.
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 2.1.2, 2.1.3, 2.2.3, 2.3.1, 2.3.2, 2.4.1, 3.1.1, 3.1.6, 3.2.2, 3.2.3, 3.3.1, 3.4.2 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 11.2.1, 11.3.1, 12.1.2, 12.3.2.

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing (K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	45	35	-	-	-	100
CAT2	15	45	40	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	20	45	35	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	25	40	35	-	-	-	100
ESE	25	40	35	-	-	-	100

B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

22NES408	ELECTRICAL MACHINES	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	ES	3	0	0	3

COURSE OBJECTIVE	To impart the knowledge on principle of operation, performance, testing of different electrical machines and identify their suitability for real time applications.	
UNIT - I	**DC MACHINES**	**9 Periods**
DC generator: Constructional details and principle of operation – emf equation – Types of dc generators – Characteristics - losses and efficiency – applications. DC Motors: Constructional details and principle of operation – back emf – Types of dc motors – Torque equation – losses and efficiency – characteristics – Three point Starter – Speed control methods.		
UNIT - II	**TRANSFORMERS**	**9 Periods**
Principle of operation – Types and constructional features of single phase and three phase transformers – EMF equation - Phasor diagram – Transformers on load and No Load - Equivalent circuit – Voltage Regulation and efficiency – All day efficiency – Auto transformers.		
UNIT - III	**INDUCTION MACHINES**	**9 Periods**
Constructional features of three phase Induction motors – Principle of Operation – torque-slip characteristics – Load test – No load and blocked rotor tests – Equivalent circuit - starting, and speed control methods – solid state control (Qualitative).		
UNIT - IV	**SYNCHRONOUS MACHINES**	**9 Periods**
Alternator: Types and constructional features – emf equation – Phasor diagrams – Voltage Regulation. Motor: Construction - Principle of operation - V and inverted V curves – Starting methods – Current loci for constant power input, constant excitation and constant power developed – Applications.		
UNIT - V	**SPECIAL MOTORS AND INTRODUCTION TO DRIVES**	**9 Periods**
Single phase induction motor-Construction details-Double field revolving theory and operation. Switched Reluctance Motor – Stepper motors – PMDC motor – BLDC motor. Introduction to drives - Types of electrical drives – factors influencing the choice of electrical drives loading conditions and classes of duty- determination of power rating		
Contact Periods: 45 Periods **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Kothari D.P. and Nagrath I.J **"Electric Machines"** Tata McGraw Hill, Reprint, 2017*
2	*Theraja B.L. and Theraja A.K **"A Text Book of Electrical Technology- Vol. II**", S.Chand and Co. Ltd., New Delhi, Reprint, 2019*

REFERENCES:

1	*Fitzgerald A.E.,Kingsly C. and Kusko A. **"Electric Machinery"** Tata McGraw Hill, 2017*
2	*Stephen J Chapman **"Electric Machinery"** Tata McGraw Hill, Fourth Edition 2015*
3	*Sen.S.K, **"Electric Drives"** Prentice Hall, Reprint 2019*
4	*Vedam Subramaniam **" Electric Drives- Concepts and Applications**" Tata McGraw Hill ,2011*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Interpret the construction, working, characteristics and applications of AC and DC machines	K3
CO2	Familiarize the functioning of transformers and Analyze its performance	K4
CO3	Appraise the working of induction motors and suitable inductive and model it	K4
CO4	Discriminate the types of synchronous machines and specify their uses for practical utility	K4
CO5	Familiarize the operation of single phase induction motors, special machines and drives.	K2

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	-	-	2	1	1
CO2	3	3	1	1	1	-	-	-	-	-	-	-	2	1	1
CO3	3	3	1	1	1	-	-	-	-	-	-	-	2	1	1
CO4	3	3	1	1	1	-	-	-	-	-	-	-	2	1	1
CO5	3	3	1	1	1	-	-	-	-	-	-	-	2	1	1
22NES408	3	3	1	1	1	-	-	-	-	-	-	-	2	1	1

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,2.4.4, 3.1.1,3.2.1,3.2.2,3.2.3,4.1.1,5.1.2
CO2	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3, 2.4.4,3.1.1,3.2.1,3.2.2,3.2.3,4.1.1,5.1.2
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.2,2.4.3, 2.4.4,3.1.1,3.2.1,3.2.2,3.2.3,4.1.1,5.1.2
CO4	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,2.4.4, 3.1.1,3.2.1,3.2.2,3.2.3,4.1.1,5.1.2
CO5	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.2,2.4.3,2.4.4, 3.1.1,3.2.1,3.2.2,3.2.3,4.1.1,5.1.2

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	30	30	-	-	100
CAT2	10	30	30	30	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	30	30	40	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	30	30	40	-	-	100
ESE	10	30	30	30	-	-	100

22NPC407	ELECTRONICS FOR ANALOG SIGNAL PROCESSING	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

COURSE OBJECTIVE	To impart knowledge on the working and applications of operational amplifiers, ADCs and DACs	
UNIT - I	**IC FABRICATION AND CHARACTERISTICS**	**9 Periods**
IC Classification - Fundamentals of Monolithic IC Technology – Basic Planar Processes - Fabrication of Typical Circuit - Fabrication of Diode, Resistance, Capacitance, JFET and MOSFET- Ideal Op-Amp – Internal Circuit of Op-Amp – Improving CMRR - DC and AC characteristics.		
UNIT - II	**APPLICATIONS OF OP-AMP**	**9 Periods**
Applications of Op-Amp: Inverting and Non Inverting Amplifiers, Voltage Follower, Adder, Subtractor, Integrator, Differentiator, Instrumentation Amplifier, Voltage to Current and Current to Voltage converters, Sample and Hold Circuits, Log and Antilog Amplifier.		
UNIT - III	**COMPARATORS AND WAVEFORM GENERATORS**	**9 Periods**
Op-amps Circuits: Comparator, Regenerative Comparator, Rectifier, Peak Detector, Clippers, Clampers – First Order and Second Order Low Pass and High Pass Active Filters - Monostable Multivibrators – Square Wave Generator - Triangular Wave Generator, Oscillators: RC Phase Shift, Wein Bridge		
UNIT - IV	**SPECIAL ICs AND APPLICATION ICs**	**9 Periods**
555 Timer: Functional Diagram, Operation and Applications in Monostable and Astable Mode, Schmitt Trigger - Phase Locked Loop: Principle, Phase Detection/Comparison, Applications - Voltage Controlled Oscillator – Voltage Regulators: Fixed Voltage Series Regulator, General Purpose Regulator, Switching Regulator.		
UNIT - V	**D/A AND A/D CONVERTERS**	**9 Periods**
DAC: Weighted Resistor, R-2R Ladder, Inverted R-2R types - ADC: Flash, Counter, Servo Tracking, Successive Approximation, Dual Slope types - DAC and ADC Specifications.		
Contact Periods: **45 Periods** **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Ramkant A Gayakwad, "**Op-Amps and Linear Integrated Circuits**", Prentice Hall of India, Fourth Edition, 2009.*
2	*Roy D Choudhary and Shail B Jain, "**Linear Integrated Circuits**", New Age International Publishers, Fifth Edition, 2018.*

REFERENCES:

1	*William D Stanely, "**Operational Amplifiers with Linear Integrated Circuits**", Pearson Education, Fourth Edition, 2009.*
2	*Robert F.Coughlin, and Fredrick F. Driscoll, '**Op-amp and Linear ICs**', Pearson Education, Sixth Edition, 2012.*
3	*David A. Bell, '**Operational Amplifiers and Linear ICs**, Oxford Higher Education, 2013.*
4	*Sergio Franco, '**Design with Operational Amplifiers and Analog Integrated Circuits**', Mc Graw Hill, 2016.*
5	*Robert F Coughlin, Frederick F Driscoll, "**Operational amplifiers and Integrated Circuits**" Prentice Hall of India, 2009.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Discuss about IC fabrication procedure and characteristics of operational amplifier	K3
CO2	Compute the gain and output voltage of the given Op-Amp circuits	K3
CO3	Design Comparators and waveform generators using Op-Amps	K3
CO4	Explain the operation of voltage regulators and timers	K3
CO5	Design ADCs and DACs using Op-Amps.	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	-	-	3	1	-
CO2	3	3	1	1	1	-	-	-	-	-	-	-	3	1	-
CO3	3	3	1	1	1	-	-	-	-	-	-	-	3	1	-
CO4	2	2	1	1	1	-	-	-	-	-	-	-	3	1	-
CO5	2	2	1	1	1	-	-	-	-	-	-	-	3	1	-
22NPC407	**3**	**3**	**1**	**1**	**1**	-	-	-	-	-	-	-	**3**	**1**	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.4,3.1.6,4.1.2,5.1.1
CO2	1.1.2,1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,2.4.4,3.1.6,4.1.2,5.1.1
CO3	1.1.1,1.1.2,1.2.1,1.3.1,1.4.1,2.1.1,2.1.2,2.1.3,2.2.2,2.2.3,2.2.4,2.3.1,2.3.2,2.4.1,3.1.6,4.1.2,5.1.1
CO4	1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.2,2.2.3,2.4.1,3.1.6,4.1.2,5.1.1
CO5	1.2.1,1.3.1,1.4.1,2.1.2,2.1.3,2.2.2,2.2.3,2.4.1,3.1.6,4.1.2,5.1.1

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	60	10	-	-	-	100
CAT2	30	60	10	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	30	50	20	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	30	50	20	-	-	-	100
ESE	30	55	15	-	-	-	100

22NPC408	DIGITAL ELECTRONICS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

COURSE OBJECTIVE	To introduce the fundamental concepts and design of digital system	
UNIT - I	**BOOLEAN ALGEBRA AND LOGIC FAMILIES**	**9 Periods**
Review of Number Systems: Binary, Octal, Decimal, Hexadecimal – Conversions - Hamming Code - Boolean Algebra: Axioms, Laws and Theorems - Logic Gates - Minimization of Logic Function using K-Map and Quine-McCluskey Method - Implementation of Functions using Basic Gates and Universal Gates - Logic Families: TTL, ECL, and CMOS.		
UNIT - II	**COMBINATIONAL CIRCUITS**	**9 Periods**
Design of Combinational Circuits: Half and Full Adder, Half and Full Subtractor, Binary Parallel Adder, Carry Look Ahead Adder, BCD Adders, Comparator, Encoder, Decoder, Multiplexer, Demultiplexer, Code Converters - Function Realization Using Multiplexers.		
UNIT - III	**SYNCHRONOUS SEQUENTIAL CIRCUITS**	**9 Periods**
Flip Flops: SR, JK, D, T and their Conversions – Master/Slave Flip Flops - Shift Registers: SISO, SIPO, PIPO, PISO, Universal Shift Registers - Counters: Up, Down, Up/Down, Mod, Ring, Johnson - Design of Synchronous Sequential Circuits: Moore/Mealy Models of Serial Adder, Sequence Detector, Parity Generator, Counter.		
UNIT - IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS, ALGORITHMIC STATE MACHINE AND MEMORY DEVICES**	**9 Periods**
Counter: Up, Down, Up/Down - Design and Analysis of Fundamental Mode Circuits -Algorithmic State Machine: ASM Chart, Design Examples - Memory Devices: ROM, RAM, PROM, EPROM - Programmable Logic Devices- ROM, PAL, PLA, PROM.		
UNIT - V	**INTRODUCTION TO VHDL**	**9 Periods**
Introduction to VHDL - Basic Elements of VHDL: Entity, Architecture, Configuration - Types of Modelling: Data Flow Modeling, Behavioral Modeling, Structural Modelling - Object Types - Data Types – Operator -. Simple VHDL Codes for Adders, Multiplexers, Demultiplexers, Flip-Flops, Counters.		
Contact Periods: **45 Periods** **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Morris Mano M, Michael D Ciletti, "**Digital Design with an Introduction to Verilog HDL**", Pearson Education International, Sixth Edition, 2018.*
2	*Anand Kumar, "**Fundamentals of Digital Circuits**", Prentice Hall of India, Fourth Edition 2016.*

REFERENCES:

1	*Donald P Leach, Albert Paul Malvino, "**Digital Principles and Applications**", Tata McGraw Hill Education Private Limited, New Delhi, Eighth Edition, 2014.*
2	*Ronald J Tocci, Neal S Widmer, Gregory L Moss, "**Digital Systems: Principles and Applications**", Pearson Education International, Twelfth Edition, 2017.*
3	*David J. Comer "**Digital Logic and State Machine Design"**, Oxford, Third Edition, 2016.*
4	*James Palmer, David Perlman, "**Schaum's Outline of Introduction to Digital Systems**", McGraw Hill, First Edition Reprint 2011.*
5	*Bhasker J, "**VHDL Primer**", Prentice-Hall of India Pvt.Ltd, Third Edition, 2009.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Simplify the Boolean expressions using Boolean algebra, K map, Quine Mccluskey method and implement it using gates	K3
CO2	Design synchronous and asynchronous circuits using flip flops	K3
CO3	Implement logic functions using programmable logic devices	K3
CO4	Describe the operation of various logic families	K2
CO5	Write VHDL codes for combinational and sequential circuits	K2

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	1	1	-	-	-	-	-	-	-	-	3	-	-
CO3	2	3	1	1	-	-	-	-	-	-	-	-	3	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-	3	-	-
22NPC408	2	3	1	1	-	-	-	-	-	-	-	-	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.1.1, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.2.3, 3.4.1, 4.3.3
CO2	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.2.3, 3.4.1, 4.3.3
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.2.3, 3.4.1, 4.3.3
CO4	1.2.1, 2.1.2, 2.1.3, 2.2.2, 2.2.4, 2.3.1, 2.3.2
CO5	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.4.2, 3.2.3, 4.1.2, 4.1.3

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	50	50	-	-	-	100
CAT2	-	50	50	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	-	50	50	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	50	50	-	-	-	100
ESE	-	50	50	-	-	-	100

22NPC409	INDUSTRIAL INSTRUMENTATION	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	3	0	0	3

COURSE OBJECTIVE	To impart the concepts and terminologies involved in the measurement of industrial parameters	
UNIT - I	**TEMPERATURE MEASUREMENT**	**9 Periods**
Definitions and Standards – Mechanical Type: Filled in System Thermometer, Sources of Errors in Filled in System, Compensation - Bimetallic Thermometers – Electrical Type: RTD, Characteristics, Signal Conditioning, 3 wire and 4 wire RTDs - Thermocouples: Laws of Thermocouple, Different Types, Reference Junction Compensation – Radiation Type: Total Radiation Pyrometers, Optical Pyrometers – Fiber Optic Sensor for Temperature Measurement – Temperature IC Sensors.		
UNIT - II	**PRESSURE MEASUREMENT**	**9 Periods**
Units of Pressure – Manometers: Different Types of Manometers - Elastic Type Pressure Gauges: Diaphragms, Capsules, Bellows and Bourdon tube - Electrical Type Pressure Gauges: LVDT, Strain Gauges, Capacitive and Piezo-resistive Pressure Sensor - Resonator Pressure Sensor - Measurement of Vacuum: McLeod Gauge, Thermal Conductivity Gauge, Ionization Gauges, Cold Cathode Type, Hot Cathode Type, Pirani Gauge – Calibration of Pressure Gauges – Dead Weight Tester.		
UNIT - III	**MEASUREMENT OF FLOW**	**9 Periods**
Variable Head Type Flow Meters: Expression for Flow Rate through Restriction - Orifice Plate - Different Types of Orifice Plates - Venturi Tube - Flow Nozzle - Pitot Tube - Installation and Applications of Head Flow Meters - Variable Area Flow Meter: Rotameter - Electrical Type Flow Meters: Construction, Principle of Operation, Applications of Electromagnetic Flow Meter, Ultrasonic Flow Meter, Laser Doppler Anemometer and Vortex Shedding Flow Meter - Positive Displacement Flow Meters: Nutating Disc, Reciprocating Piston and Oval Gear Flow Meters -Turbine Flow Meter - Calibration of Flow Meters.		
UNIT - IV	**LEVEL MEASUREMENT**	**9 Periods**
Different Types of Level Measurement: Float, Displacer, Hydrostatic, Thermal Effect Type - Electrical Methods: Resistive and Capacitive Type - Rotating Paddle Switches - Conductivity Sensors - Nucleonic Gauge - Ultrasonic Sensor - Nuclear Radiation Sensor - Solid Level Measurement - Transmitters: Principle of operation of Temperature, Pressure, Flow and Level Transmitters - Smart Transmitters.		
UNIT - V	**MEASUREMENT OF VISCOSITY, HUMIDITY, MOISTURE AND DENSITY**	**9 Periods**
Viscosity: Saybolt, Rotameter and Torque Type Viscometers – Humidity: Dry and Wet Bulb Psychrometers – Resistive and Capacitive Type Hygrometers - Moisture: Conductivity, Capacitive, Microwave and IR Sensor Type – Density: Float, Gas Bridge, Pressure Head Type – pH Measurement – Safety Practices: Hazardous Areas and Classification – Intrinsic Safety - NEMA for Enclosures.		
Contact Periods: **45 Periods** **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS:

1	*Patranabis D, **"Principles of Industrial Instrumentation"** Third Edition, McGraw Hill Education Pvt. Ltd., 2016.*
2	*William C. Dunn, **"Fundamentals of Industrial Instrumentation and Process Control"**, Second Edition, McGraw Hill Education Pvt. Ltd., 2018.*

REFERENCES:

1	*Ernest O. Doebellin.E.O. and Manik D.N **"Measurement systems Application and Design",** Seventh Edition, McGraw Hill Education Pvt. Ltd., 2019.*
2	*B. G. Liptak, **"Instrumentation Engineers Handbook (Measurement)",** Fourth Edition**,** CRC Press, 2012.*
3	*K. Krishnaswamy, **"Industrial Instrumentation"**, New Age International Publishers, New Delhi, 2013.*
4	*S. K. Singh,**"Industrial Instrumentation and Control",** Third Edition, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 2009.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Select a suitable sensor for the measurement of different range of temperature.	K2
CO2	Describe the construction and working of different types of pressure measuring devices.	K2
CO3	Interpret the concept of variable head, variable area and electrical type flow meters.	K2
CO4	Classify level sensors for liquid and solid type level measurement.	K2
CO5	Identify the instruments for the measurement of viscosity, humidity, moisture, density and familiarize with the safety methods followed in industries.	K2

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	-	-	-	-	-	-	-	-	-	3	2
CO2	2	2	1	3	-	-	-	-	-	-	-	-	-	3	2
CO3	2	2	1	3	-	-	-	-	-	-	-	-	-	3	2
CO4	2	2	1	3	-	-	-	-	-	-	-	-	-	3	2
CO5	2	2	1	3	-	2	2	-	-	-	-	-	-	3	2
22NPC409	**2**	**2**	**1**	**3**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.2, 2.4.3, 3.1.4, 3.4.1, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3
CO2	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.2, 2.4.3, 3.1.4, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3
CO3	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.2, 2.4.3, 3.1.4, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3
CO4	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.2, 2.4.3, 3.1.4, 3.4.2, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3
CO5	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.3.2, 2.4.3, 3.1.4, 3.1.5, 3.4.2, 4.1.1, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 6.1.1, 7.1.2, 7.2.2

ASSESSMENT PATTERN - THEORY							
Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70	-	-	-	-	100
CAT2	30	70	-	-	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	50	50	-	-	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	-	60	40	-	-	-	100
ESE	40	60	-	-	-	-	100

22NPC410	FUNDAMENTALS OF SIGNALS AND SYSTEMS	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
• LINEAR ALGEBRA AND CALCULUS • FOURIER SERIES AND TRANSFORM CALCULUS	PC	3	0	0	3

COURSE OBJECTIVE	To familiarize signals and systems in terms of both time and transform domains, taking the advantage of the complementary sights and tools that these different perspectives provide.	
UNIT - I	**INTRODUCTION TO CONTINUOUS TIME SIGNALS(CT) AND SYSTEMS**	**9 Periods**
Introduction to signals and systems and their classifications. Definition of CT signal, Representation of elementary signals: Impulse, Pulse, Step, Ramp, Exponential Sinusoidal. Classification Of Signals:–periodic and aperiodic, power and energy, deterministic and random signals .Definition of CT system, Classification and characterization with examples:–Static, dynamic, causal, non causal, linear, nonlinear, time variant, time invariant, stable and unstable, FIR, IIR, reversible and irreversible, recursive non-recursive system.		
UNIT - II	**ANALYSIS OF CT SIGNALS**	**9 Periods**
Time domain analysis:-solutions of differential equations. Fourier series and Fourier transform of signals, spectrum of CT signals, and Gibb's phenomenon. Analysis of random signals.		
UNIT - III	**DISCRETIZATION SIGNAL RECONSTRUCTION**	**9 Periods**
Discretization of signals: sample and hold circuit. Sampling:-Sampling theorem, selection of sampling rate, Types of sampling, Aliasing:-Aliasing effects, Anti-aliasing filter,Quantization:-Quantization errors due to truncation and rounding in fixed and floating point representations, Signal reconstruction:-Interpolation using zero-order and first-order hold.		
UNIT - IV	**CLASSIFICATION AND ANALYSIS OF DISCRETE TIME (DT) SIGNALS**	**9 Periods**
DT signals:–Introduction, Definition, Elementary DT signals, Characterization. DT systems: Definition, Classification, Characterization. Time Domain Analysis:-Solutions of Difference Equations		
UNIT - V	**TRANSFORM TECHNIQUES FOR DT SIGNALS AND SYSTEMS**	**9 Periods**
Z-Transform–Definition, Properties, ROC and its properties, Inverse Z Transform. Analysis of LT systems using Z Transforms:–Stability, Causality, Recursive, Non-recursive systems.		
Contact Periods: **45 Periods** **Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods**		

TEXT BOOKS :

1	*P. Ramesh Babu & R. Anandanatarajan, **"Signals and System"**, Scitech Publications (India) Pvt Limited, 2007.*
2	*Tarun Kumar Rawat, **"Signals and System",** Oxford University Press,2010.*
3	*Proakis,J.G.,& Manolakis,D.G.,**"Digital Signal Processing:Principles and Algorithms, & Applications"**,3rd Edition, Prentice Hall of India,2007.*

REFERENCES:

1	*Allan V. Oppenheim, S. Wilsky and S.H.Nawab, **"Signals and Systems",** Pearson Education, Indian Reprint, 2007.*
2	*H P Hsu, **"Signals and Systems (Schaum's Outlines)"** Tata McGraw Hill,2006.*
3	*John Alan Stuller, **"An Introduction to signals and Systems",** Thomson, 2007.*
4	*Edward W Kamen, Bonnie S Heck, **"Fundamentals of Signals and Systems using the Web and MATLAB"** Pearson, Indian Reprint,2007.*

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Understanding the continuous time signal, systems and their classifications	K4
CO2	Analyze continuous time systems in complex time domain	K4
CO3	Understand the process of sampling and the effects of under sampling and Signal reconstructio	K4
CO4	Analyze discrete time signals, systems and time domain .	K4
CO5	Apply Z- transform for analysis of continuous-time and discrete-time signals and systems	K4

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	1	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	3	1	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	3	1	-	-	-	-	-	-	-	3	-	-
CO4	3	3	2	3	1	-	-	-	-	-	-	-	3	-	-
CO5	3	3	2	3	1	-	-	-	-	-	-	-	3	-	-
22NPC410	3	3	2	3	1	-	-	-	-	-	-	-	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

CO1	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.1.4, 2.1.2, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2,1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2.
CO2	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.1.4, 2.1.2, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2,1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2.
CO3	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.1.4, 2.1.2, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2,1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2.
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.1.4, 2.1.2, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2,1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2.
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.1.4, 2.1.2, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1,2.4.2, 2.4.3, 2.4.4, 3.1.1, 3.1.2, 3.2,1, 3.2.2, 3.2.3, 3.3.1, 4.1.1, 4.1.2, 4.1.4, 4.2.2, 4.3.2, 4.3.3, 4.3.4, 5.1.1, 5.1.2.

ASSESSMENT PATTERN - THEORY

Test/Bloom's Category	Remembering (K1)%	Understanding (K2) %	Applying (K3)%	Analyzing(K4)%	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	15	50	20	-	-	100
CAT2	15	15	50	20	-	-	100
Individual Assessment 1 /Case Study 1/ Seminar 1 / Project1	15	15	50	20	-	-	100
Individual Assessment 2 /Case Study 2/ Seminar 2 / Project 2	15	15	50	20	-	-	100
ESE	15	15	50	20	-	-	100

22NPC411	ANALOG AND DIGITAL CIRCUITS LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
• ELECTRONICS FOR ANALOG SIGNAL PROCESSING • DIGITAL ELECTRONICS	PC	0	0	3	1.5

COURSE OBJECTIVE	To provide hands on experience on working with analog and digital circuit design

LIST OF EXPERIMENTS

1. Realization of Boolean expressions using basic and universal gates
2. Design and implementation of combinational circuits
3. Design and implementation of flip flops using logic gates
4. Design and Implementation of registers
5. Design and Implementation of counters
6. Design and Implementation of synchronous sequential circuit
7. Design and Implementation of mathematical operations using operational amplifier
8. Design of Instrumentation amplifier
9. Implementation of voltage and current regulators
10. Realization of a stable multivibrator using 555 Timer
11. Design and implementation of active filters
12. Design and Implementation of ADC and DAC
13. Design and Implementation of Oscillators using Opamp
14. Simulation of circuits using software tools

Contact Periods: **45 Periods**

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES Upon Completion of the course, the students will be able to		**Bloom's Taxonomy Mapped**
CO1	Use basic gates to build combinational circuits	K4
CO2	Design different types of counter circuits using flip flops	K4
CO3	Design Op-amp based application circuits	K4
CO4	Choose regulator ICs as per requirement	K2
CO5	Implement multivibrator circuits using 555 timers	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	1	2	1	1	1	3	-	-
CO2	3	3	3	3	3	-	-	1	2	1	1	1	3	-	-
CO3	1	1	1	1	1	-	-	1	2	1	1	1	3	-	-
CO4	1	1	1	1	1	-	-	1	2	1	1	1	3	-	-
CO5	2	2	2	2	2	-	-	1	2	1	1	1	3	-	-
22NPC411	2	2	2	2	2	-	-	1	2	1	1	1	3	-	-

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping	
CO1	1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.2, 2.4.3, 2.4.4, 3.4.2, 4.1.2, 4.1.3, 4.1.4, 5.1.1, 5.1.2, 5.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO2	1.1.1, 1.2.1,1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3,2.4.4,3.2.3,3.4.2,4.1.2,4.1.3,4.1.4,5.1.1,5.1.2,5.2.1,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO3	2.1.1, 2.1.3, 2.2.2, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 4.1.2, 4.1.3, 4.1.4, 5.1.1, 5.1.2, 5.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO4	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.4.2, 4.1.2, 4.1.3, 4.1.4, 5.1.1, 5.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1
CO5	1.1.1, 1.1.2, 1.2.1, 1.3.1, 1.4.1, 2.1.1, 2.1.2, 2.1.3, 2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.3.1, 2.3.2, 2.4.1, 2.4.2, 2.4.3, 2.4.4, 3.2.2, 3.4.1, 3.4.2,4.1.1, 4.1.2, 4.1.3, 5.1.1, 5.1.2, 5.2.1, 8.1.1, 9.1.1, 9.2.2, 9.2.3, 9.3.1, 10.1.2, 10.1.3, 11.3.1, 12.1.2, 12.3.1

22NPC412	VIRTUAL INSTRUMENTATION LABORATORY	SEMESTER IV

PREREQUISITES	CATEGORY	L	T	P	C
NIL	PC	0	0	3	1.5

COURSE OBJECTIVE	To provide a foundation in use of virtual instrument software for real time applications.

LIST OF EXPERIMENTS

1. Creating, Editing, Developing of VI
2. Arithmetic, Logic operations using VI
3. Conversion of VI into Sub VI
4. FOR loop, While loop using VI
5. Programming Structure, Arrays, Clusters
6. Design of Controller using Control and Simulation Tools
7. Measurement of Electrical Quantities using Electric Power Tools.
8. Data Acquisition from Sensors using DAQ
9. Frequency analysis of 1st and 2nd order System using ELVIS kit
10. Modulation Techniques using DSP Embedded kit
11. Analysis of electrical circuits using multisim.
12. Measurement of Strain and Temperature using CompactRIO
13. Signal Conditioning circuits using RIO.
14. Data updation using Web Publishing Tools.

Contact Periods: **45 Periods**
Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES Upon Completion of the course, the students will be able to		Bloom's Taxonomy Mapped
CO1	Exercise the simple applications using controls and function pallets.	K1
CO2	Understand the concepts Arrays, loops, stack structures bundle functions	K2
CO3	Design signal conditioning circuits and driver circuits for different sensors.	K4
CO4	Analyze the signals acquired by the DAQ, ELVIS and Embedded kit	K4
CO5	Measure the industrial parameters using advanced hardwares in VI	K3

COURSE ARTICULATION MATRIX

a) CO/PO Mapping

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	-	-	1	2	1	1	1	2	1	1
CO2	2	2	1	1	2	-	-	1	2	1	1	1	3	3	1
CO3	2	2	1	2	2	-	-	1	2	1	1	1	3	3	1
CO4	2	2	1	2	2	-	-	1	2	1	1	1	3	2	2
CO5	2	2	1	1	2	-	-	1	2	1	1	1	2	2	2
22NPC412	2	2	1	2	2	-	-	1	2	1	1	1	3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial

b) CO and Key Performance Indicators mapping

B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

CO1	1.1.1,1.1.2,1.4.1,2.1.1.2.1.2,2.3.2,2.4.1,2.4.2,3.1.1,3.2.1,4.3.1,5.1.1,5.1.2,5.2.1,5.2.2,8.1.1,9.1.1, 9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO2	1.1.1,1.1.2,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.2.2,2,2.4,2.3.2,2.4.1,2.4.2,3.1.1,3.1.4,3.2.1,4.3.14.3.3, 5.1.1,5.1.2,5.2.1 5.2.2,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO3	1.1.1,1.1.2,1.4.1,2.1.1,2.1.2,2.1.3,2.4.1,2.4.2,2.4.3,3.1.1,3.1.4,3.2.1,4.2.1,4.3.1,4.3.3,5.1.1,5.1.2, 5.2.1,5.2.2,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO4	1.1.1,1.1.2,2.1.1,2.1.2,2.1.3,2.2.4,2.3.2,2.4.1,2.4.2,3.1.1,3.1.4,3.2.1,4.2.1,4.3.1,4.3.3,5.1.1,5.1.2, 5.2.1,5.2.2,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1
CO5	1.1.1,1.1.2,1.4.1,2.1.1,2.1.2,2.1.3,2.2.1,2.3.2,2.4.1,2.4.2,3.1.1,3.1.4,3.2.1,4.3.1,4.3.3,5.1.1,5.1.2, 5.2.1,5.2.2,8.1.1,9.1.1,9.2.2,9.2.3,9.3.1,10.1.2,10.1.3,11.3.1,12.1.2,12.3.1