SYLLABI BOOK

BACHELOR OF TECHNOLOGY
INSTRUMENTATION AND CONTROL ENGINEERING

Department of Instrumentation and Control Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.

http://www.ddu.ac.in

With effect from
AY. 2021-2022

TEACHING SCHEME FOR THE COURSE
B. TECH. INSTRUMENTATION AND CONTROL
(Admission Year 2021)

B.Tech. Semester-1 (2021-2022)

Subject		AICTE Code Ref.	Teaching Scheme			Total	Credit	Exam Scheme (Marks)				
			Lect	Tut	Prac			Th.	Int.	TW	Prac.	Total
1	Mathematics -I	BSC103	3	1	0	4	4	60	40	0	-	100
2	Thermodynamics	ESC 209	3	0	2	5	4	60	40	50	-	150
3	Mechanics	BSC101	3	1	0	4	4	60	40	0	-	100
4	Elements of Electrical Engineering	ESC101	3	0	2	5	4	60	40	50	-	150
5	Computer Programming	ESC-103	2	0	3	5	3.5	40	0	50	-	90
6	Workshop Practice -I	ESC104	0	0	2	2	1	0	0	50	-	50
7	Environment Studies	MC-II	2	0	0	2	0	40	0	0	-	40
			16	**2**	**9**	**27**	**20.5**	**320**	**160**	**200**	**0**	**680**

B.Tech. Semester-2 (2021-2022)

Subject		AICTE Code Ref.	Teaching Scheme			Total	Credit	Exam Scheme (Marks)				
			Lect	Tut	Prac			Th.	Int.	TW	Prac.	Total
1	Mathematics -II	BSC104	3	1	0	4	4	60	40	0	-	100
2	Engineering Graphics	ESC102	3	0	3	6	4.5	60	40	50	-	150
3	Chemistry	BSC102	3	0	0	3	3	60	0	0	-	60
4	Basic Electronics	ESC201	3	0	2	5	4	60	40	50	-	150
5	Mechanics of Solids	ESC105b	3	0	2	5	4	60	40	50	-	150
6	Workshop Practice -II	ESC	0	0	3	3	1.5	0	0	50	-	50
			15	**1**	**10**	**26**	**21**	**300**	**160**	**200**	**0**	**660**

B.Tech. Semester-3 (2022-2023)

Subject		AICTE Code Ref.	Teaching Scheme			Total	Credit	Exam Scheme (Marks)				
			Lect	Tut	Prac			Th.	Int.	TW	Prac.	Total
1	Mathematics -III	BSC201	3	1	0	4	4	60	40	0	0	100
2	Electronic Measurement	PCC(EC22)	2	1	2	5	4	60	40	25	25	150
3	Network Analysis	ESC(EC06)	3	1	2	6	5	60	40	25	25	150
4	Digital Electronics	PCC(EC03)	3	0	2	5	4	60	40	25	25	150
5	English	HSMC101	2	0	2	4	3	40	0	0	50	90
6	Universal Human Values-II	HSMC301	3	0	0	3	3	60	0	0	0	60
			16	**3**	**8**	**27**	**23**	**340**	**160**	**75**	**125**	**700**

B.Tech. Semester-4 (2022-2023)

Subject		AICTE Code Ref.	Teaching Scheme			Total	Credit	Exam Scheme (Marks)				
			Lect	Tut	Prac			Th.	Int.	TW	Prac.	Total
1	Control Theory	PCC(EC19)	2	0	2	4	3	60	0	25	25	110
2	Analog Electronics	PCC(EC09)	3	1	2	6	5	60	40	25	25	150
3	Power Electronics	PCC(ECEL14)	3	0	2	5	4	60	40	25	25	150
4	Electrical Machines and Power	PCC(ESCXX)	3	0	2	5	4	60	40	25	25	150
5	Control System Components	PCC(EC19)	2	0	2	4	3	60	0	25	25	110
6	Technical Communication Skills	HSMC201	2	0	2	4	3	40	0	0	50	90
			15	**1**	**12**	**28**	**22**	**340**	**120**	**125**	**175**	**760**

B.Tech. Semester-5 (2023-2024)

Subject		AICTE Code Ref.	Teaching Scheme			Total	Credit	Exam Scheme (Marks)				
			Lect	Tut	Prac			Th.	Int.	TW	Prac.	Total
1	Microcontroller Fundamentals	PCC	3	0	2	5	4	60	40	25	25	150
2	Instrumentation Software Tools **(Program Elective I)**	PEC	3	0	2	5	4	60	40	25	25	150
	Modeling, Simulation and Evolutionary Techniques **(Program Elective I)**	PEC	3	0	2	5	4	60	40	25	25	150
3	Sensors and Transducers	PCC	3	0	2	5	4	60	40	25	25	150
4	Process Measurement	PCC	3	0	2	5	4	60	40	25	25	150
5	Communication Systems **(Program Elective II)**	PEC	2	1	0	3	3	60	0	0	0	60
	Cyber Physical Systems **(Program Elective II)**	PEC	2	1	0	3	3	60	0	0	0	60
6	Entrepreneurship and Innovation	OEC	2	0	1	3	2.5	60	0	25	25	110
			17	**1**	**8**	**26**	**21.5**	**360**	**160**	**125**	**125**	**770**

B.Tech. Semester-6 (2023-2024)

Subject		AICTE Code Ref.	Teaching Scheme			Total	Credit	Exam Scheme (Marks)				
			Lect	Tut	Prac			Th.	Int.	TW	Prac.	Total
1	Microcontroller Applications **(Program Elective III)**	PEC	3	0	2	5	4	60	40	25	25	150
	Embedded Systems **(Program Elective III)**	PEC	3	0	2	5	4	60	40	25	25	150
2	Instrumentation Systems	PCC	3	0	2	5	4	60	40	25	25	150
3	Power Plant Automation **(Program Elective IV)**	PEC	2	1	0	3	3	60	0	0	0	60
	Analytical Instrumentation **(Program Elective IV)**	PEC	2	1	0	3	3	60	0	0	0	60
4	Process Instrumentation and Control	PCC	3	0	2	5	4	60	40	25	25	150
5	Automation Systems Integration	PCC	3	0	2	5	4	60	40	25	25	150
6	Economics and Management	HSMC	2	0	0	2	2	40	0	0	0	40
7	Introduction to R Programming	OEC	2	0	2	4	3	60	0	25	25	110
			18	**1**	**10**	**29**	**24**	**400**	**160**	**125**	**125**	**810**

B.Tech. Semester-7 (2024-2025)

Subject		AICTE Code Ref.	Teaching Scheme			Total	Credit	Exam Scheme (Marks)				
			Lect	Tut	Prac			Th.	Int.	TW	Prac.	Total
1	Biomedical Instrumentation	PCC	3	0	2	5	4	60	40	25	25	150
2	Digital Signal Processing **(Program Elective V)**	PEC	3	0	2	5	4	60	40	25	25	150
	Industrial Electronics & Drives **(Program Elective V)**	PEC	3	0	2	5	4	60	40	25	25	150
3	Advanced Control Theory & Design	PCC	3	0	0	3	3	60	0	0	0	60
4	Process Control	PCC	3	0	2	5	4	60	40	25	25	150
5	Robotics Engineering **(Program Elective VI)**	PEC	3	0	2	5	4	60	40	25	25	150
	Fundamentals of Machine Learning **(Program Elective VI)**	PEC	3	0	2	5	4	60	40	25	25	150
6	Industrial Exposure & Practice	PROJ	0	1	2	3	2	0	0	25	25	50
7	Smart Instrumentation	OEC	3	0	0	3	3	60	0	0	0	60
			18	**1**	**10**	**29**	**24**	**360**	**160**	**125**	**125**	**770**

B.Tech. Semester-8 (2024-2025)

Subject		AICTE Code Ref.	Teaching Scheme			Total	Credit	Exam Scheme (Marks)				
			Lect	Tut	Prac			Th.	Int.	TW	Prac.	Total
1	Industrial Internship-Project	PROJ	0	0	24	24	12	0	0	0	350	350
2	Seminar	PROJ	0	0	12	12	6	0	0	150	0	150
			0	**6**	**36**	**36**	**18**	**0**	**0**	**150**	**350**	**500**

Total B.Tech IC Program Credit= 174

PROGRAM ELECTIVE OPTIONS

Program Elective – 1

1. Instrumentation Software Tools
2. Modeling, Simulation and Evolutionary Techniques

Program Elective – 2

1. Communication Systems
2. Cyber Physical Systems

Program Elective – 3

1. Microcontroller Applications
2. Embedded Systems

Program Elective – 4

1. Power Plant Automation
2. Analytical Instrumentation

Program Elective – 5

1. Digital Signal Processing
2. Industrial Electronics & Drives

Program Elective – 6

1. Robotics Engineering
2. Fundamentals of Machine Learning

OPEN ELECTIVE OPTIONS

Open Elective – 1

1. Entrepreneurship and Innovation

Open Elective – 2

1. Introduction to R Programming

Open Elective – 3

1. Smart Instrumentation

B. TECH. SEMESTER – I (CH/CL/IC/MH)

SUBJECT: (BS102) MATHEMATICS - I

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	1	0	4	4	60	40	-	-	100

Reference Code BSC102

DETAILED SYLLABUS

[1] CALCULUS

Evolutes and involutes, Evaluation of definite and improper integrals; Beta and Gamma functions and their properties, Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule, Maxima and minima.

[2] MATRICES

Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Rank of a Matrix, Linear systems of equations, Determinants, Cramer's Rule, Inverse of a matrix, Gauss Elimination and Gauss Jordan method.

[3] VECTOR SPACES

Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Linear Independence of vectors, Diagonalization.

[4] MULTIVARIABLE CALCULUS (DIFFERENTIATION)

Limit, Continuity and Partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Vector Differential Calculus; Gradient, curl and divergence.

TEXT / REFERENCE BOOKS

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

2) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

3) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

5) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

6) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

7) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

8) V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

COURSE OUTCOMES

After successful completion of the course, students will be able to:

Understand the concepts of linear algebra, Infinite series and Fourier series.

Implement vector differential calculus for solving engineering problem.

Apply methods for solving multivariate linear problems of engineering.

Apply methods for finding optimum value of function of several variables.

Evaluate eigenvalues and eigen vectors for analysing different engineering problems.

Construct Langrange's function for constraint linear optimize problem.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	1	1	2	3	2	2
CO2	3	3	3	2	3	2	1	1	2	3	1	3
CO3	3	3	2	3	3	3	2	1	2	2	2	3
CO4	3	3	2	2	2	3	2	2	2	3	3	2
CO5	3	3	3	3	2	3	2	2	2	3	1	3
CO6	3	3	2	3	2	2	2	2	2	3	3	3
Aveg.	**3**	**3**	**2.5**	**2.5**	**2.3**	**2.5**	**1.7**	**1.5**	**2**	**2.8**	**2**	**2.7**

B. TECH. SEMESTER – I (CH/CL/IC/MH)

SUBJECT: (ES111) THERMODYNAMICS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	50*	-	150

Reference Code ESC209

*TW Marks includes Viva based on TW

DETAILED SYLLABUS

[1] INTRODUCTION

Macroscopic versus microscopic view point, thermodynamic systems and control volume, thermodynamic properties, processes and cycles, homogeneous and heterogeneous systems, thermodynamic equilibrium, quasi-static process, pure substance, concept of continuum, temperature and zeroth law of thermodynamics, ideal gas and gas laws.

[2] ENERGY AND ENERGY TRANSFER

Forms of energy, energy transfer by heat and work, mechanical forms of work, first law of thermodynamics, energy conversion efficiencies

[3] PROPERTIES OF PURE SUBSTANCES

Pure substance, phases and phase change process, thermodynamic properties, property diagrams, ideal gas equation of state, van der waal equation, virial equation of state

[4] ENERGY ANALYSIS OF A CLOSED SYSTEM PdV

work in various quasi-static processes, energy balance, specific heats, internal energy, enthalpy and specific heats of solids, liquids and ideal gases

[5] ENERGY ANALYSIS OF A OPEN SYSTEM

Conservation of mass, flow work and energy of a flowing fluid, energy analysis of steady and unsteady flow systems.

[6] SECOND LAW OF THERMODYNAMICS

Introduction to second law, thermal energy reservoir, heat engine, refrigerator and heat pump, Clausis and Kelvin-Plank statement, perpetual motion machines, reversible and irreversible processes, Carnot and reversed Carnot cycle, , entropy principle and isentropic process, Tds and Maxwell relation

[7] SEAM BOILERS

Introduction, classification, mountings and accessories, classification and comparison of boiler draught systems 8 APPLICATIONS OF THERMODYNAMICS Construction and working of pumps, compressors, IC engine-Otto and Diesel engines, vapour compression refrigeration system, vapour absorption refrigeration system.

TEXT / REFERENCE BOOKS

1) Yunus A. Cengel, Michael A. Boles., “Thermodynamics- An engineering approach”, Tata McGraw Hill publishing co. ltd.

2.) Nag P.K., “Engineering Thermodynamics”, Tata McGraw Hill publishing co. ltd.

3.) Smith J.M., Van Ness H.C., Abbott M.M, “Introduction to chemical engineering thermodynamics”, McGraw Hill publishing co. Ltd.

4.) Sonntag. R.E., Borgnakke, C. and Van Wylen G.J., ”Fundamental of thermodynamics”, John Wiley and Sons.

5.) Moran M.J. and Shapiro H.N., “Fundamentals of engineering thermodynamics”, John Wiley and Sons.

COURSE OUTCOMES

After successful completion of the course, students will be able to:

CO Number	Cognitive Level/Bloom’s Taxonomy	Statement
CO1	Analsye	Analyse heat, work and energy interaction for different process.
CO2	Understand	Discuss basic terminology of thermodynamics systems and interpret steady flow process. Describe applied machines.
CO3	Remember	Describe fundamentals of the first and second laws of thermodynamics and explain their significance to a wide range of systems.
CO4	Evaluate	Evaluate entropy changes in a various processes and determine the reversibility or irreversibility of a process.
CO5	Apply	Use different thermodynamics relations to obtain Maxwell relations to interpret various processes.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3				1	1					2
CO2	3	3	1		1							1
CO3	3	2		1	2		1	1			2	2
CO4	2	1	1		2							1
CO5	1	1			1							1

1-Slightly; 2-Moderately; 3-Substantially

CO	PSO1	PSO2	PSO3
CO1	1	2	
CO2	3	1	1
CO3	3	2	
CO4	2		
CO5	1	1	

SUGGESTED LIST OF PRACTICALS

Sr. No.	Title
1	Study of modern steam boilers.
2	Study of boiler mountings and accessories.
3	Calorific values of fuel and its measurement.
4	Study of reciprocating and centrifugal pumps.
5	Study of reciprocating and centrifugal compressors.
6	Study of 4-stroke petrol engine (Otto cycle).
7	Study of 4-stroke diesel engine (Diesel cycle).
8	Study of vapour compression and vapour absorption refrigeration system.
9	Study of industrial piping system.
10	Study of basic flow regulating devices.

B. TECH. SEMESTER – I (CH/CL/IC/MH)

SUBJECT: (ES112) ELEMENTS OF ELECTRICAL ENGINEERING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	50*	-	150

Reference Code ESC101

*TW Marks includes Viva based on TW

A. DETAILED SYLLABUS

[1] DC CIRCUITS

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

[2] AC CIRCUITS

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

[3] TRANSFORMERS

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

[4] ELECTRICAL MACHINES

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

[5] ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthling. Elementary calculations for energy consumption, power factor improvement. DC-DC buck and boost converters. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

[6] SEMICONDUCTORS, DIODES AND APPLICATIONS

Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) in brief.

B. TEXT / REFERENCE BOOKS

[1] Basic Electrical, Electronics and Computer Engineering, R. Muthu Subramanian, S. Sali-vahanan, K. A. Muraleedharan, 2nd Edition, Tata McGraw Hill.

[2] Principles of Electronics, V. K. Mehta & Rohit Mehta, 11th Edition, S. Chand & Company.

[3] Electrical Technology (Vol: II), B. L. Theraja, A. K. Theraja, 23rd Edition, S. Chand & Company.

[4] Basic Electrical Engineering, D.P. Kothari, I. J. Nagrath, 3rd Edition, Tata McGraw Hill.

C. COURSE OUTCOMES

At the end of the course, students should be able to

CO1 Apply basic circuital law and simplify the network using reduction techniques. Apply KVL, KCL and Ohm's Laws to complex RLC networks to find response in any part of the network in form of node voltages and loop currents for given excitation. Apply superposition, Thevenin's and Norton's theorem to simplify the network and determine load voltage / current.

CO2 The representation of alternating quantities. Analyse the single-phase AC circuits consisting of combinations of R, L and C.

CO3 Acquire knowledge about the constructional details, principle of operation and applications of AC and DC machines.

CO4 Gain knowledge for installation of electrical safety component and apply for the practical problems.

CO5 Analyse basic quantities of simple magnetic circuits. Obtain equivalent circuit of a transformer for analysis of its performance.

CO6 Analysis and Application of basic semiconductor devices.

D. COURSE MATRIX

Course Outcome (CO's)	**Program Outcomes (PO's)**											
	Domain Specific (PSO)					**Domain Independent (PO)**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2			2			1				
CO2	1	3						1				
CO3	3	2				1	1					
CO4	3	2	3		2			1				
CO5	1	3	3	2	2							
CO6	3	3										

1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)

B. TECH. SEMESTER – I (CH/CL/IC/MH)

SUBJECT: (BS103) MECHANICS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	1	0	4	4	60	40	-	-	100

Reference Code ESC205

DETAILED SYLLABUS

NO	TOPIC	L+T (hrs)	Cos
[1]	**Resultant force for 2D and 3D** force system, concept of free body diagrams	14	CO1, CO2
[2]	**Equilibrium** Equations for particles and rigid body subjected to 2D and 3D force system	12	CO1, CO2,
[3]	**Centroid and Centre of Gravity, Moment of Inertia**	08	CO3
[4]	**Rotational Transformation of scalers and vectors**, Newton's Laws for particle motion, Potential Energy function F= - Grad V	04	CO4
[5]	**Conservative and Non-Conservative Forces**, Conservation of momentum, angular momentum	04	CO4
[6]	**Kinematics in a Coordinate System Rotating and Translating in a Plane**	04	CO5
[7]	**Free Harmonic Motion:** damped harmonic motion, forced oscillation and resonance	06	CO5

TEXT / REFERENCE BOOKS

1) Engineering Mechanics, M. K. Harbola, 2nd Edition, Cengage Learning, 2013.

2.) Mechanics – J P Den Hartog, Dover Publications, 2003.

3.) Mechanical Vibrations - J P Den Hartog, Dover Publications, 1985.

4.) Theory of Vibrations with Applications – W. T. Thomson, 5th Edition, Pearson Education, 2008.

5.) Engineering Mechanics: Statics (V.1), Dynamics (V.2), J. L. Meriam and L. G. Kraige, 5th Edition, Wiley, 2017.

6.) Engineering Mechanics: Statics & Dynamics, Irving H. Shames, 4th Edition, Pearson Education, 2005.

7.) Vector Mechanics for Engineers: Statics (V.1), Dynamics (V.2), F. P. Beer and E. R. Johnston, 10th SI edition, McGraw Hill Education, 2017

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Able to provide students with exposure to the systematic methods for solving engineering problems.
CO2	Learn	Student will learn different various types of forces and force system. Effect of Force system and Equilibrium condition the factor affecting the Equilibrium.
CO3	Learn	Student will be able to learn of the Center of Gravity and Moment of Inertia of any type of the section of the body
CO4	Develop	To develop the understanding of modeling dynamic systems of engineering and ability to model the engineering components as particles to study their Kinematics. Application of work energy principle
CO5	Apply	Application of Newton's laws to particles and systems of particles. Fundamental understanding of vibrations and finding out natural frequency for mechanical systems

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2	1	2	3	1	2	3	3	3	3
CO2	3	3	3	3	2	2	1	1	3	1	3	3	3	3	3
CO3	3	3	2	3	3	1	2	2	3	1	2	3	3	3	2
CO4	3	3	3	3	2	2	1	1	3	1	3	3	3	3	3
CO5	3	3	3	2	2	1	1	2	3	1	3	3	3	2	3
..															
Avg															

B. TECH. SEMESTER – I (CH/CL/IC/MH)

SUBJECT: (ES113) COMPUTER PROGRAMMING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
2	0	3	5	3.5	40	-	50*	-	90

Reference Code ESC103
*TW Marks includes Viva based on TW

A. DETAILED SYLLABUS

[1] INTRODUCTION
Introduction to components of computer system, Idea of algorithm, Introduction to C, Constants, Variables & Data types in C, Managing input and Output operators

[2] OPERATORS AND EXPRESSIONS
C Operators: Arithmetic, relational, logical, increment °t, assignment and conditional, Arithmetic Expressions & Precedence Rule, Type conversion in C, Mathematical.

[3] DECISION MAKING AND BRANCHING
Decision making with If & If...else statements, goto statements.

[4] DECISION MAKING AND LOOPING
The while statement, the break statement & the do... while loop, the for loop, Jump within loops - Programs.

[5] ARRAYS
Array 1D, 2D, Character Array as String.

[6] USER DEFINED FUNCTIONS
Categories of Functions (Including using built in library), Call by Value, Parameter passing to function, Recursion.

[7] STRUCTURE
Defining structure, Assigning value to the structure members, Array of structure

[8] POINTER
Idea of pointer, declaration and Initialization of pointer, Passing address as function argument, Passing array to function using pointer. 9 FILE HANDLING

B. TEXT / REFERENCE BOOKS

1) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

2.) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

3.) Yashvant Kanetkar, Let Us C, 12th Edition, BPB Publication.

4.) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

C. COURSE OUTCOMES

At the end of the course, students should be able to

CO1 Recognize the fundamentals of programming such as variables, data types, operators and input output operations.

CO2 Analyze and solve programming problems using decision making – branching and looping.

CO3 Evaluate problems/programs using user defined function and arrays.

CO4 Develop an application using the concepts of array, pointer, structure, and file management to solve engineering and/or scientific problems.

D. COURSE MATRIX

Course Outcome (CO's)	Program Outcomes (PO's)											
	Domain Specific (PSO)					Domain Independent (PO)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3				1		1		1		1
CO2	3	3		2		1			1	1		
CO3	2	2	1									
CO4	2	2		1				1				
1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)												

B. TECH. SEMESTER – I (CH/CL/IC/MH)

SUBJECT : (SM101) ENVIRONMENTAL STUDIES (SM101)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
2	–	–	2	0	40	–	P/F	–	40

A. COURSE OVERVIEW

Motivation: Identify and analyze the current issues related to the environment, increase awareness and induce interest among students to propose ethically appropriate and economically feasible solutions for sustainable developmental activities.

Objective: The objective for this course is to bring awareness about sustainable development is a key to the future of mankind. Understanding, analyzing and proposing solutions to the contemporary environmental issues and problems of pollution, population explosion, solid waste disposal, environmental degradation, economic productivity, global warming, ozone layer depletion and loss of biodiversity.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**The multidisciplinary nature of environmental studies** Definition, scope and importance & Need for public awareness	1	CO1 CO3
[2]	**Natural resources** **Renewable and non-renewable resource**: **Natural resources and associated problems** Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, and their effects on forests and tribal people Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefit and problems Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification Role of an individual in conservation of natural resources. Equitable use of resources of sustainable lifestyles	5	CO1 CO2 CO3

[3]	**Ecosystems** 1) Concept of an ecosystem, Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem 2) Ecological succession, Food chains, food webs and ecological pyramids 3) Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)	5	CO1 CO2
[4]	**Biodiversity and its conservation** A. Introduction definition: Genetic, species and ecosystem diversity B. Bio-geographical classification of India C. Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels D. India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India E. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity	5	CO1 CO2
[5]	**Environmental Pollution** 1. Definition, Causes, effects and control measures of: 2. Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards 3. Solid waste management, causes, effects and control measures of urban and industrial wastes 4. Role of an individual in prevention of pollution, Pollution case studies 5. Disaster management: floods, earthquake, cyclone and landslides	5	CO1 CO3 CO4
[6]	**Social issues and the environment** [5] From unsustainable to sustainable development, Urban problems related to energy [6] Water conservation, rain water harvesting, watershed management [7] Resettlement and rehabilitation of people: its problems and concerns. Case studies [8] Environmental ethics: Issues and possible solutions [9] Climate change: Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. [10] Case studies [11] Wasteland reclamation, Consumerism and waste products [12] Environment Protection Act: Air (Prevention and Control of Pollution) Act, Water (Prevention &Control of Pollution) Act,	5	CO1 CO3 CO4

	Wildlife Protection Act, Forest Conservation Act [13] Issues involved in enforcement of environmental legislation [14] Public awareness		
[7]	**Human Population and the Environment** **A.** Population growth, variation among nations, population explosion, Family Welfare Program, environment and human health, human rights, Value education **B.** HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environmental and human health **C.** Case studies	4	CO1 CO3 CO5
[8]	**Field work** 1. Visit to a local area to document environmental assets (river/forest/ grassland/hill/mountain) 2. Visit to a local polluted site - Urban/Rural/Industrial/Agricultural 3. Study of common plants, insects, birds 4. Study of simple ecosystems – pond, river, hill, slopes etc.		CO2 CO3 CO4 CO6
	Termwork: (a) Awareness Activities: i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste ii) Slogan making event iii) Poster making event iv) Cycle rally v) Lectures from experts (b) Actual Activities: i) Plantation ii) Gifting a tree to see its full growth iii) Cleanliness drive iv) Drive for segregation of waste v) To live some big environmentalist for a week or so to understand his work vi) To work in kitchen garden for mess vii) To know about the different varieties of plants viii) Shutting down the fans and ACs of the campus for an hour or so.	**(Pass/ Fail)**	CO1 CO2 CO3 CO4 CO5 CO6

C. TEXT BOOKS

1. Erach Bharucha Textbook of Environmental Studies; Second Edition, Universities Press: Hyderabad, 2013.

D. REFERENCE BOOKS

1.

2. Varandani, N. S. Basics of Environmental studies; Lambert Academic Publishing: Germany, 2013.

3.Basak, A. Environmental Studies; Dorling Kindersley: India, 2009.

4.Dhameja, S. K. Environmental studies; S. K. Kataria and Sons: New Delhi, 2007.

5.Rao, C. S. Environmental Pollution Control Engineering; Wiley publishers: New Delhi, 2006.

6.Brunner, R. C. Hazardous Waste Incineration; McGraw Hill: Michigan, 1989.

7.Clark, R. S. Marine Pollution; Clanderson Press Oxford: Bath, 2001.

8.Agarwal, K. C. Environmental Biology; Nidi Publ.: Bikaner, 2001.

9.Cunningham, W.P.; Cooper; Gorhani, T. H. E.; Hepworth, M.T., Environmental Encyclopedia; Jaico Publ. House: Mumbai, 2001.

10.De, A. K. Environmental Chemistry; Wiley Eastern: New Delhi, 2006.

11.Gleick, H. P. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security; Stockholm Env. Institute Oxford Univ. Press: New York, 1993.

12.Hawkins, R.E., Encyclopedia of Indian Natural History; Bombay Natural History Society: Bombay, 1987.

13.Heywood, V. H.; Waston, R. T. Global Biodiversity Assessment; Cambridge Univ. Press: Cambridge, 1995.

14.Mckinney, M.L.; School, R.M. Environmental Science systems & Solutions; Web enhanced edition: USA, 1996.

15.Miller, T.G. Jr.; Spoolman, S. E. Environmental Science; Cengage learning: Wadsworth, 2014.

16.Rao, M. N.; Datta, A.K. Waste Water treatment; Oxford & IBH Publ.: New Delhi, 1987.

17.Townsend, C., Harper, J.; Michael, B. Essentials of Ecology; Blackwell: Oxford, 2008.

18.Trivedi, R. K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II; B. S. Publications, Hyderabad, 2010.

19.Trivedi, R. K.; Goel, P. K. Introduction to air pollution; ABD Publishers: Jaipur, 2003.

20.Wanger, K. D., Environmental Management; W.B. Saunders Co. Philadelphia, USA, 1998.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	**Recall, understand and interpret** the terminologies used in environmental studies correctly
CO2	Evaluate	**Relate** the importance of natural resources, biodiversity, hotspots and **deduce** the threats to biodiversity
CO3	Analysis	**Analyse** the factors causing environmental pollution, **formulate** the role of an individual in abatement and control of pollution, **improve** disaster management techniques
CO4	Evaluate	**Evaluate** the social issues involved in climate change, water conservation, rainwater harvesting, wasteland reclamation, consumerism and waste generation, environmental ethics, environmental laws and requirement of public awareness
CO5	Comprehension	**Understand** the issues related to population, family welfare programs, human health, value education, and role of IT in environment
CO6	Application	**Make use of** the field work including visits to local areas to document environmental assets, assess the polluted sites, study species and ecosystems in our surroundings

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	1	1	1	3	1	1	3	2	2	2	3	3	2
CO2	1	2	1	1	1	2	3	2	2	2	2	2	2	2	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	3	2	3	2	3	3	3
CO5	2	3	3	3	2	3	3	3	3	3	1	2	2	2	2	3
CO6	3	3	3	3	3	3	3	3	3	3	2	3	2	3	3	3
Avg	2.16	2.67	2.33	2.33	2.16	2.5	3	2.5	2.33	2.83	2	2.5	2.16	2.67	2.67	2.67

B. TECH. SEMESTER – I (CH/CL/IC/MH)

SUBJECT: (ES114) WORKSHOP PRACTICE - I

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
0	0	2	2	1	-	-	50*	-	50

Reference Code ESC104

*TW Marks includes Viva based on TW

DETAILED SYLLABUS

[1] Introduction To Workshop, Basic Workshop types

[2] Safety requirement in workshop, Safety rules

[4] To Understand "5S" Concept for Workplace

[5] Demonstration of Tin smithy Tools and it's exercise

[6] To make job for Tin smithy shop

[7] Demonstration of Plumbing tools, It's accessories.

[8] To make job for Plumbing shop

[9] Introduction to Fabrication shop, Welding Equipment

[10] To make job for Fabrication shop

[11] Introduction of Machine shop

[12] Introduction and Demonstration of Lathe machine

[13] Introduction and Demonstration of Milling and Radial Drilling m/c

TEXT / REFERENCE BOOKS

1) Equipment Manuals

COURSE OUTCOMES

CO1 Understand basic house keeping and safety requirement while working in workshop.
CO2 Identify and use tools / Accessories of different workshop departments which could result in skill improvement of students.
CO3 Remember, analyse and apply theoretical and practical knowledge for prototype development by completing workshop assignments and jobs.
CO4 Enhancing creativity by performing various practical tasks in different workshop trade.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	-	-	2	1	1	2	-	-	2
CO2	2	1	2	-	-	2	1	1	2	-	-	2
CO3	2	1	2	-	-	2	1	1	2	-	-	2
CO4	2	1	2	-	-	2	1	1	2	-	-	2

1-Slightly; 2-Moderately; 3-Substantially

CO	PSO1	PSO2	PSO3
CO1	2	2	1
CO2	2	2	1
CO3	2	2	1
CO4	2	2	1

B. TECH. SEMESTER – II (CH/CL/IC/MH)

SUBJECT: (BS203) MATHEMATICS - II

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	1	0	4	4	60	40	0	0	100

Reference Code BSC104

DETAILED SYLLABUS

[1] FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS AND INTRODUCTION TO HIGHER ORDER DIFFERENTIAL EQUATIONS

Exact, linear and Bernoulli's equations, Introduction to second order linear differential equations with variable coefficients, Method of variation of parameters, Cauchy-Euler equation.

[2] SERIES SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS BY POWER SERIES METHOD

Introduction, Validity of series solution of the equation, General Method, Forms of series solution.

[3] PARTIAL DIFFERENTIAL EQUATIONS

Basic Concepts, Classification and Solutions of partial differential equations: Lagrange's linear equation of first order, Non-linear equations of first order- Charpit's method, Homogenous linear equations with constant coefficient to find the complementary functions and the particular integral, Introduction to non-homogenous linear equations with constant coefficients, Method of separation of variables.

[4] MULTIVARIABLE CALCULUS (INTEGRATION)

Multiple Integration: Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Introduction to Triple integrals (Cartesian), Vector line integrals, Vector surface integrals, Theorems of Green, Gauss and Stoke's.

[5] LAPLACE TRANSFORM

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions, Finding inverse Laplace transform by different methods, Convolution theorem, Evaluation of integrals by Laplace transform, Solving ODE by Laplace Transform method.

TEXT / REFERENCE BOOKS

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

2.) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Ed. Pearson, 2002.

3.) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4.) W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Prob-lems, 9th Edn., Wiley India, 2009.

5.) S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

6.) E. A. Coddington, An Intro. to Ordinary Differential Equations, Prentice Hall India, 1995.

7.) J. W. Brown & R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

8.) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Pub., 2008.

B. TECH. SEMESTER – II (CH/CL/IC/MH)

SUBJECT: (ES203) ENGINEERING GRAPHICS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	3	6	4.5	60	40	50*	-	150

Reference Code ESC102

*TW Marks includes Viva based on TW

DETAILED SYLLABUS

[1] INTRODUCTION TO ENGINEERING DRAWING
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic section curves (Ellipse, Parabola, Hyperbola), Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid), Involutes; Archemedian Spiral

[2] SOLID GEOMETRY
Projection of points, projection of lines and their applications. Projection of regular planes such as square, rectangle, triangle, circle, pentagon, hexagon, rhombus. Projection of right and regular solids inclined to both the planes (prisms, pyramids, cylinder and cone)

[3] ORTHOGRAPHIC PROJECTIONS
First angle and third angle projection methods, conversion of pictorial views into Orthographic projections with dimensioning, sectional orthographic projection, special sections

[4] SECTION OF SOLIDS AND DEVELOPMENT OF SOLIDS
Sections and Sectional Views of Right Angular Solids Covering, Prism, Cylinder, Pyramid, Cone

[5] DEVELOPMENT OF SURFACES
Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

[6] ISOMETRIC PROJECTIONS
Principles of Isometric projection – Isometric Scale, Isometric projection and view, Conversion of orthographic views to isometric projections and views

[7] WORKING ENVIRONMENT OF CAD SOFTWARE
Menu bar, Quick access toolbar, Dashboard/Ribbon, Toolbars, Drawing space, Navigation bar (View controls: zoom, pan, orbit,), Command prompt, Status bar, Drawing Area (Background, Crosshairs, Coordinate System), Shortcut Menu, Properties manager

[8] DRAWING CUSTOMIZATION
Setting up the drawing sheet (drawing sheet templates, drawing limits, drawing units etc.), Coordinate system (User coordinate system, Absolute and relative coordinates, Cartezian and Polar coordinates), Modes of drawing (Grid, Snap, Ortho, Osnap, Otrack, Polar tracking, Iso draft, etc.) Formatting (colors, line type, line weight, point style etc.)

TEXT / REFERENCE BOOKS

1) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

2.) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
3.) Shah P. J., (2014) Engineering Graphics, S. Chand Publishing
4.) Luzadder W., Duff J., (1992), Fundamentals of Engineering Drawing, Peachpit Press
5.) Gill P. S., (2009), Engineering Drawing, S. K. Kataria & Sons
6.) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

SUGGESTED LIST OF PRACTICALS

Sr. No. Title

1 Types of lines, Dimensioning methods and Dimensioning systems (Zero sheet)

2 Geometrical Constructions

3 Engineering Curves (Conics) and Orthographic Projection

4 Projections of Straight lines and Sectional Orthographic Projection

5 Engineering Curves: Cycloids & involute and Projections of right and regular Planes

6 Isometric Projection and Projections of right and regular solids

7 Archimedean spiral and Development of surfaces

COURSE OUTCOMES

After successful completion of the course, students will be able to:

CO1	To understand primary concepts of Engineering Drawing and geometrical construction.
CO2	Demonstrate correct usage of methods, concepts, and theories to illustrate and solve problem of conic sections and plane and space curves
CO3	Illustrate correct usage of methods, concepts, and theories to solve problem of solid geometry.
CO4	Select an appropriate standard projection system, break down complex 3D problem into various orthographic and sectional orthographic views, and illustrate missing features and learn basis aspects of CAD software.
CO5	Generate isometric projection from two-dimensional drawing and prepare drawing in CAD software.
CO6	Create development of various parts/components in real life situation.

COURSE ARTICULATION MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	1	1	1	2
CO2	3	1	1	1	-	-	-	-	1	1	1	2
CO3	3	2	1	1	-	-	-	-	1	1	1	2
CO4	3	2	1	1	2	-	-	-	1	1	1	2
CO5	3	2	1	1	2	-	-	-	1	2	1	2
CO6	3	2	1	1	-	-	-	-	1	2	1	2

CO	PSO1	PSO2	PSO3
CO1	1	1	1
CO2	2	2	1
CO3	2	1	1
CO4	2	2	2
CO5	2	2	2
CO6	2	2	1

1-Slightly; 2-Moderately; 3-Substantially

B. TECH. SEMESTER – II (CH/CL/IC/MH)

SUBJECT: (ES204) BASIC ELECTRONICS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	50*	-	150

Reference Code ESC201

*TW Marks includes Viva based on TW

A. DETAILED SYLLABUS

[1] TRANSISTOR & CHARACTERISTICS

Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Di-vider Bias Configuration

[2] FIELD EFFECT TRANSISTOR (FET)

Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuit

[3] TRANSISTOR AMPLIFIERS AND OSCILLATORS

Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Cou-pling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Prin-ciple, Advantages of Negative Feedback, Topologies, Current Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift

[4] OPERATIONAL AMPLIFIERS AND APPLICATIONS

Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, and inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator, wein bridge oscillator.

[5] DIGITAL ELECTRONICS FUNDAMENTALS

Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification, Logic ICs, Implementation of combinational logic - half and full adder/subtractor, multiplexers, de-multiplexers

[6] SENSORS & SIGNAL CONDITIONING CIRCUITS

Types of sensors – pneumatic, electromagnetic, electronic, smart sensors. Diaphragm, bellows and bourdon tube, Resistive, Capacitive, Inductive, ultrasonic, LVDT, piezoelectric, optoelec-tronic transducers, thermocouple, RTD and thermistors, Application of sensors for flow, level, temperature and stress measurement, Bridge Circuit, Differential Amplifier, Instrumentation Amplifier

B. TEXT / REFERENCE BOOKS

1) Principles of Electronics, 11th Edition By V. K. Mehta & Rohit Mehta Publisher: S. Chand & Company

2.) Electrical & Electronic Measurement & Measuring Instruments, 17th Edition By A.K. Sawhney Publisher: Dhanpat rai

3.) M. M. Mano, "Digital logic and Computer design", Publisher : Pearson Education India.

C. COURSE OUTCOMES

At the end of the course, students should be able to

- **CO1** To understand fundamentals of transistor and analyse the transistor characteristics for different transistor configurations.
- **CO2** Designing the biasing circuit of BJT amplifier and its application.
- **CO3** Study the construction and characteristics of FET and its classifications.
- **CO4** Understand digital gates and apply Boolean algebra for minimization of Boolean expression and implement various combinational circuits.
- **CO5** Analyse the fundamental of op-amp and its applications.
- **CO6** Understand different types of sensors, its working principals and their applications

D. COURSE MATRIX

Course Outcome (CO's)	**Program Outcomes (PO's)**											
	Domain Specific (PSO)					**Domain Independent (PO)**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2		2			1				
CO2	3	2				1	1					
CO3	2	3	2					1	1			
CO4	3	2	3		2			1	1	1		
CO5	2	3	2	2	2				1	1		
CO6	2	2	3	2								

1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)

	PSO1	**PSO2**	**PSO3**
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

B. TECH. SEMESTER – II (CH/CL/IC/MH)

SUBJECT: (ES205) MECHANICS OF SOLIDS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	50*	-	150

Reference Code BSC101

*TW Marks includes Viva based on TW

DETAILED SYLLABUS

NO	TOPIC	L+T (hrs)	COs
[1]	Concept of stress and strain, elasticity, generalized Hooke's law for 3D, concept of isotropy and homogeneity, plane stress and plane strain idealization, axial, volumetric and thermal stresses and strains	12	CO1, CO2
[2]	Force-strain-deformation analysis for axial load, flexure, shear and torsion	18	CO3 CO4
[3]	Mechanical properties of metals – elasticity, plasticity, strain hardening, hardness, toughness, fatigue, strain energy	04	CO1
[4]	Transformation of stress and strain at a point, Principal stresses and strains, Mohr's Circle, strain rossete	06	CO5

TEXT / REFERENCE BOOKS

1) Strength of Materials: Part– I and II, Stephen Timoshenko, 3rd Edition, CBS Publisher, 2002.

2.) Strength of Materials, Sadhu Singh, 1st Edition, Khanna Book Publishing Company, 2016.

3.) Advanced Mechanics of Solid, L. S. Srinath, 3rd Edition, McGraw Hill Publication, 2017.

4.) Engineering Mechanics of Solids, E P Popov, 2nd Edition, Prentice Hall India Learning Pvt. Ltd, 2002.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply	Apply the fundamental concepts of force deformation and stress-strain relationships to basic engineering structures.
CO2	Understand	The student will have the basic understanding of stress, strain & Deformation, Bending, Bending Stress in members.
CO3	Apply	Ability to draw shear force diagram and banding moment for different types of beams
CO4	Evaluate	To be able to determine the shear stress and twist in shafts subjected to torque
CO5	Analyse	Apply the concept of principal stresses and theories of failure to determine stresses on a 2-D element.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2	1	2	3	1	2	3	3	3	3
CO2	3	3	3	3	2	2	1	1	3	1	3	3	3	3	2
CO3	3	2	3	2	1	1	2	2	3	2	3	3	3	2	3
CO4	3	3	3	3	2	2	2	1	3	1	3	3	3	3	3
CO5	3	3	3	3	2	1	1	1	3	2	3	3	3	2	3
..															
Avg															

	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5			

B. TECH. SEMESTER – II (CH/CL/IC/MH)

SUBJECT: (BS204) CHEMISTRY

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	0	3	3	60	-	-	-	60

Reference Code BSC102

*TW Marks includes Viva based on TW

DETAILED SYLLABUS

[1] ATOMIC AND MOLECULAR STRUCTURE

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multi centre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

[2] SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.

[3] INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

[4] USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams

[5] PERIODIC PROPERTIES

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

[6] STEREOCHEMISTRY

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

TEXT / REFERENCE BOOKS

1) University chemistry, by B. H. Mahan

2.) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

3.) Fundamentals of Molecular Spectroscopy, by C. N. Banwell

4.) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

5.) Physical Chemistry, by P. W. Atkins

6.) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

B. TECH. SEMESTER – II (CH/CL/IC/MH)

SUBJECT: (ES206) WORKSHOP PRACTICE - II

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
0	0	3	3	1.5	-	-	50*	-	50

Reference Code ESC104b

*TW Marks includes Viva based on TW

A. DETAILED SYLLABUS

• Introduction to Electrical Components: Switches, MCB, ELCB, Tube-light, Bulb, parallel connection of electrical components, wiring in fan and motor

• Introduction to Electronic Components: Active and passive components

• Use of basic source & measuring instruments (Power supply, function generator, CRO, DMM)

• Measure voltage, current, frequency, phase difference, power, power factor for single and three phase supply

• Identify various types of ports, cables and connectors

• Linux installation

• Network cabling and crimping for wired and wireless network

• PCB layout design (like proteus) Software installation and layout design using the same

• Solder and de-solder electronic components on PCB

• Identify and rectify open circuit and short circuit faults in PCB/system.

• Test assembled electronic circuit for various parameters and faults • To design a device for charging small battery during door opening and closing.

• To design a mobile charger using solar PC cell panel for offices and house hold.

• To design/develop an electronic weighing machine.

• To design/develop an electronic lock for house in the workshop.

• To design/develop and innovative electrical bell using electronics components

MINI Project:

Apart from above experiments a group of students has to undertake a mini project. Following are some examples for the same:

B. TEXT / REFERENCE BOOKS

1) Electronic Principles, Albert Malvino and David J. Bates, 7th Edition, McGraw Hill

2) Electronic Devices, Thomas L. Floyed, 7th Edition, Pearson

B. TECH. SEMESTER – III (EC/IC)

SUBJECT: MATHEMATICS – III

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	1	0	4	4	60	40	0	0	100

Reference Code BSC201a

A. DETAILED SYLLABUS

1 **NUMERICAL METHODS:** Solution of algebraic and transcendental equations by regula-falsi method and Newton-Raphson's method, solution of linear simultaneous equations by Gauss-Jordan and Gauss-Seidel method, numerical methods to solve first order and first degree ordinary differential equations by Runge's method and Runge-Kutta method, numerical integration using trapezoidal rule, Simpson's one-third rule, and Simpson's three-eighth rule.

2 **FINITE DIFFERENCES AND INTERPOLATION:** Finite difference: Introduction to forward difference, backward difference, central difference, shift, and averaging operators. Newton's forward and backward difference interpolation formula, central difference interpolation formula by Stirling formula and Bessel's formula. Lagrange's interpolation formula for unequal interval. Numerical differentiation: Derivatives using forward difference, backward difference, and central difference (Stirling's) formula for tabulated values, maxima and minima of a tabulated function

3 **COMPLEX NUMBERS:** Definition, elementary operations, properties, Argand diagram, modulus, amplitude, De-Moivre's theorem, expand $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ in powers of $\sin\theta$, $\cos\theta$, and $\tan\theta$ respectively, expand $\sin m\theta$, $\cos m\theta$, or $\sin m\theta \cdot \cos m\theta$ in a series of sines or cosines of multiples of θ.

4 **PROBABILITY DISTRIBUTIONS AND STATISTICS:** Probability distributions: Binomial distribution, Poisson distribution, and normal distribution, calculation of errors: probable error and standard error, coefficient of correlation, rank correlation, lines of regression, curve fitting: method of least square approximation for straight line, parabola, second degree parabola, and non-polynomial approximation.

B. RECOMMENDED TEXT / REFERENCE BOOKS

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

2) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

3) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

4) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

C. COURSE OUTCOMES

CO Number	Statement
CO1	
CO2	
CO3	
CO4	

D. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
CO7												
CO8												

E. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			
CO7			
CO8			

B. TECH. SEMESTER – III (EC/IC)

SUBJECT: ELECTRONIC MEASUREMENT

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
2	1	2	5	4	60	40	25	25	150

Reference Code EC22

A. COURSE OVERVIEW

The creating sound background for understanding of operating principle, working and application of various electronic instruments. By offering these course department encourages to use sensors for measurement of various parameters like temperature, pressure, level and flow. Moreover, design and analysis of various bridge circuits and meter circuit utilized in electronic measurement.

B. DETAILED SYLLABUS

NO. TOPIC

[1] MEASUREMENT AND ERROR
Accuracy and Precision, Definitions, Significant Figures, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors , Problems.

[2] SYSTEM OF UNITS OF MEASUREMENTS
Fundamental and Derived Units, System Of Units, Electric and Magnetic Units, International System of Units, Other System of Units, Conversion of Units.

[3] STANDARDS OF MEASUREMENTS
Classification of Standards, Standards of Mass, Length and Volume, Time and Frequency Standards, Electrical Standards, Standards of Temperatureand Luminous Intensity, IEEE standards.

[4] BRIDGES AND THEIR APPLICATION
Introduction, Wheatstone Bridge, Kelvin Bridge, Guarded Wheatstone Bridge, AC Bridges and their Application, Comparison Bridges, Maxwell Bridge, Hay Bridge, Schering Bridge, Unbalance Conditions, Wien Bridge, Wagner Ground Connection, Potentiometer.

[5] ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS
Amplified DC Meter, AC Voltmeter using Rectifiers, True RMS- Responding Voltmeter, Electronic Multimeter, Analog Voltmeter, Differential Voltmeters, Digital Voltmeters, Component Measuring Instruments, Q Meter, Vector Impedance Meter, Vector Voltmeter, RF Power and Voltage Measurement.

[6] OSCILLOSCOPES
Introduction, Oscilloscope, Block Diagram, Cathode Ray Tube, CRT Circuits, Vertical Deflection System, Delay Line, Multiple Trace, Horizontal Deflection System, Oscilloscope Probes and Transducers, Oscilloscope Techniques, Special Oscilloscopes.

[7] ELECTROMECHANICAL INDICATING INSTRUMENTS
Suspension Galvanometer, Torque and Deflection of the Galvanometer, Permanent-Magnet Moving coil Mechanism, DC Ammeters, DC voltmeters, Voltmeter Sensitivity, Series ohmmeter, Shunt ohmmeter, Multi meter or VOM, Calibration of DC Instruments, Thermo instruments, Electrodynamometers in Power Measurements, Watt Meter, Instrument Transformers

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Electrical & Electronic Measurement & Measuring Instruments, A. K. Sawhney, 17th Edition, Dhanpat Rai & Co.
2) Electronic Instrumentation and Measurement Technique, Wlliam D. Cooper & Albert D. Helfrick, 5thEdition, Prentice Hall of India
3) Electronics Measurement & Instrumentation, R. K. Rajput, 1st Edition, Prentice Hall of India
4) Electronic Instrumentation, H. S. Kalsi, 2nd Edition, Tata McGraw Hill

D. COURSE OUTCOMES

CO NUMBER	Statement
CO1	Study of various parameters based on measurement and error.
CO2	Study of system units of Measurements like, fundamental and derived units, Electric and Magnetic units and conversion of units.
CO3	Design and extend meter circuit like DC Ammeter, DC Voltmeter & series type ohmmeter for given specification.
CO4	Illustrate the working of instrument for measuring AC parameters like voltage, current, power factor and energy.
CO5	Design DC bridges for measurement of low & medium value of resistance like Wheatstone bridge, kelvin's double bridge.
CO6	Design AC bridges for measurement of primary and secondary parameters of components.
CO7	Compare various voltmeters like amplified DC meter, AC voltmeter using rectifier, True rms responding voltmeter and electronic multimeter for improving accuracy of measurement.
CO8	Illustrate the working of various oscilloscope for measuring voltage, frequency and phase. Applications of various transducers used in measurement systems.

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
CO7												
CO8												

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			
CO7			
CO8			

B. TECH. SEMESTER – III (EC/IC)

SUBJECT: NETWORK ANALYSIS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	1	2	5	5	60	40	25	25	150

Reference Code EC06

A. COURSE OVERVIEW

This course is designed to provide a complete overview of electric circuit analysis used in electronics engineering. The students can analyse electrical networks by understanding application of basic laws, theorems and transforms. The concept of this subject is useful to the students for understanding the concept of stability of the circuit and its frequency domain analysis.

B. DETAILED SYLLABUS

NO **TOPIC**

[1] **DEVELOPMENT OF THE CIRCUIT CONCEPT**
Introduction, Charge and Energy, The Relationship of Field and Circuit Concepts, The Capacitance Parameter, The Inductance Parameter, The Resistance Parameter, Units and scaling, Approximation of a Physical System as a circuit.

[2] **CONVENTIONS FOR DESCRIBING NETWORKS**
Reference Directions for Current and Voltage, Active Element Conventions, the Dot Convention for Coupled Circuits, Topological Description of Networks.

[3] **NETWORK EQUATIONS**
Kirchhoff's Laws, The Number of Network Equations, Source Transformations, Examples of the Formulation of Network Equations Loop Variable Analysis, Node Variable Analysis, Determinants: Minors and the Gauss Method, Duality.

[4] **FIRST ORDER DIFFERENTIAL EQUATIONS**
General and particular solutions, Time constants, the integrating factor, More Complicated Networks.

[5] **INITIAL CONDITIONS IN NETWORKS**
Why Study Initial Conditions? Initial Conditions in Elements, Geometrical Interpretation of Derivatives, A Procedure for Evaluating Initial Conditions, Initial State of a Network.

[6] **DIFFERENTIAL EQUATIONS**
Second order equations, Internal Excitation, Higher order equations ;Internal Excitation, Networks Excited by External Energy Sources, Response as related to the s-Plane Location of Roots, General Solutions in terms of S,Q and ωn.

[7] **THE LAPLACE TRANSFORMATION**
Introduction, The Laplace Transformation, Some Basic Theorems for the Laplace Transformation, Examples of the solution of problems with the Laplace Transformation, Partial Fraction Expansion, Heaviside's Expansion Theorem, Examples of Solutions by the Laplace Transformation.

[8] **TRANSFORMS OF SPECIAL SIGNAL WAVEFORMS**
The Shifted Unit Step Function, The Ramp and impulse Functions, Waveform Synthesis, The Initial and Final Value of f (t) from F(s), The Convolution Integral, Convolution as Summation.

[9] IMPEDANCE FUNCTIONS AND NETWORK THEOREMS

The concept of Complex Frequency, Transform Impedance and Transform Circuits, Series and Parallel Combinations of Elements, Superposition and Reciprocity, Thevenin's Theorem and Norton's Theorem.

[10] NETWORK FUNCTIONS: POLES AND ZEROS

Terminal Pairs or Ports, Network Functions for One Port and Two port. The Calculation of Network Function (1) Ladder Networks (2) General Networks, Poles and Zeros of Network Functions, Restrictions on Pole and Zero Locations for Driving-Point Functions, Restrictions on Pole and Zero locations for Transfer Functions, Time-domain Behaviour from the Pole & zero plot, Introduction to band pass, low pass, high pass and band reject filters.

[11] TWO PORT NETWORKS

Relationship of two port variables, short circuit admittance parameters, the open circuit impedance parameters, transmission parameters, the hybrid parameters, relationship between parameter sets, parallel connection of two port networks.

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Network Analysis, M.E. Van Valkenburg, 3rd Edition, Prentice Hall of India Private Limited

2) Network Analysis and Synthesis, U. A. Patel, 3rd Edition, Mahajan Publication House.

3) Circuit Theory - Analysis & Synthesis, A. Chakraborty, 1st Edition, Dhanpatrai publication

D. COURSE OUTCOMES

CO NUMBER	Statement
CO1	Apply KVL, KCL and Ohm's Laws to complex RLC networks as well as coupled networks to find response in any part of the network in form of node voltages and loop currents for given excitation.
CO2	Compute response of the network for given excitation using classical method (solving differential equations).
CO3	Apply Laplace transformation and network theorem to complex RLC networks in order to simplify the network and determine load voltage/current.
CO4	Find Laplace transform of given time domain function/waveform and obtain response of the network using Laplace transform method.
CO5	Synthesized a stable electrical network with the help of network theorem and poles&zeros.
CO6	Find two port parameters for given network.

E. COURSE MATRIX

Course Outcome (CO's)	Program Outcomes (PO's)											
	Domain Specific (PSO)					Domain Independent (PO)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2			1				2
CO2	3	2				1	1					2
CO3	2	3	2					1	1			2
CO4	3	2	3		2			1	1	1		2
CO5	2	3	2	2	2				1	1		2
CO6	2	2	3	2								1
1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)												

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2			1				2
CO2	3	2				1	1					2
CO3	2	3	2					1	1			2
CO4	3	2	3		2			1	1	1		2
CO5	2	3	2	2	2				1	1		2
CO6	2	2	3	2								1

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

B. TECH. SEMESTER – III (EC/IC)

SUBJECT: DIGITAL ELECTRONICS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	1	2	6	5	60	40	25	25	150

Reference Code EC03

A. COURSE OVERVIEW

Computer systems and digital communications have affected positively every aspect of our life. Digital Electronics is the foundation of these systems. On completion of the subject students will have the skills and confidence to conceive and implement a digital system. The objective of this course is to provide the fundamental concepts associated with the digital logic and circuit design. To apply the laws involved in the Boolean algebra for the simplification of logic functions which results in the minimization of hardware requirements. To design and analysis of combinational and sequential circuits utilized in the different digital circuits and systems.

B. DETAILED SYLLABUS

NO. TOPIC

[1] INTRODUCTION TO LOGIC CIRCUITS
Logic Gates & Networks, Truth Tables, Boolean Algebra, Synthesis using AND, OR and NOT Gates, NAND – NOR Logic Networks, Sum of Products and Product of Sums Forms, Introduction to Verilog.

[2] IMPLEMETATION TECHNOLOGY
Transistor Switches, NMOS & CMOS Logic Gates, Negative Logic Systems, Introduction to PAL, PLA, CPLD & FPGAs, Voltage Levels in Logic Gates, Noise Margin, Dynamic Operation & Power Dissipation in Logic Gates, Fan-in and Fan-out, Transmission Gates, Transistor-Transistor Logic, Emitter - Coupled Logic.

[3] OPTIMIZED IMPLEMENTATION OF LOGIC FUNCTIONS
Karnaugh Map Strategy for Minimization, Minimization of POS Forms, Multiple Output Circuits, Multilevel Synthesis, Analysis of Multilevel Synthesis.

[4] COMBINATIONAL CIRCUITS
Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Comparison Circuits

[5] SEQUENCIAL CIRCUITS
Basic Latch, Gated SR Latch, Gated D Latch, Master Slave & Edge Triggered D Flip-Flops, T & JK Flip Flops, Registers, Counters, Reset Synchronization, BCD- Ring –Johnson Counters.

[6] SYNCHRONOUS SEQUENCIAL CIRCUITS
Basic Design Steps, Mealy State Model, Design of Counter, FSM as an Arbiter Circuit, Analysis of Synchronous Sequential Circuits.

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Fundamentals of Digital Logic with Verilog Design, Stephen Brown & Zvonko Vrenesic, Tata McGraw Hill
2) Digital Logic and Computer Design, Morris Mano, Prentice Hall of India
3) Fundamental of Digital Circuits, Anand Kumar, Prentice Hall of India

D. COURSE OUTCOMES

CO NUMBER	Statement
CO1	Analyse and calculate parameters such as noise margin, input –output voltages, fan-out, and speed power product, power dissipation for ECL and TTL logic families. Implement the Boolean functions using CMOS gates.
CO2	Attempt SOP to POS conversion (& vice versa) for implementation of Boolean expressions using AND-OR-INVERT functions as well as universal gates. Also to optimize the Boolean expressions either by applying Boolean algebra or by using minimization techniques as K-Map method and Tabulation Method with "don't care" conditions up to 6 variables.
CO3	Implement various combinational circuits like Multiplexers, Decoders, Encoders, Code Converters, and Arithmetic Comparison Circuits using basic gates. Design and Implement basic combinational blocks of a digital computer using multiplexers, decoder, PLA, PAL and verify the circuit implementations with the help of simulation tool.
CO4	Implement a basic memory element using flip-flops and understand the characteristics of various flip-flop designs and compare them with respect to their timing relationship, hardware requirement and limitations.
CO5	Differentiate Combinational and Sequential circuits. Design and analyse FSMs using sequential circuits. Reduce hardware requirement of FSMs by minimizing state table. Analyse Mealy and Moore machine designs using timing waveforms.
CO6	Construct sequential circuits like asynchronous/ synchronous counters, shift registers and counters for timing signal generation.

E. COURSE MATRIX

Course Outcome (CO's)	**Program Outcomes (PO's)**											
	Domain Specific (PSO)					**Domain Independent (PO)**						
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2		1	1					
CO2	3	3	3	2		1	3				1	1
CO3	3	3	2	1		1	3				1	1
CO4	3	3	3	1		1	1				1	1
CO5	3	1	3	3	3	2	3		1		1	
CO6	3	3	3	2	3	1	3		1		2	
1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)												

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2		1	1					
CO2	3	3	3	2		1	3				1	1
CO3	3	3	2	1		1	3				1	1
CO4	3	3	3	1		1	1				1	1
CO5	3	1	3	3	3	2	3		1		1	
CO6	3	3	3	2	3	1	3		1		2	

G. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

B. TECH. SEMESTER – III (IC)

SUBJECT: (HS301) UNIVERSAL HUMAN VALUES-II

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	0	3	3	60	-	-	-	60

Reference Code HSMC

A. COURSE OBJECTIVE

Universal human values is a course which help the student to see the need for developing a holistic perspective of life. To sensitize the student about the scope of life – individual, family, society and nature/existence. Strengthening self-reflection. To develop more confidence and commitment to understand, learn and act accordingly.

B. DETAILED SYLLABUS

[1] COURSE INTRODUCTION

Need, Basic Guidelines, Content and Process for Value Education Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels

[2] UNDERSTANDING HARMONY IN THE HUMAN BEING

Harmony in Myself! Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya

[3] UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY

Harmony in Human-Human Relationship Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

[4] UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE

Whole existence as Co-existence : Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence

[5] IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order

C. RECOMMENDED TEXT / REFERENCE BOOKS

21.R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
22.JeevanVidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
23.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
24.The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
25.Small is Beautiful - E. F Schumacher.
26.Slow is Beautiful - Cecile Andrews
27.Economy of Permanence - J C Kumarappa
28.Bharat Mein Angreji Raj - PanditSunderlal

D. COURSE OUTCOMES

CO NUMBER	SKILL	STATEMENT
CO1	Application	To start exploring themselves: get comfortable with each other and with the teacher; they start appreciating the need and relevance for the course
CO2	Application	To note that the natural acceptance (intention) is always for living in harmony, only competence is lacking
CO3	Application	To present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them
CO4	Application	To grasp the right utilization of their knowledge in their streams of Technology/Engineering/Management/any other area of study to ensure mutual fulfilment. E.g. mutually enriching production system with rest of nature

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	0	1	0	0	3	0	3	1	1	0	2
CO2	0	0	1	0	0	3	1	3	2	2	1	1
CO3	0	0	2	0	0	3	2	2	2	2	0	1
CO4	0	0	1	0	0	3	2	3	1	2	2	1

	PSO1	PSO2	PSO3
CO1	1	0	0
CO2	0	1	0
CO3	0	1	0
CO4	1	0	0

B. TECH. SEMESTER – IV (IC)

SUBJECT: (IC410) CONTROL THEORY

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
2	0	2	4	3	60	-	25	25	110

Reference Code EC19

A. COURSE OVERVIEW

This course is designed to provide complete overview of control theory used in an Instrumentation and Control engineering. The students can differentiate between an open loop and closed control systems, find transfer function of control systems using a block diagram reduction technique and a signal flow graph technique, find sensitivity and stability of a linear control system, analyse control systems using time domain and frequency domain analysis techniques and co-relate time domain and frequency domain specification terms.. The concept of this subject is useful to the students for understanding the concept of control systems, sensitivity and stability and its time domain and frequency frequency domain analysis.

B. DETAILED SYLLABUS

NO	TOPIC
1	**INTRODUCTION:** Open loop and closed loop control system, Servomechanism, Historical development of control system, - sampled data & digital control system, Multivariable control system, Application in non engineering field.
2	**MATHEMATICAL MODELS OF PHYSICAL SYSTEMS:** Introduction, Differential equation of physical systems, Transfer functions, Block diagram algebra, signal flow graph. (Note: Problems on electrical, mechanical & electromechanical systems only.)
3	**FEEDBACK CHARACTERISTICS OF CONTROL SYSTEMS:** Feedback and non feedback systems, reduction of parameter variations by use of feedback, control over system dynamics by use of feedback, effects of disturbance signals by use of feedback, linearizing effect of feedback, regenerative feedback, Basics of Feed forward Control System with example.
4	**TIME RESPONSE ALALYSIS, DESIGN SPECIFICATION AND PERFORMANCE INDICES CONCEPTS OF STABILITY AND ALGEBRAIC CRITERIA:** Introduction, standard test signals, time response of first order system, time response of second order system, steady state errors and error constants, effects of adding zero to a system, design specifications and constructions for second and higher order systems, performance indices, examples, concepts and conditions for stability, Huwitz's and Routh's stability criteria, relative stability criteria.
5	**THE ROOT LOCUS TECHNIQUE:** Introduction, Rules of construction of root loci, sketching of root locus and applications
6	**FREQUENCY DOMAIN ANALYSIS & STABILITY:** Frequency domain specifications, correlation between time and frequency domain specifications, Bode plot, Polar plot. Concept of stability, R H criterion, Nyquist stability.

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Control System Engineering: By Nagrath & Gopal
2) Control systems Engineering: By – U. A. Patel, Mahajan Publishing House
3) Problems and Solutions of Control Systems With Essential Theory: by Jairath, CBS Publisher
4) Modern Control Engineering: By K. Ogata , Prentice Hall
5) A course in control engineering: By A. Subbarao and Parag R. Desai. Dhanpat Rai Publications Ltd.
6) Automatic Control System: By S.N.Verma , Khanna Publications
7) Feedback Control Systems: By Di Staffeno

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Application	Understand the classification of control system and basic components of closed loop and open loop control system.
CO2	Application	Apply basic concept of mathematical modeling and understand the FEEDBACK CHARACTERISTICS of control system
CO3	Analysis	Understand and analyze LTI Systems using various stability analysis techniques.
CO4	Analysis	Analyze time and frequency response of control system

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2		1	1	1		1	1	1
CO2	3	3	1	2		1	1		1	1		
CO3	2	2	1	1					1		1	
CO4	2	2	2	1				1				1

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1	2	2	3
CO2	3	3	2
CO3	2	2	2
CO4	2	2	2

B. TECH. SEMESTER – IV (IC)

SUBJECT: (IC411) ANALOG ELECTRONICS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	1	2	6	5	60	40	25	25	150

Reference Code EC09

A. COURSE OVERVIEW

The course is designed for a smooth transition from the world of physics to electronics and computations for the first-year students of different branches of engineering; the course combines basic electrical circuit and electronics components into a single unified treatment and provides a strong background to understand the role of electronics in contemporary world of system designs.

This course provides the concepts associated with Transistor fundamentals, biasing of BJTs and MOSFETs using basic circuits. Technical details of the typical circuits that are used in our day-to-day life like rectifiers, voltage regulators, and amplifiers are discussed in this course. The sensors useful for automation in different engineering fields are also shown as integral part of electronic circuits in this subject.

B. DETAILED SYLLABUS

NO TOPIC

[1] FREQUENCY RESPONSE OF AMPLIFIERS

Effect of Coupling and Emitter Bypass Capacitors on Low frequency response, The RC-Coupled Amplifier, The Hybrid Pi Transistor Model at High Frequencies, Variations of Hybrid Pi Parameters, The CE short-circuit Current Gain, The Generalized Voltage-Gain Function, Single-Stage CE Transistor Amplifier Responses, The Gain-Bandwidth Product, Emitter Follower at High Frequencies, High-Frequency Response of Two Cascaded CE Transistor Stages, Step Response of an Amplifier.

[2] FIELD EFFECT TRANSISTORS

The Junction Field-Effect Transistor, The JFET Volt-Ampere Characteristics, Fabrication of JFETs, The Enhancement Metal-Oxide-Semiconductor Field-Effect, Transistor (MOSFET), The Depletion MOSFET, Biasing the Field-Effect Transistor, The JFET or MOSFET Small-Signal Model, The JFET as Voltage-Controlled Resistor (VCR).

[3] OPERATIONAL_AMPLIFIER CHARACTERISTICS

The Basic Operational Amplifier, The Differential Amplifier, The Emitter-Coupled Differential Amplifier, Transfer Characteristics of a Differential Amplifier, Operational Amplifier Design Techniques, Offset Error Voltages and Currents, Measurement of Operational Amplifier Parameters, Frequency Response of Operational Amplifiers

[4] Operational AMPLIFIER SYSTEMS

Basic Operational Amplifier Applications, Differential (Instrumentation) Amplifiers, AC-Coupled Amplifier, Analog Integration and Differentiation, Electronic Analog Computation, Active Filters, Active Resonant Band pass Filters, Precision AC/DC Converters, Sample-and-Hold Systems, Logarithmic and Exponential Amplifier, Digital-to-Analog(D/A) Converters, Analog-to-Digital(A/D) Converters, Instrumentation Amplifier.

[5] WAVESHAPING AND WAVEFORM GENERATORS

Clipping (Limiting Circuits), Clipping at Two Independent Levels, Comparators, Applications of Comparators, Regenerative Comparators (Schmitt Trigger), Square- Wave and Triangular-Waves Generators, Pulse Generators, Voltage Time-Base Generators,Astable and monostable multivibrator using op-amp, Sinusoidal Generators, The Phase-Shift Oscillator, A General Form of Oscillator Configuration, The Wien Bridge Oscillator, Crystal Oscillators, Timer 555- Astable and Monostable mode

[6] POWER CIRCUITS AND SYSTEMS

Large-Signal Amplifiers, Harmonic Distortion, Amplifier Classification, Efficiency of a Class A Amplifier, Class B Push-Pull Amplifiers, Class AB Operation, Regulated Power Supplies, series voltage regulator

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Jacob Millman & Christos C. Halkias, Integrated Electronics, 1st Edition, Tata McGraw Hill

2) Robert L. Boylstead& Louis Nashelsky, Electronic Devices &Circuit Theory, 8th Edition, Prentice Hall of India

3) K. R. Botkar, Integrated Circuits, 9th Edition, Khanna Publications

4) Op - Amp and Linear Integrated Circuits, Ramakant A. Gayakwad, 4th Edition, Pearson Education

D. COURSE OUTCOMES

CO NUMBER	Statement
CO1	Analyse class A, Class B, Class AB and Push-Pull amplifier in terms of operating characteristics, harmonic distortion and power efficiency.
CO2	Design regulated power supply to provide constant voltage with specified minimum load current for the given specification.
CO3	Computation of transfer gain, input and output impedance of various types of negative feed-back amplifiers.
CO4	Develop OPAMP circuits to perform mathematical operations like addition, subtraction, multiplication, division, integration, differentiation, logarithm, antilogarithm
CO5	Design different types of waveform generators using discrete components and OPAMP and IC 555 like astable and Monostable Multivibrator
CO6	Design analog active filters using OPAMP and Sinusoidal Oscillator for given frequency and gain.

E. COURSE MATRIX

Course Outcome (CO's)	Program Outcomes (PO's)											
	Domain Specific (PSO)					Domain Independent (PO)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3				1		1		1		1
CO2	3	3		2		1			1	1		
CO3	2	2	1									
CO4	2	2		1				1				
CO5	3	3				1	1		1			
CO6	2	3		1								1
1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)												

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3				1		1		1		1
CO2	3	3		2		1			1	1		
CO3	2	2	1									
CO4	2	2		1				1				
CO5	3	3				1	1		1			
CO6	2	3		1								1

F. CO and PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

B. TECH. SEMESTER – IV (IC)

SUBJECT: (CI413) ELECTRICAL MACHINES & POWER

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code ESC

A. COURSE OVERVIEW

This course provides fundamental concepts associated with working and analysis of electrical machines. This also includes concepts to analyse the mechanism of electrical power generation, transmission and distribution. After studying this course, the students will be able to identify and troubleshoot electrical faults in switchgear.

B. DETAILED SYLLABUS

NO TOPIC

[1] DC MACHINES

DC Generator & DC Motor

Operating Principle and Types of DC generator &motor, Losses in DC Generator, Power Stages in DC Generator, Maximum Efficiency and Power in DC Generator, Generator Characteristics, Speed control of DC motor

[2] AC MACHINES

Single Phase Transformer

Working Principle, Construction, Characteristics of an Ideal Transformer, EMF Equation, Transformer Load Analysis, Transformer Parameters, Equivalent Circuit, Open Circuit & Short Circuit Tests, Efficiency, Regulation, All day efficiency, Parallel Operation of transformer.

Three Phase Induction Motors

Working Principle, Construction, Relation between Torque & Rotor Power Factor, Starting Torque and Running Torque of Motor, Effect of Change in Supply Voltage on Starting Torque, Torque Slip Characteristics, Induction Motor as a Generator, Power Stages, Starting Methods of Induction Motor, Speed Control of Induction Motors

Single Phase Motors

Introduction and Broad Classifications, Self-Starting Mechanism, AC Series Motor and Universal Motors.

Alternators

Working Principle, Construction, Factors Affecting Alternator Size, Alternator on Load, Synchronous Reactance, Vector Diagrams, Voltage Regulation by EMF Method, Parallel Operation of Alternators.

[3] ELECTRICAL POWER GENERATION

Schematic Arrangement of Various Power Plants - Thermal, Hydro, Nuclear, Diesel and Gas Turbine Based Power Plant, Structure of Electric Power System, Load Curves, Important Terms and Factors, Load Duration Curves, Types of Loads, Wind energy: types, power in the wind, types of wind turbine generators, Solar Energy: types of solar cell, A generic photovoltaic cell, from cells to modules to array, physics of shading, Introduction to major types of PV system, Maximum Power point tracker, Concentrating Solar Power (CSP) Technologies, Introduction to smart grid

[4] POWER FACTOR IMPROVEMENT

Power Triangle, Disadvantages and Causes of Low Power Factor, KVAR Calculations, Importance of Power Factor Improvement, Most Economical Power Factor.

[5] TRANSMISSION LINE & UNDER GROUND CABLES

Classification of Transmission Line & Under Ground Cables, Main Components, Conductor Materials,

Types of Insulators, String Efficiency and Its Improvement, Construction of underground Cables

[6] INTRODUCTION TO SWITCH GEAR

Essential Features of Switchgear, Switchgear Equipment - Circuit Breaker, Fuses, Relay, Principle and Methods of *arc* Quenching in Circuit Breaker, Desirable Characteristics of Fuse Element, Fuse Element Materials, Theory of Protective Relays, Fundamental Requirements of Protective Relay, Calculation of Relay Operating Time, The Bus Bar Arrangement, Faults in Power System.

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Electrical Technology (Vol: II), B. L. Theraja& A. K. Theraja, 23rd Edition, S. Chand & Company Ltd.

2) Principles of Power System, V. K. Mehta &Rohit Mehta, 4th Edition, S. Chand & Company Ltd.

3) Theory and Performance of Electrical Machine, V.B. Gupta, 13th Edition, Laxmi Publications

4) Electrical Engineering, R.K. Rajput, 1st Edition, Laxmi Publications

5) Course in Power System, J. B. Gupta, 10th Edition, S. K. Kataria& Sons.

6) Switchgear and Protection, J. B. Gupta, 2nd Edition, S. K. Kataria& Sons.

D. COURSE OUTCOMES

CO NUMBER	Statement
CO1	Evaluate important parameters such as efficiency and regulation of transformer.
CO2	Analyze the operation of induction motor and determine important parameters.
CO3	Analyze the operation of generator and determine its voltage, current, power.
CO4	Analyze the operation of various power stations and find out load curves parameter.
CO5	Understand the importance of power factor improvement in power system and compute the transmission line parameter.
CO6	Apply the knowledge of various protective devices against electrical faults.

E. COURSE MATRIX

Course Outcome (CO's)	Program Outcomes (PO's)											
	Domain Specific (PSO)					Domain Independent (PO)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1						1	2		
CO2	3	2			1				2	1		
CO3	3	2							1	1		
CO4	3	2								1		
CO5	3	2	2				2					
CO6	3	2	2			1	1	1				1
1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)												

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1						1	2		
CO2	3	2			1				2	1		
CO3	3	2							1	1		
CO4	3	2								1		
CO5	3	2	2				2					
CO6	3	2	2			1	1	1				1

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

B. TECH. SEMESTER – IV (IC)

SUBJECT: (IC412) POWER ELECTRONICS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	5	60	40	25	25	150

Reference Code PCC

A. COURSE OVERVIEW

Industrial automation has been contributing immensely in the growth of the manufacturing seector and country at large. At field level, power electronics is playing a game changer role in automatic adjustments of final control elements. On completion of this course, students will learn and develop skills to understand and implement a thyristor based control system. The objective of this course is to provide the fundamental concepts associated with the construction and working of thyristor based circuits. To study the design and to analyze industry grade high power circuits utilized in the different automatic systems is one of the main goals of this course.

B. DETAILED SYLLABUS

NO TOPIC

1 POWER ELECTRONICS APPLICATIONS
Introduction, Thyristor applications, Advantages and disadvantages of thyristor converter systems, Power semiconductor converters

2 POWER SEMICONDUCTOR DEVICES
Introduction, Power semiconductor devices, Power diode, Types of power diodes, Performance parameters of power diodes, Series operation of power diodes, Parallel operation of power diodes, Hybrid devices

3 THYRISTOR PRINCIPLES AND CHARACTERISTICS
Introduction, Thyristor construction, Thyristor operation and characteristics, Firing circuit design considerations, Requirements of firing circuits, Thyristor transient characteristics, Thyristor types, Series and parallel operations of thyristors, Ratings of thyristors, Relative performance of power electronic devices

4 TRIGGERING DEVICES
Introduction, Triggering devices, Uni Junction Transistor (UJT), Characteristics and applications of UJT, Programmable Uni-junction Transistor (PUT), DIAC, Silicon Controlled Switch (SCS), Silicon Unilateral Switch (SUS), Silicon Bilateral Switch (SBS)

5 REGULATORS AND POWER SUPPLIES
Introduction, Filter voltage regulation and ripple voltage, Voltage multiplier circuits, Zener voltage regulators, Complete voltage regulated power supply, IC voltage regulators

6 THYRISTOR COMMUTATION CIRCUITS
Introduction, Turn-off characteristics, Commutation of a thyristor, Natural commutation, Forced commutation, Conditions for commutation, Classification of forced commutation methods-Class A, B, C, D, E and F type commutation

7 THYRISTOR TRIGGERING CIRCUITS
Introduction, Requirements of triggering circuits, Thyristor firing circuits, Pulse transformer triggering, Control of converter, Firing angle control, Firing SCR by UJT, TRIAC firing circuit, Phase control of SCR by Pedestal and Ramp

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) A Textbook on Power Electronics, Harish C. Rai, Galgotia Publications
2) Power Electronics, MD Singh and KB Khanchandani, Tata McGraw Hill Publication
3) Power Electronics, PC Sen, Tata McGraw Hill Publication
4) Thyristor: Theory and Applications, RK Sugandhi and KK Sugandhi, New Age Pub.
5) An Introduction to Thyristors and their applications, Ramamurthy, East West Pub.

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Understand Analyse	Gain knowledge of the family of semiconductor devices and compare the operational characteristics of various power semiconductor devices
CO2	Understand Analyse	Gain knowledge of the series and parallel operations of power diodes and their applications.
CO3	Understand Analyse	Understand the construction and principles of operation of thyristors and their firing considering SCR as case study, understand the ratings and relative performance
CO4	Understand Apply Analyse	Understand the fundamentals of thyristor triggering and typical characteristics of various triggering devices, understand various thyristor firing techniques
CO5	Understand Analyse	Understand the fundamentals of thyristor commutation, understand various thyristor commutation methods
CO6	Understand Apply Analyse	Understand the operation of various regulators and their applications in power supply circuits

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5			
CO6			

B. TECH. SEMESTER – IV (IC)

SUBJECT: (IC-414) CONTROL SYSTEM COMPONENTS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
2	0	2	4	3	60		25	25	110

A. **COURSE OVERVIEW:** This course provides knowledge about various electrical, mechanical, electromagnetic and hydraulic components used in control systems.Understanding the principle, construction, working and applications of these components is a very important and crucial part of plant engineering specially in process and manufacturing industries.

B. **DETAILED SYLLABUS**

NO TOPIC

[A] INTRODUCTION TO CONTROL PROBLEM

Control systems: Terminology and basic structure, the genesis and essence of feedback control theory, Feedback control structure.

[B] MECHANICAL COMPONENTS

CAMS AND FOLLOWERS: Introduction, Components of Cam, Types of Cam, Types of Followers, Classifications, Cam Motions, Cam Terminology, Cam Profile

GEARS, CLUTCHES, BREAKS: Introduction of Gears, Clutches, Brake.

[C] ELECTRO-MECHANICAL COMPONENTS

SERVO MOTOR: Introduction, DC Servomotors, AC Servomotors

STEPPER MOTORS: Introduction, PM type Stepper Motor, VR type Stepper Motor, Hybrid Stepper Motor, Disc Magnet Stepper Motor, Applications of Stepper Motors

UNIVERSAL MOTOR: Construction, Operation, Speed control

SWITCHES: Single pole, double pole, electro mechanical Switches

SOLENOIDS: Introduction, Construction, Working, Selection and different types of Solenoid.

[D] OPTO-ELECTRONIC DEVICES

Classification, Photo conductive, Photo Voltaic & Photoemissive sensors , Liquid Crystal Display.

[E] SAFETY AND AUXILIARY COMPONENTS

RELAYS: Introduction, Classification of Relays, Relay Circuits, Construction of Relay, Logic Relay, Optoelectronic Relay, Relay Problems & Remedies, Relay Race, Actuation & Release Time,Characteristics of Electromechanical Relay, Dynamic Characteristics of Reed Relay

POTENTIOMETER: Introduction, Type of Potentiometers, Applications, Selection of Potentiometers.

TACHOMETERS: Introduction, Characteristics requirement, DC Tachogenerator, AC Tachogenerator, Tachometer Applications, characteristics of Tachogenerator

[F] HYDRAULIC SYSTEMS

Introduction, Advantages & Disadvantages of Hydraulic Systems, Components of Hydraulic System, Classification of Hydraulic Systems, Pump-Controlled Hydraulic System, Pump Controlled Hydraulic Motor, Hydraulic Transmission Lines, Hydraulic Power Supply, Hydraulic Valves.

C. **RECOMMENDED TEXT/REFERENCE BOOKS**

[1] Control systems components, By: M.D. Desai, PHI publication, 2008

[2] Control systems principle and design, 4th Edition, By: M.Gopal, Tata McGraw-Hill Education publication, 2015

[3] Electronic Devices and Circuits – An Introduction, By: Mottershed, Prentice hall publication, 1997

[4] Modern Control Technology: Components and systems, By: Kilian, Cengage Learning publication, 1996

[5] Mechanical & Industrial Measurements, 11th Edition,By: R. K. Jain, Khanna Publishers, 2011

D. COURSE OUTCOMES

After completion of the course students should be able to:

CO Number	**Skill**	**Statement**
CO1	Understand	Understand and analyze the construction and operation of mechanical and electromechanical control system components
CO2	Understand	Understand and apply the standards and characteristics for selection of mechanical and electromechanical control system components
CO3	Analyze	Understand and analyze the construction and operation of safety and auxiliary control system components and identify control system problems
CO4	Apply	Understand and apply the standards and characteristics for selection of safety and auxiliary control system components and identify control system problems
CO5	Analyze	Understand and analyze the construction and operation of hydraulic and opto electronic control system components
CO6	Apply	Understand and apply the standards and characteristics for selection of hydraulic and opto electronic control system components

E. COURSE MATRIX

POs COs	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO01	3	3	1	1	2	3	2	1	2	1	2	3
CO02	3	3	2	2	2	2	3	1	2	1	2	3
CO03	3	3	1	1	2	3	2	1	2	1	2	3
CO04	3	3	2	2	2	2	3	1	2	1	2	3
CO05	3	3	1	1	2	3	2	1	2	1	2	3
CO06	3	3	2	2	2	2	3	1	2	1	2	3
AV	**3**	**3**	**1.5**	**1.5**	**2**	**2.5**	**2.5**	**1**	**2**	**1**	**2**	**3**

	PSO1	**PSO2**	**PSO3**
CO1	3	2	3
CO2	3	2	3
CO3	3	2	3
CO4	3	2	3
CO5	3	2	3
CO6	**3**	**2**	**3**
Av	**3**	**2**	**3**

F. LIST OF EXPERIMENTS

Sr. No.	**Experiment**
1	To find out characteristics of potentiometer
2	To study Cams and Follower
3	To study various types of switches
4	To study different types of gears.
5	To Study the construction & operation of DC Relay
6	To study the Bouncing Characteristics of a relay
7	To study construction and working of solenoid
8	To measure speed of motor using photoelectric type & magnetic type sensor
9	To study basic components and circuits of hydraulic system

10	To study the characteristics of following opto electronic devices

B. TECH. SEMESTER – IV (IC)

SUBJECT: (HS402) TECHNICAL COMMUNICATION SKILLS

Teaching Scheme (Hours/Week)		Credits	Examination Scheme						
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
2	0	2	4	3	40	-	-	50	90

Reference Code HSMC201

A. COURSE OVERVIEW

The course is designed to help students learn technical communication and ethics in engineering. It helps students to understand the importance of self development and moral reasoning along with building positive self esteem.

B. DETAILED SYLLABUS

NO. TOPIC

[1] INTRODUCTION
Basics and importance of Technical Communication, General and Technical Communication, objectives and Characteristics of Technical Communication, Process of Communication, interpersonal and organisational Communication levels, Non-verbal communication.

[2] TECHNICAL WRITING
Writing technical reports, technical proposals, Formal letters, memos, Email, Email etiquettes, Business letters, Research papers and technical descriptions, application letter writing, resume writing, follow-up letter writing, Minutes of meeting, Making notes.

[3] TECHNICAL COMMUNICATION
Effective public Speaking, Formal Presentations, Presentation aids, Interviews, Group discussions, Telephone Etiquettes.

[4] ENGINEERING ETHICS
Ethics and excellence in Engineering, Role and responsibility of engineer, Moral reasoning and Code of ethics.

[5] SELF DEVELOPMENT AND SELF-ESTEEM
Importance of Attitude, Goal setting, Self-esteem, Steps to building positive Self-esteem

C. RECOMMENDED TEXT / REFERENCE BOOKS

29.Raman Sharma, Technical Communications, 3rd Edition, Oxford Publication, London
30.David F. Beer and David McMurrey, Guide to writing as an Engineer, 3rd Edition, John Willey, NewYork
31.Shiv Khera, You Can Win, Macmillan Books, New York
32.Diane Hacker, Pocket Style Manual, Bedford Publication, New York
33.Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York
34.Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi
35.Xebec, Presentation Book, TMH New Delhi

D. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Describe Verbal and Non Verbal aspects of Communication
CO2	Apply	Write technical documents for professional communication
CO3	Apply	Practice etiquettes in communication at workplace
CO4	Apply	Demonstrate ethics and moral reasoning in engineering

CO5	Apply	Practice positive attitude and set long term/short term goals
CO6	Apply	Plan self development and build positive self esteem

E. COURSE MATRIX

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	0	0	0	0	0	0	0	0	0	3	0	1
CO2	0	0	0	0	0	0	0	0	0	3	0	1
CO3	0	0	0	0	0	0	0	0	3	2	1	1
CO4	0	0	0	0	0	3	0	3	0	2	1	1
CO5	0	0	0	0	0	0	0	0	2	2	2	2
CO6	0	0	0	0	0	0	0	0	2	2	1	2

	PSO1	**PSO2**	**PSO3**
CO1	0	0	0
CO2	0	0	0
CO3	0	0	0
CO4	1	0	0
CO5	0	0	0
CO6	1	0	1

F. LIST OF EXPERIMENTS

1) Formal Letter writing
2) Resume writing
3) Formal Presentation
4) Role Play
5) Group Discussion
6) Public speaking exercise
7) Case studies related to Self development, Ethics
8) Meeting conduction and writing minutes of meeting
9) Mock Interview
10) Book review

B. TECH. SEMESTER – V (IC)

SUBJECT: (IC5XX) MICROCONTROLLER FUNDAMENTALS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PCC

Type of Course: Program Core

Prerequisite: Basic Programming, Digital Electronics

Rationale: Microprocessors are used extensively in the design of any computing facility. On the other hand, microcontrollers are single chip computers, integrating processor, memory and other peripheral modules into a single System-on-Chip (SoC). The use of microcontrollers in industrial and domestic electrical devices has become ubiquitous over the past decade. Engineers associated with the Instrumentation/Electrical domain need to have an understanding of such embedded systems, both hardware and software. This subject will equip students with programming and analytical skills required for embedded system implementation. Specifically, the students would be able to comprehend 8 bit microcontroller and microprocessor architectures.

.A. OBJECTIVES OF THE COURSE

- To understand architecture of embedded systems and features of AVR microcontrollers
- To equip with skills required for microcontroller system implementation
- To write assembly and C programs for AVR microcontrollers as per requirement

.B. DETAILED SYLLABUS

[A] INTRODUCTION TO MICROPROCESSOR & MICROCONTROLLER

Introduction to Microprocessors, Basic information about Instruction Set & Assembly Language, Introduction to CISC & RISC Architecture, Difference between Microprocessor & Microcontroller and Example Application Discussion

[B] MICROPROCESSOR 8085 ARCHITECTURE, MEMORY & I/O DEVICES INTERFACING

Microprocessor Architecture & Its Operation, Memory Devices, I/O Devices, Logic Devices for Interfacing, Memory Interfacing, I/O Interfacing, Timing diagram & Applications

[C] AVR ARCHITECTURE & ASSEMBLY LANGUAGE PROGRAMMING

Architecture, Memory Map & Registers of AVR, Assembly Programming, Data Move Instructions and I/O Port Programming, Branch & Call Operations, Arithmetic Instructions and Programs

[E] AVR TIMERS & INTERRUPTS

Programming Timers 0, 1 and 2, Counter Programming, Timer Programming in C, AVR Interrupts, Programming of Timer & External Hardware Interrupts, Interrupt Priority, Interrupt Programming in C, Serial Port Connection of ATMEGA & Programming in C and Assembly Language

[E] BASICS OF SERIAL COMMUNICATION

Basics of Serial Port Communication, SPI & I2C Bus

.C. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To conceptually comprehend microprocessor and microcontroller architectures/systems
CO2	Apply	To utilize/apply features of embedded system and build programming logic/logical flowcharts
CO3	Create	To write/create assembly language and C programs for AVR microcontrollers

.D. Mapping of CO's and PO's

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	*	*	*	*								*
CO2			*	*	*	*						
CO3			*	*	*							

.E. CO PO Matrix

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1								2
CO2			3	2	3	1						
CO3			3	3	3							

.**F. CO PSO Matrix**

PSOs COs	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	3	3	2
CO3	3	3	3

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.**G. RECOMMENDED TEXTBOOKS**

36.Microprocessor Architecture, Programming and Applications with the 8085, by R. S. Gaonkar, Penaram International Publishing (India) Private Limited.

37.The AVR Microcontroller & Embedded Systems, by Mahuammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Pearson Publication.

.**H. REFERENCE BOOKS AND NOTES**

1) Embedded Systems, by B. Kanta Ra, PHI.
2) Fundamentals of Microprocessors & Microcomputers ,b y B. Ram, Dhanpat Rai Publications.
3) Microprocessor Application in Control & Instrumentation by Bibbero
4) Programming and Customizing the AVR Microcontroller by Dhananjay Gadre

.**I. LIST OF EXPERIMENTS**

1. Introduction to 8085 microprocessor
2. Microprocessor : Pin functions , Data operations and Timing Diagrams
3. Introduction to AVR/Atmel Studio
4. Basics of AVR Assembly Language
5. Advanced Data Transfer
6. Branching & Looping
7. Arithmetic, Logical Instructions & Programs

8. I/O port programming & Programming Logic
9. AVR Timers/Counters
10. Introduction to AVR microcontroller kit

B. TECH. SEMESTER – V (IC)

SUBJECT: (IC-5XX) INSTRUMENTATION SOFTWARE TOOLS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PEC

Program Elective I

A. COURSE OVERVIEW

Simulation and GUI development are amongst most important areas of instrumentation. While, simulation provides an opportunity to study the aspects that are physically unrealizable and feasible, GUI development enables user-friendly operation of a process interface. The course provides learning of Simulation and GUI Designing software. Using simulation software, the students can design-develop models, study, analyze and solve engineering problems to consolidate theoretical learning. Using GUI development platform, simple-effective-user friendly GUIs can be designed and implemented to cater to need-based custom solutions and facilitate human-machine interaction.

B. DETAILED SYLLABUS

NO TOPIC

[1] Introduction to Scilab

The Scilab, Scilab architecture, Installation and setting up Scilab, Scilab environment, Syntax

Scilab data types

Constants, Constant matrices, String matrices, Polynomials, Boolean operations, Matrix operations

[2] Programming with Scilab

Programming structures: Operators–General, Arithmetic, Conditional, Boolean type operators

Structures–Conditional, Loop structures: FOR loop, DO WHILE Loop, Functions, Selected data types

[3] Graphics under Scilab

The graphics window, The media, Plotting parameters, 2D plotting, Graphics library

[4] Formatted Input and Output (Lab content)

Scilab environment, General display commands, Output commands, Input commands, Commands for files

[5] Introduction to LabVIEW

Introduction, Advantages of LabVIEW, Software environment, Creating and saving a VI, Front panel toolbar, Block Diagram toolbar, Palettes – Tools, controls and functions palettes, Front Panel controls and indicators, Block diagram – terminals, nodes, functions, SubVIs, Express Vis and wires, Data types, Data flow diagram

Modular Programming

Introduction, Modular programming in LabVIEW, Build a VI front panel and block

diagram, Icon and connector pane, Creating an icon, Building a connector pane, Displaying SubVIs and express Vis as icons or expandable nodes, Creating SubVIs from sections of a VI, opening and editing SubVIs

[6] Repetition and Loops

Introduction, FOR loops, WHILE loops,

Arrays

Introduction, Arrays in LabVIEW, Creating one-dimensional array controls, indicators and constants, Creating two-dimensional arrays

Clusters

Introduction, Creating cluster controls, indicators and constants, Order of cluster elements, Cluster operations, Assembling-Disassembling clusters, Conversions between Arrays and Clusters

Structures

Introduction, Case structures, Formula nodes

[7] Graphical system design (Lab content)

Introduction, Graphical System Design (GSD) model, Design flow with GSD, Virtual Instrumentation, Virtual Instrument (VI) and Traditional Instrument, Hardware and software in VI, VI for test, control and design, GSD using LabVIEW, Graphical programming and textual programming

Plotting data (Lab content)

Introduction, Types of waveforms, Waveform graphs, Waveform charts, Waveform data type, XY graphs

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Virtual Instrumentation using LabVIEW, Jovitha Jerome, Prentice Hall of India
2) Programming in Scilab 4.1 by Vinu V. Das, Newage Publication
3) Notes on Scilab, Gary Bunting
4) Introduction to Scilab, Michael Baudin, Scilab Consortium
5) Virtual Instrumentation using LabVIEW, Sanjay Gupta & Joseph John, Tata McGraw Hill

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Understand	To understand the significance and use of modelling-simulation and Graphical Use Interface (GUI) design
CO2	Application	To write simulation program using SCILAB software and to write graphical programs for GUI development
CO3	Application	To build models for simulation study and data acquisition applications to cater customized requirements

E. COURSE MATRIX

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	1	0	2	0	0	0	0	0	0	1
CO2	2	0	2	0	3	0	0	0	0	0	0	0
CO3	2	0	2	0	2	0	0	1	0	0	0	0

L. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			

M. LIST OF EXPERIMENTS

1. Introduction to LabVIEW
2. Using loops in LabVIEW
3. Arrays and Clusters in LabVIEW
4. Decision Making using Case Structures in LabVIEW
5. File Handling in LabVIEW
6. Introduction to Scilab
7. Matrix Algebra in Scilab
8. Using loops and logical operators in Scilab
9. Graphical data presentation in Scilab
10. File handling in Scilab

B. TECH. SEMESTER – V (IC)

SUBJECT: (IC-5XX) MODELING, SIMULATION, AND EVOLUTIONARY TECHNIQUES

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PEC

Program Elective I

D. COURSE OVERVIEW

Novel techniques are emerging for mathematical optimization of control systems aiming to overall enhancement of manufacturing units. Using computer or microprocessor based control systems; such techniques are first simulated and then implemented to solve long pending process control problems of the industry. This course provides knowledge about modeling and simulation of various types of controllers. Using this learning, students can learn to build and analyze different models of controllers and advanced control algorithms leading to intelligent process control strategies.

E. DETAILED SYLLABUS

NO TOPIC

[1] Introduction:

Introduction, Objectives of the course, Overview of the course, Classification of Systems, Models, Purposes of Modelling, Classification of Models, Modelling Techniques, System Variables.

[2] Simulation:

Explanations of System, Modelling and Simulation, Classification of System Models, Step-wise Procedure for Simulation Study, Advantages and Disadvantages of Simulation, Basic Flow Chart for Simulation Study

Monte-Carlo Simulation Technique, Step-wise Procedure for Monte-Carlo Simulation Technique, Verification and Validation of Simulation Models, Various techniques of model validation.

[3] Fuzzy Logic Control (FLC):

Introduction, Fuzzification and Defuzzification of models, Fuzzy sets and set operations, Elementary Fuzzy Operators, Step-wise Procedure for Design of FLC using Matlab, Detailed Explanation of Matlab Fuzzy Logic Toolbox and its usage, Design of Fuzzy Controller, Design of Fuzzy Logic based Controller

[4] Artificial Neural Networks (ANN):

Architecture Introduction to ANN, ADALIN, Learning method Delta Rule, MSE based Training to ADALIN, Adaptive Filtering, Tapped Delay Line, Adaptive Filter, Basic ANFIS, ANFIS Learning Algorithms, Step-wise Procedure to setup ANFIS using Matlab Takagi-Sugeno FIS, Mamdani FIS, Mamdani v/s Sugeno

[5] Evolutionary Techniques:

Introduction to Genetic Algorithms (GA), Darwin's Observation, Darwin's Theory – Natural Selection, Terminology of GA, Applications of GA, Controller optimization using GA, Kohonon's Self Organizing Map (SOM), Hopfield Neural Network

F. RECOMMENDED TEXT / REFERENCE BOOKS

[15] Process Control–Principles and Applications by Surekha Bhanot, Publisher: Oxford University Press.

[16] Introduction to Artificial Neural Systems by Jacek M. Zurada, West Publishing Company, USA.

[17] Advanced Control Engineering by Ronald S. Burns, Butterworth-Heinemann Publishers, USA.

[18] Genetic Programming – On the Programming of Computers by Means of Natural Selection by John R. Koza, A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England.

[19] Optimization of PID controller using Ant Colony and Genetic Algorithms by Unal, Tpuz and Erdal, 2013 edition, Springer

[20] Design of Fuzzy Controllers by Jan Jantzen, Tutorial Paper, Department of Automation, Technical University of Denmark, Denmark.

[21] G. D. Sousa, B. K. Bose, "A Fuzzy Set Theory based Control of a Phase-controlled Convertor DC Machine Drive", IEEE Trans., Vol. IA – 30, no. I, pp. 34-44.

[22] Process Control and Optimization, Instrument Engineer's Handbook, Volume II by Bela G. Liptak, 2006 Edition, Taylor and Francis, CRC Press, USA.

[23] Aris R., "Mathematical Modelling, Vol. 1: A Chemical Engineering Perspective (Process System Engineering)", Academic Press, 1999.

Referred Research Publications:

- M. Godoy Simoes, Bimal K. Bose and Ronald J. Spiegel, "Fuzzy Logic based intelligent control of a variable speed cage machine wind generation system", IEEE Trans. on Power Electronics, Vol. 12, pp. 87-95, Jan. 1997.

- M. Godoy Simoes, Bimal K. Bose and Ronald J. Spiegel, "Design and Performance Evaluation of a Fuzzy Logic based Variable Speed Wind Generation System", IEEE Trans. on Industry Applications, Vol. 33, pp. 956-965, July-Aug. 1997.

+Class Notes and Discussions in Theory and Laboratory Sessions

G. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Understand	To understand the significance and use of simulation based study and choice of suitable models and techniques
CO2	Application	To learn and apply Fuzzy Logic Control (FLC) for customized needs
CO3	Application	To learn and apply Artificial Neural Network(s) (ANN), Genetic Algorithms (GA) to suit custom requirements

H. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	0	1	0	2	0	0	0	0	0	0	1
CO2	2	0	2	0	3	0	0	0	0	0	0	0
CO3	2	0	2	0	2	0	0	1	0	0	0	0

F. CO AND PSO MATRIX

PSO CO	**CO1**	**CO2**	**CO3**
PSO1			
PSO2			
PSO3			

G. LIST OF EXPERIMENTS

1. Introduction to Modeling and Simulation
2. Modeling of simple process control systems
3. Evolutionary techniques, classification, and application criteria
4. Fuzzy Logic: concepts, terminologies, and application development
5. Fuzzy Logic: design and implementation
6. Genetic Algorithms: concepts, terminologies, and application development
7. Genetic Algorithms: design and implementation
8. Artificial Intelligence and Neural Networks: concepts, design and application development
9. Adaptive system design and tuning approaches
10. Case study: classical, Fuzzy Logic, Genetic Algorithms and ANFIS

B. TECH. SEMESTER – V (IC)

SUBJECT: (IC5XX) SENSORS AND TRANSDUCERS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PCC

A. COURSE OVERVIEW

Sensors and Transducers is a prominent course to make the students aware about importance of measurement in control system design-development along with classification and terminologies of measurement Techniques and to learn about specifications, selection criteria and characteristics of instrumentation measurement systems

B. DETAILED SYLLABUS

NO. TOPIC

[1] FUNDAMENTAL INSTRUMENTATION

Basic concepts of measurement , Fundamental elements of measurement system, Applications of instrumentation systems, Classification of Instruments, Standards & calibration, Errors & Uncertainties in performance parameters, Static performance parameters, Impedance loading & matching, Selection of the instrument, Formulation of system equations, Dynamic response

[2] INDUSTRIAL MEASUREMENT

Displacement Measurement: Introduction, Principles of transduction (variable resistance, inductance, reluctance and capacitance type transducers), digital transducers, measurement of Acceleration

Speed Measurement: Introduction, Mechanical tachometers: Revolution counter, Centrifugal force tachometer, Resonance tachometers, Electric tachometers: Eddy current type tachometers, Electric Generator type tachometers, Contactless type tachometers, Frequency type tachometers, Ignition type tachometers, Stroboscopic tachometers, Pneumatic type speed transmitting elements, Measurement of Speed, Frequency and Short Time Intervals by direct application of frequency standards by comparative methods.

[3] PROCESS PARAMETERS MEASUREMENT

Measurement of Humidity, Specific gravity and Viscosity, Measurement of pH & conductivity.

[4] STRAIN MEASUREMENT

Introduction, Factors affecting strain measurements, Types of strain gauges, Theory of operation of resistance strain gauges, Types of electrical strain gauges, Materials for strain gauges, Gauging techniques and other factors, Strain gauge circuits

[5] VIBRATION MEASUREMENT

Introduction, Characteristics of vibration, Analysis of vibration sensing devices, Vibration sensing devices, Signal conditioners, Shock measurements, System characteristics, Vibration exciters, Calibration

[6] BASICS OF ANALYTICAL INSTRUMENTS

Basic elements of analytical instruments, Basic Introduction mass Spectrometers, IR Spectrophotometers and UV Spectrophotometers, Introduction of chromatography – Gas Chromatography

C. RECOMMENDED TEXT / REFERENCE BOOKS

.Instrumentation Devices & Systems by Rangan, Sharma & Mani, 2nd edition-2005
.Mechanical & Industrial Measurement by: R.K. JAIN, 11h Edition- 2004
.Handbook of Analytical Instruments by: RS Khandpur, 16th reprint -2005
.Instrumentation Measurement & Analysis by: B.C. NAKRA & K. K. CHAUDHRY,3rd edition-2013
.Mechanical & Industrial Measurement by: R.K. JAIN, 11th Edition-2004
.Handbook of Analytical Instruments by: R. S. KHANDPUR
.Instrumentation devices & systems by RANGAN, SHARMA & MANI
.Industrial Instrumentation Fundamentals by: A.E.FRIBANCE

D. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Develop awareness about needs of measurement systems along with their design-development, classification and associated technical terminologies
CO2	Synthesis	Aware about criteria to design measurement system
CO3	Application	Develop measurement system for different process parameters as per standards.
CO4	Understand	Understand static & dynamic characteristics of instruments
CO5	Analysis	Learn methods and applications in the field of analytical instrumentation.

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1								
CO2	3	2	1	1								
CO3	3	3	2	2	2	3	2	3	2	1	1	1
CO4	3	3	3	3	2							
CO5	2	2		2	1	3						1

	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	3	3
CO3	3	3	3
CO4	3	2	2
CO5	2	1	1

F. LIST OF EXPERIMENTS

1. Demonstrate the characteristics of Linear Variable Displacement Transformer
2. To Perform the characteristics of Light Dependent Resistor
3. To Perform the characteristics of Strain Gauge
4. Demonstrate the characteristics of Capacitive Pick-up
5. Observe characteristics of Piezoelectric Pick-up
6. Demonstrate the working of Proximity Switch
7. Measurement of pH of different solutions using Combination Electrode.
8. Measurement Of Conductivity Using Conductivity Cell (DIGITAL).
9. Measurement of Relative Humidity.
10. Gas Chromatography

B. TECH. SEMESTER – V (IC)

SUBJECT: (IC-5XX) PROCESS MEASUREMENT

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PCC

A. COURSE OVERVIEW: This course provides knowledge about the measurement of process parameters like Pressure, temperature, Flow and Level. Measurement of these parameters is a very important and crucial part of plant engineering specially in process and manufacturing industries. Further, the knowledge of the measuring equipment is very essential for Instrumentation and control engineering students.

B. DETAILED SYLLABUS

NO TOPIC

[A] PRESSURE MEASUREMENT:

Manometers, Elastic type – Bourdon tube, diaphragm, bellows elements, Bell gauges, Solid State, Piezo-elastic and vibrating element type pressure transducer, Vacuum gauges Mechanical and electric types, differential pressure transmitter, ISA/ANSI/IEC Standards for pressure measurement devices

[B] FLOW MEASUREMENT:

Theory of flow system, Reynold's number, Variable pressure (Head) type meters-orifice, Orifice calculations and installation, Venturi tube, Pilot tube, Flow nozzle. Variable Area meters-rotameter, Open channel meters, Mass flow meters, Velocity meters, Quantity meters, Electomagnetic flow meter, turbine flow meters, Ultrasonic flow meters, Vortex flow, Anemometers, Flow markers, Laser anemometers, Flow measurement for solid materials, ISA/ANSI/IEC Standards for flow measurement devices

[C] LEVEL MEASUREMENT:

Theory of level measurement, Float gauges, Differential pressure type level measurement technique, Level measurement by weighing, bubbler technique, thermal effect type, Capacitance type, Ultrasonic and radiation type level measurement techniques, level measurement in open vessels and pressure vessels, Measurement of interface levels, Measurement of level of dry material, ISA/ANSI/IEC Standards for level measurement devices

[D] TEMPERATURE MEASUREMENT:

Liquid Gas and Vapour filled thermometers, Bimetal thermometers, Resistance Thermometers RTD, Thermisters, Thermo electric temperature measurement technique Thermocouples and thermopiles Radiation thermometers optical and electrical pyrometers Accuracy and response characteristic of different devices, Differential Temperature measurement, ISA/ANSI/IEC Standards for temperature measurement devices

C. RECOMMENDED TEXT/REFERENCE BOOKS

[1] Industrial Instrumentation, D.P. Eckman. , CBS Publishers and Distributers
[2] Principles of industrial instrumentation , D Patranabis, Tata Mc Graw Hill
[3] Industrial Instrumentation and Control, S.K.Singh, Tata Mc Graw Hill
[4] Instrumentation Devices and system , Rangan, Sharma, Mani, McGraw Hill Education
[5] Instrumentation, Measurement and Analysis , B.C. Nakra & K. K. Chaudhary , McGraw Hill
[6] Mechanical And Industrial Measurements, R. K. Jain, Khanna Publishers
[7] Modern Sensors Handbook, Pavel Ripka, Wiley
[8] Industrial Instrumentation- Principles & Design , Tattamangalam R.Padmanabham, Springer

[9] Instrumentation and Process Measurement , W.Bolten, Universities Press
[10] Instrumentation Measurement and Control , A.K. Ghosh, PHI

D. COURSE OUTCOMES

After completion of the course students should be able to:

CO Number	Skill	Statement
CO1	Understand	Describe working principle and operation of various transducers/sensors for process measurements applications
CO2	Understand	Describe the construction of various instruments used for measurement of process parameters like pressure, temperature, level and flow in automation and control
CO3	Analyze	Describe and analyze various standards and characteristics of the sensors for process parameters like pressure, temperature, level and flow in automation and control
CO4	Apply	Describe features of measuring devices for selection, calibration, installation and commissioning of instrumentation systems.

E. COURSE MATRIX

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	0	1	3	2	1	1	0	2
CO2	3	3	2	1	0	1	2	1	1	1	0	2
CO3	3	3	3	2	0	1	2	1	1	1	0	2
CO4	3	3	2	2	0	1	3	2	1	1	0	2

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	2	1	1
CO3	2	1	2
CO4	1	1	1

G. LIST OF EXPERIMENTS

1. To find out input output characteristic of RTD
2. To find out time constant of given RTD
3. To find out input output characteristic of Thermocouple
4. To find out time constant of given Thermocouple
5. To find out characteristic of Thermistor
6. To measure temperature of an object using non contact thermometer
7. To find out characteristics of given strain gauge pressure transducer
8. To find out characteristics of given piezoelectric pressure transducer
9. To measure flow using orifice plate
10. To measure flow using Venturi tube
11. To measure level in a tank using hydrostatic level sensor
12. To measure level in a tank using Ultrasonic level sensor

B. TECH. SEMESTER – V (IC)

SUBJECT: (IC5XX) COMMUNICATION SYSTEMS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
2	1	0	3	3	60	0	0	0	60

Reference Code PEC

Type of Course: Program Elective-II

Prerequisite: Analog Electronics

Rationale: In the modern world, communication is crucial for exchange of information. Modern communication relies on efficient hardware and is based on analog and digital techniques. This course will equip students with the knowledge of communication techniques and hardware components.

A. OBJECTIVES OF THE COURSE

- To understand the basic concepts of communication systems and protocols
- To familiarize students with analog and digital communication
-To impart knowledge about hardware components involved in fundamental and modern communication systems.

B. DETAILED SYLLABUS

[A] INTRODUCTION TO COMMUNICATION SYSTEMS

Introduction to Communication, Elements of Communication System, Need for Modulation, Electromagnetic Spectrum & Typical Applications, Basic Terminologies in Communication Systems, Signal Representation & Analysis

[B] AMPLITUDE MODULATION

Principles of Amplitude Modulation (AM), AM modulating circuits, AM Modulator & Demodulator Circuits, Basics of AM Transmitters & Receivers.

[C] ANGLE MODULATION

Introduction, Principal of FM, Sinusoidal FM & Analysis, Non-Sinusoidal Modulation : Deviation Ratio, Phase Modulation, Comparison between PM & FM, Sinusoidal PM, Digital PM, Angle Modulators & Demodulators, FM Transmitters & Receivers

[D] DIGITAL COMMUNICATION

Introduction, Information Capacity, Bits, Bit Rate, Baud, and Mary Encoding, Amplitude-Shift Keying, Frequency-Shift Keying, Phase-Shift Keying, Quadrature-Amplitude Modulation, Bandwidth Efficiency, Carrier Recovery, Clock Recovery, Differential Phase-Shift Keying, Probability of Error and Bit Error Rate. Error Performance

[E] PULSE MODULATION

Introduction, Pulse Amplitude Modulation, Pulse Code Modulation, Differential PCM, Delta Modulation, Pulse Frequency Modulation, Pulse Time Modulation, Pulse Position Modulation, Pulse Width Modulation

[F] FIBER OPTICS

Introduction, History of Optical Fiber Communications, Optical Fibers versus Metallic, Electromagnetic Spectrum, Block Diagram of an Optical Fiber Communications System, Optical Fiber Types, Light Propagation, Optical Fiber Configurations, Optical Fiber Classifications, Cable Facilities, Losses in Optical Fiber Cables, Light Sources, Optical Sources, Light Detectors, Lasers

[H]INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING

Introduction & History, Data Communications Network Architecture, Protocols and Standards, Standard Organization for Data Communication, Layered Network Architecture, Data Communication Circuits, Serial & Parallel Data Transmission, Data Communication Circuit Arrangement, Data Communication networks

[I]FUNDAMENTAL CONCEPTS OF DATA COMMUNICATIONS

Introduction, Data Communications Codes, Bar Codes, Error Control, Error Detection, Error Correction, Character Synchronization, Data Communications Hardware, Data Communications Circuits, Line Control Unit, Serial Interfaces (RS232 & RS485), Data Communications Modems

D. COURSE OUTCOMES

After completion of the course students should be able to:

CO Number	Skill	Statement
CO1	Understand	To understand fundamentals of communication systems and data communication models
CO2	Analyze	To understand and analyze different modulation techniques and study of various protocols for data communication in industrial networking
CO3	Analyze	To understand hardware, circuits for implementation of modulation techniques and study fiberoptics data communications.

E. COURSE MATRIX

Mapping of CO's and PO's (number grading)

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12
CO1	2	0	0	2	3	0	0	2	0	0	0	0
CO2	2	0	0	0	2	3	0	0	0	0	0	0
CO3	3	0	0	3	3	2	0	2	2	0	0	3

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	3	3	2
CO3	3	2	2

G. RECOMMENDED TEXTBOOKS

[1] Electronics Communication, Roddy & Coolen, Pearson Prentice Hall, Inc.

[2] Advanced Electronic Communications Systems, Wayne Tomasi, Pearson Education Limited.

[3] Electronic Communication Systems, George Kennedy, Tata McGraw-Hill Education Pvt. Ltd.

H. REFERENCE BOOKS AND NOTES

[1] Modern digital ananlog communication system, B.P.Lathi

[2] Electronic Communication Systems, William Schweber, PHI Publication.

[3] Communication systems, Simon Haykins, John Wiley Publication.

B. TECH. SEMESTER – V (IC)

SUBJECT: (IC-5XX) CYBER PHYSICAL SYSTEMS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
2	1	0	3	3	60	0	0	0	60

Reference Code PEC

Type of Course: Program Elective-II

A. COURSE OVERVIEW

Cyber Physical System (CPS) plays crucial role in today's industry, where automation is generally achieved by interdisciplinary mode involving various branches of engineering to solve real life problems. It improves the standard of living of human life. It provides challenges to implement next generation systems leading to solutions showing future trends, application area and challenges.

B. DETAILED SYLLABUS

NO TOPIC

[1] Introduction to Cyber Physical Systems

Cyber-Physical Systems (CPS) in the real world , Basic principles of design and validation of CPS, Industry4.0, Auto SAR, IIOT implications, Building Automation, Medical CPS

[2] CPS-Environment

Human and CPS, Human Computer Interface(HCI),Hardware and Software Co-Design CPS HW platforms - Processors, Sensors, Actuators, CPS Network – Wireless Hart, CAN, Automotive Ethernet, CPS Sw stack- RTOS, Scheduling Real Time control tasks

[3] CPS Engineering

CPS Models, Low level Control, Mid High Level Control and Automation, From features to software components, CPS performance Analysis- effect of scheduling, bus latency, Sense and actuation faults on control performance, network congestion Architecture and Design Language

[4] CPS Analysis and Verification

Advanced Automata based modeling and analysis, Basic introduction and examples, Timed and Hybrid Automata Formal Analysis: Flow pipe construction, reachability analysis, Analysis of CPS Software, Weakest Pre-conditions, Hybrid Automata Modeling: Flow pipe construction using SpaceX and Phaver tools, CPS SW Verification: Frama-C

[5] CPS Security

Information and Cyber Security basics, Privacy in CPS, Threats to CPS in various domains such as Automotive, Medical, Industrial control etc.,CPS Attack models

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Principles of Cyber-Physical Systems, Rajeev Alur, MIT Press
2) Introduction to Embedded Systems-A Cyber-Physical System Approach, Sanjit Seshia, MIT Press
3) Verification and Control of Hybrid Systems: A Symbolic Approach, P. Tabuada, Springer-Verilog

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Understand	To develop awareness regarding Cyber Physical System and its design and implementation in various applications
CO2	Understand	To familiarize regarding CPS environment, Human Computer Interaction design aspects and relevant hardware-software
CO3	Understand	To study implementation technologies for CPS engineering design
CO4	Understand	To learn CPS modelling, analysis and security aspects for CPS

E. COURSE MATRIX

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	0	1	0	0	0	0	1	0	0	0	1
CO2	2	0	2	0	0	0	0	1	0	0	0	0
CO3	2	0	2	0	0	0	0	1	0	0	0	0
CO4	1	0	2	0	0	0	0	1	0	0	0	0

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	3	3	2
CO3	3	2	2
CO4	2	2	2

B. TECH. SEMESTER – V (IC)

SUBJECT: (IC-5XX) ENTREPRENEURSHIP AND INNOVATION

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
2	-	1	3	2.5	60	0	25	25	110

Reference Code OEC

A. COURSE OVERVIEW

This Innovation and Entrepreneurship course focuses on the interconnection between entrepreneurial thinking and innovation. Specifically, we look at models used in Silicon Valley to grow both start-up companies as well as innovation inside large organizations. This course addresses critical areas for successful growth, including design thinking, open innovation, business models, product-market fit, and financing. This course will teach you how to think like an entrepreneur and provide you with the models, tools, and frameworks to further develop your business or idea.

B. DETAILED SYLLABUS

NO TOPIC

[1] INTRODUCTION TO SUSTAINABLE ENTREPRENURSHIP

Sustainability, Innovation and Society: Sustainability: The Concept for Modern Society, Challenges for the Future; Innovation and Entrepreneurship: The Invisible Cycle; Sustainability, Ethical Perspectives; International Perspective on Entrepreneurship.

[2] BUSNESS RELATED CONCEPTS AND CSR STRATEGY

Business Related Concepts: Entrepreneurship: A Driver for Innovation, Next Stage of Responsible Business; Entrepreneurship: Introducing Shared Innovation into the Business Model; the Evolution of CSR from Compliance to Sustainable Entrepreneurship; How to Design CR Strategies that Optimize Impact for Business and Society.

[3] CORPORATE CAPABILITY MANAGEMENT

Implementation and Instruments: Embedding Entrepreneurship in Companies: The Eternal Internal Challenge; Fostering Sustainable Innovation within Organizations; Corporate Capability Management: Collective Intelligence in Use for Improvement on a Company's Sustainability, Innovativeness and Competitiveness.

[4] SOCIAL ENTREPRENURSHIP

New perspectives: Social Entrepreneurship/ Responsible Entrepreneurship; Sustainability and SMEs: The Next Steps; Risk Management Issues; Marketing issues; funding a venture; presentation on idea generation by students for their business; writing, refining and
presenting the business model for the proposed business idea.

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Weidinger, C. (2014). Sustainable Entrepreneurship Business Success through Sustainability. Springer. Leal-Millan, A., Peris-Ortiz, M., & Leal-Rodríguez, A. L. (2018). Sustainability in Innovation and Entrepreneurship. Springer International Publishing: Cham, Switzerland.
2) Sharma, S., Starik, M., & Wuebker, R. (2008). Sustainability, innovation and entrepreneurship: introduction to the volume.
3) Nicolopoulou, K., Karatas-Ozkan, M., Janssen, F., & Jermier, J. M. (Eds.). (2016). Sustainable entrepreneurship and social innovation. Taylor & Francis.
4) Wagner, M. (Ed.). (2017). Entrepreneurship, innovation and sustainability. Routledge.
5) Larson, A. (2011). Sustainability, innovation, and entrepreneurship

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Analysis	Understand and imbibe the concepts of sustainability and sustainability entrepreneurship opportunities that arise even in crisis situations
CO2	Synthesis	Learn ecological problems facing local and global communities and recognize.
CO3	Analysis	Evaluate the rewards and risks of undertaking Sustainable Entrepreneurship
CO4	Application	Learn to exploit opportunities in the form of innovative products, services, and production processes that alleviate social or environmental conditions.

E. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	0	0	0	3	3	1	1	0	0	3
CO2	0	3	3	2	0	2	0	0	0	0	0	2
CO3	0	0	0	0	0	3	3	2	0	0	0	2
CO4	0	0	3	2	0	2	3	2	0	0	0	1

F. CO AND PSO MATRIX

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3
CO2	2	2	2
CO3	2	1	2
CO4	1	1	1

B. TECH. SEMESTER – VI (IC)

SUBJECT: (IC-6XX) MICROCONTROLLER APPLICATIONS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PEC

Type of Course: Program Elective-III

Prerequisite: Basic Programming, Digital Electronics, Microcontroller Fundamentals

Rationale: Microcontrollers are widely used in various applications to control products, devices, processes and systems and hence it is important for students involved with the domain of Instrumentation and Control as well as Automation. This subject will equip students with skills required to conceive and implement microcontroller based system.

A. OBJECTIVES OF THE COURSE

- To utilize features of microcontroller system for various applications
- To design/implement required hardware circuits for sensing/measurement and control
- To write assembly and C programs for AVR microcontrollers for interfacing hardware components

B. DETAILED SYLLABUS

NO TOPIC

[1] AN AVR MICROCONTROLLER DESIGN
Aspects of microcontroller design, Testing the Design, Timing Subroutine, Lookup Tables Concept

[2] PROGRAMMING DISPLAYS
LCD Pin diagram, LCD Interfacing, LCD Datasheet, LCD Timing diagram, LCD Programming : 8 bit mode, Programming and Interfacing : 4 bit mode, Seven Segment Display: Interfacing & programming

[3] DATA ACQUISITION
Different types of Keyboard, Keyboard Programming Issues, Keyboard programming logic, Keyboard Interfacing & programming, ADC Characteristics, Concept of Successive Approximation, ADC Programming, Internal ADC Programming, Sensor Interfacing and signal conditioning, DAC interfacing, Programming DAC for signal generation

[4] ACTUATION
Relay, Relay Interfacing, Optoisolators, Stepper Motor Construction, Interfacing & Programming, Stepper motor control : Normal 4 step sequence, Wave drive 4 step sequence, Half step 8 step sequence, Input Capture programming, Wave Generation in AVR , PWM Programming & DC Motor Speed Control, Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Comparison Circuits

[5] SERIAL
Serial Data Communication, Serial Peripheral Interface, MAX7221 Display Interface using SPI, Inter IC bus, DS1307 RTC Interface using I2C, RS232 & RS485 Bus Communication applications using UART.

[6] OTHER APPLICATIONS
Measurement of frequency, Voltage, Current, Power, Temperature, Pressure, Level & Flow

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) The AVR Microcontroller & Embedded Systems, by Mahuammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Pearson Publication
2) Embedded Systems, by B. Kanta Ra, PHI
3) Fundamentals of Microprocessors & Microcomputers ,b y B. Ram, Dhanpat Rai Publications
4) Microprocessor Application in Control & Instrumentation by Bibbero
5) Programming and Customizing the AVR Microcontroller by Dhananjay Gadre

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Analysis	To understand, analyse criteria/features of microcontroller according to applications
CO2	Application	To design signal conditioning circuits, understand hardware components and protocols
CO3	Application	To develop high level and assembly language programs using internal organization of AVR architecture based microcontroller and build applications.

E. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	0	1	1	0	0	0	0	0
CO2	3	0	3	0	3	2	0	0	0	0	0	1
CO3	3	3	3	3	3	0	0	0	0	0	0	0

F. CO AND PSO MATRIX

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2
CO2	3	3	2
CO3	3	2	2

F. LIST OF EXPERIMENTS

1. Introduction to AVR microcontroller kit
2. Buzzer test with delay
3. I/O Interfacing
4. LCD Display
5. Keyboard Interfacing
6. ADC Interfacing & LCD Display
7. Motion Control using L293 Driver IC
8. Real Time Clock display using DS1307
9. ULN 2003 high current driver Interfacing
10. Serial Communication using RS232

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PEC

Type of Course: Program Elective-III

Prerequisite: Basic Programming, Digital Electronics

Rationale: Microcontrollers are single chip computers, integrating processor, memory and other peripheral modules into a single System-on-Chip (SoC). Engineers associated with the Instrumentation/Electrical domain need to have an understanding of such embedded systems, both hardware and software. This subject will equip students with programming and analytical skills required for embedded system implementation. Specifically, the students would be able to comprehend ARM controller architectures.

A. OBJECTIVES OF THE COURSE

- To understand architecture of ARM microcontrollers
- To equip with skills required for microcontroller system implementation
- To write programs for ARM microcontrollers as per requirement

B. DETAILED SYLLABUS

[A] TECHNICAL OVERVIEW OF ARM CORTEX M3 & M4 PROCESSORS

General Information & Features of ARM Processors

[B] ARM ARCHITECTURE

Introduction, Programmer's model, Application Program Status Register (APSR), Memory Exceptions & Interrupts, System Control Block, Debug, Reset & Reset Sequence, Architecture Over view of STM324xx Cortex M4, Introduction to Memory & Bus Architecture

[C] INSTRUCTION SET

Introduction & Comparison of Instruction set of M4 Processor, Understanding Assembly Language Syntax, Unified Assembly Language, Instruction Set , Cortex M4 Specific Instruction Set, Barrel Sifter

[E] MEMORY SYSTEM

Memory System Feature, Memory Map, Interfacing of Processor to memory & peripherals, memory requirement, Data Alignment & Unaligned data access support, Bit band Operation ,Memory access permission & attributes, Memory barriers & memory system in microcontroller, Embedded flash memory interface of STM32, Overview of memory protection unit

[E] EXCEPTIONS AND INTERRUPTS

Overview of Exceptions & Interrupts, Types of Exceptions, Interrupt management, Priority & Vector Table, Interrupt Input & Pending Behaviours, Exception Sequence Overview , NVIC Registers for interrupt control,

SCB Registers for interrupt & exception Control, Special Registers for Exception or Interrupt masking, Examples & Software Interrupts, Exception Handling in C, Exception Sequence, Exception Handling Optimisation.

[F]FLOATING POINT OPERATION & DSP

Floating Point data Presentation, FPU of Cortex M4, Lazy stacking, Floating Point operation in C, Floating point exceptions, DSP on a microcontroller, Dot product, Cortex-M4 DSP instructions, Writing optimized DSP code. Writing optimized DSP code

[G]INTRODUCTION TO CORTEX M4 PERIPHERALS

Power Control, Reset & Clock Control, System Configuration Controller, General Purpose Digital I/O, Watch Dog Timer, Basic Timer, General Purpose Timers, Advanced Control Timers, Real Time Clock, Analog to Digital Converter, PWM & DMA Controller

C. COURSE OUTCOMES

After completion of the course students should be able to:

i To conceptually comprehend advanced microcontroller architectures/systems

ii To utilize/apply features of embedded system and build programming logic/logical flowcharts

iii To write/create assembly language and C programs for AVR microcontrollers

D. Mapping of CO's and PO's (number grading)

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	1	0	0	0	0	0	0	0	2
CO2	0	0	3	2	3	1	0	0	0	0	0	0
CO3	0	0	3	3	3	0	0	0	0	0	0	0

E. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	3	3	2
CO3	3	2	2

F. RECOMMENDED TEXTBOOKS

1. The Definitive Guide to ARM® CORTEX® -M3 and CORTEX® -M4 Processors (Third Edition) By: Joseph Yiu, Newnes, Elsevier
2. Embedded Systems By: B. Kanta Rao , PHI Learning Private Limited.
3. STM32F4xx Reference Guide By: Silicon Technologies

G. REFERENCE BOOKS AND NOTES

1. Mastering STM32 ,A step-by-step guide to the most complete ARM Cortex-M platform, using a free and powerful development environment based on Eclipse and GCC, By: Carmine Noviello

H. LIST OF EXPERIMENTS

1. Getting Started with Integrated Development Environment (Student Edition Open Source)
2. System Clock & Configuration Programming
3. Digital I/O Programming
4. General Purpose Timer & Time Delay Applications in C
5. Advanced Timer Applications Programming in C
6. DMA Application Programming in C
7. ADC Application Programming in C
8. UART Application Programming in C
9. SPI & I2C Programming in C
10. Temperature Monitoring

B. TECH. SEMESTER – VI

SUBJECT: (IC6XX) INSTRUMENTATION SYSTEMS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PCC

A. COURSE OVERVIEW

This course provides useful information regarding standard P&I diagrams and their interpretation. This course also provides useful information for standard instrument installation practices and safety instruments and related aspects. The course also provides knowledge about DCS architecture, networking fundamentals and application of industrial networking for automatic industrial process control.

B. DETAILED SYLLABUS

NO **TOPIC**

[1] **INTRODUCTION & SYMBOLS**
Introduction to instrumentation system, Standard instrumentation system symbols, Symbols for Distributed Control Systems, Standard P & I diagrams for typical instrumentation systems.

[2] **INSTRUMENT AIR SYSTEMS**
Sizing criteria, Pressure level, air supply source, compressor systems, dryers, Distribution systems, case purging for electrical area classification

[3] **CONTROL CENTRES AND CONTROL PANELS**
Control rooms, layout, Uninterruptible power supply, electrical classifications, Control panel types, graphical displays, Panel inspection

[4] **INDUSTRIAL NETWORKING**
An introduction to networking in process automation, Serial Communication, communication formats,error checking, encoding, communication modes, Serial interface standards, RS-232, RS-422, RS-485, USB, HART network, Field buses, MODBUS, PROFIBUS, FOUNDATION, Infrared, Radio and Wireless LAN networks, Introduction to OLE and OPC.

[5] **DISTRIBUTED DIGITAL CONTROL SYSTEMS**
Introduction, History, Architecture of DCS, Architecture of DCS components – like Process Control Units, Single Loop & Multi Loop Controllers, Man-Machine Interface, Key-board units, Engineering unit etc., Typical graphics display used in DCS, Architecture of some popular DCS.

[6] **INSTALLATION PRACTICE**
Installation practice for commissioning, maintenance & renovation of a plant. Documents required for installation of instrumentation systems. Testing of different instruments. Industry Standards & Recommended Practices for the installation & maintenance of various Instruments.

[7] **SAFETY DEVICES**
Pressure safety valves, pressure relief valves, pressure switch, rupture disc, flame arrester, intrinsic safety

C. RECOMMENDED TEXT/REFERENCE BOOKS

1) Applied Instrumentation in Process Industries, Vol. I and II by Andrews & Williams
2) Instrument Engineer's Handbook (Process Control), by B. G. Liptak
3) Computer based industrial control, by Krishnakant, 1997 edition
4) PC-based Instrumentation Concepts and Practice by N. Mathivanan

D. COURSE OUTCOMES

CO NUMBER	SKILL	STATEMENT
CO1	Application	To understand, interpret, design and apply P and I diagrams
CO2	Understand	To understand instrument air systems and control room supply systems
CO3	Understand	To study and understand working of safety devices and standard installation procedures for instruments
CO4	Analysis	To study, compare, and analyze distinguishing architectures of popular DCS and industrial networking

E. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	0	3	0	0	0	2	2	1	1
CO2	3	2	2	0	1	0	0	0	2	2	1	1
CO3	3	1	2	0	1	0	0	0	2	2	1	1
CO4	3	2	2	0	3	0	0	0	2	2	1	1

F. CO AND PSO MATRIX

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2
CO2	2	2	2
CO3	2	2	2
CO4	3	3	3

F. LIST OF EXPERIMENTS

1. Instrumentation symbols and their interpretation
2. Uninterruptible Power supply.
3. P and I diagrams using Smart Draw – software tool
4. Compressor for Instrument Air supply system
5. Pressure switch
6. Air Filter and Regulator unit for instrument air supply
7. Strip Chart Recorder
8. Application of MODBUS communication
9. HART protocol and its applications
10. DCS architecture

B. TECH. SEMESTER – VI (IC)

SUBJECT: (IC6XX) POWER PLANT AUTOMATION

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
2	1	-	3	3	60	0	0	0	60

Reference Code PEC

Type of Course: Program Elective-IV

Prerequisite: Measurement Techniques, Process Measurement

Rationale: Core subject for Instrumentation and Control Engineering undergraduate course. Modern Power Plant are having DCS/PLC systems. The purpose is to lessen the various automated control process in the power plant process. Also to add up as various numbers of process are going on it is quite difficult to maintain each and every process manually.

A. OBJECTIVES OF THE COURSE

- To prepare students to acquire knowledge various types of power plants.
- To prepare students to acquire knowledge different control techniques for boiler and turbine.
- To prepare students to acquire knowledge about various interlocks and safety standards for turbine and generator.

B. DETAILED SYLLABUS

[A] Introduction to Power Plant:

Plant overview, Role of Control and instrumentation in power plant, Classification of power plants: thermal, hydro, combined cycle and nuclear.

[B] Boiler & Turbine Supervisory Control:

Introduction, Operation, Drum level control, Combustion control, Turbovisory system, Measurement and analysis of gas, Super-heated steam temperature, Level, Pressure and Flow. Coordinated controls of boiler and turbine.

[C] Power Plant Process:

Boiler process, Turbine process, Fuel Handling Plant, Air Compressor, etc.

[D] Power Plant Subsystem Automation:

Control of mill throughput, Mill temperature control, Forced draught control, Feed pump control, Boiler-following-turbine load control, Advanced Gas Cooled Reactors (AGRs) .

[E] Electrical Instruments and Metering:

Recorders and Industrial Displays, Electrical Instruments and Metering Working of meters, Meter calibration.

[F] Plant Optimization:

Performance optimization of power plant with integrated Controls, Plant Optimization Performance measurement of power plant.

[G]System Interlocks and Safety:

Turbine Interlock and Protections, Interlock and Protections for Generator.

C. COURSE OUTCOMES

CO NUMBER	SKILL	STATEMENT
CO1	Understand	To understand, thermal power plant and nuclear power pant and understand the role of control and instrumentation in power plant.
CO2	Understand	To understand, solar power plant and wind power pant and understand the role of control and instrumentation in power plant.
CO3	Understand	To s understand various thermal power plant optimization performance parameters

D. Mapping of CO's and PO's (number grading)

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	3	2	1	1	1	2	1	1	1
CO2	3	3	2	2	0	0	0	0	0	0	0	0
CO3	3	3	2	2	2	3	1	1	2	0	1	1

E. CO AND PSO MATRIX

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2
CO2	2	2	2
CO3	2	1	1

F. RECOMMENDED TEXTBOOKS

[1] Modern Power Station Practice: Incorporating Modern Power System Practice: Vol. F- Control and Instrumentation. / by British Electricity International

[2] Instrumentation Engg's Handbook on Process Control- Bela G. Liptak

[3] Power plant Engineering – P. K. Nag, Mc Graw Hill, 3rd edition

G. REFERENCE BOOKS AND NOTES

[1] Power plant instrumentation and control handbook – Swapan Basu and Ajaykumar Debnath, Academic Press, 1st edition

[2] Standard Handbook of Power plant Engineering– Thomas C. Elliot, Mc Graw Hill

[3] Energy and Power Generation Handbook – K. R. Rao, ASME Press

B. TECH. SEMESTER – VI(IC)

SUBJECT: (IC6XX) ANALYTICAL INSTRUMENTS

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
2	1	0	3	3	60	00	00	00	60

Reference Code PEC

Type of Course: Program Elective-IV

A. COURSE OVERVIEW

Analytical Instruments is a course to make the students aware about importance of analytical instruments to control quality of food, chemicals and pharmaceutical and beverages. The latest techniques such as GC, Spectrometers etc. have been included. The knowledge gained in this subject will help the students to work in this field.

B. DETAILED SYLLABUS

NO.	TOPIC
[1]	**Spectrophotometers: UV - VIS – IR** Electromagnetic radiation, beer-Lambert law, Absorption Instruments, Colorimeters, Spectrophotometers, Sources of error in Spectrophotometric Measurement, Calibration.
[2]	**Spectrophotometers**: **IR, Raman & Photo acoustic and photo thermal** Infrared Spectroscopy, Basic Components of Infrared spectrophotometers, Sample Handling Technique Fourier Transform Infrared Spectroscopy, Calibration, Attenuated Total Reflection Technique, Raman Spectrometers, Photo acoustic and photo thermal Spectrometers.
[3]	**Gas Chromatograph, Liquid Chromatograph & Mass Spectrometers:** Chromatography, Basic Parts of a Gas Chromatograph, Methods of Measurements of Peak Areas, Liquid chromatography, types of LC, Amino Acid Analyzers. Basic Mass Spectrometers, Types of Mass Spectrometry, Components of Mass Spectrometers, Resolution, Application of Mass Spectrometry.
[4]	**Flame Photometers & X-Ray Spectrometers:** Principle, Constructional Details of Flame Photometers, Clinical Flame Photometers,Accessoriesfor Flame Photometers, Interferences in Flame Photometry, Procedure for Determination.
[5]	**Electron and Ion Spectroscopy:** Surface Spectroscopic Techniques, Electron Spectroscopy, Instrumentation for ElectronSpectroscopy, Ion Spectroscopy, Instrumentation for Ion Spectroscopy, Radio chemical Instruments, Automated Biomedical Analysis Systems.
[6]	**Gas Analyzer & Industrial Gas Analyzers:** Blood pH measurement, CO2 & O2 Analyzer, gas analyzers, para-magnetic O2 analyzer, magnetic wind analyzer, IR gas analyzer.

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Handbook of Analytical Instruments by: R. S. KHANDPUR
2) Instrumentation methods by B. K. Sharma
3) Analytical Instrumentation by Bela G. Liptak
4) Laboratory Instrumentation by Mary C. Haven (Author), Gregory A. Tetrault(Author), Jerald R. Schenken (Author)

D. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Develop awareness about needs of different Analytical instruments for measuring different parameters for analysis and testing of the products, classification and associated technical terminologies.
CO2	Analyse	Compare specifications and salient characteristics based choice making of analytical instruments and methods and applications in the field of Analytical instrumentation.
CO3	Analyse	Develop awareness of measuring different strategies with analytical instruments and acquired the knowledge about its importance for the analysis and testing of any product/material with the help of different analytical instruments.

E. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	3	2	1	1	1	2	1	1	2
CO2	3	3	2	2	0	0	0	0	0	0	1	2
CO3	3	3	2	2	2	3	1	3	2	0	1	2

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1
CO2	2	2	2
CO3	3	2	2

B. TECH. SEMESTER – VI (IC)

SUBJECT: (IC6XX) PROCESS INSTRUMENTATION AND CONTROL

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PCC

Type of Course: Program Core

Prerequisite: Measurement techniques, Process measurement and control theory

A. COURSE OVERVIEW

Core subject for Instrumentation and Control Engineering undergraduate course. Using proper instrumentation and control systems maintain the proper ratio of ingredients, regulate temperatures and monitor outputs. Without this standard of control, products would vary and quality would be impaired. With improved quality comes higher levels of safety.

B. DETAILED SYLLABUS

NO TOPIC

[1] P/I AND I/P CONVERTERS
Manometric transducers, Torque balance design, Oscillator type, electro pneumatic transducers, Transducer positioners, magnetic converters, differential transformer converters

[2] CONTROLLER PRINCIPLES
Introduction, process characteristics, control system parameters, discontinuous controller modes, continuous controller modes, composite control modes

[3] CONTROL LOOP CHARACTERISTICS
Introduction, control system configuration, Single and multivariable control systems, Control system quality, Stability, Process loop tuning

[4] PNEUMATIC CONTROL VALVE AND ACTUATORS
Introduction, operating mechanism of control valves, direction control valves, construction and working of control valves, Pneumatic Actuators, Selection of control valves and actuators

[5] CONTROL VALVE CHARACTERISTICS
Characteristics of control valves, rangeability, control valve selection, Sizing of control valves

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Process Control Instrumentation Technology, By: C. D. Johnson, Pearson Education Ltd

2) Industrial Instrumentation Fundamentals By: Austin Fribance, Tata McGraw Hill publication

3) Applied Instrumentation in Process Industries, Vol. II, By: W. G. Andrews/H. B.Williams, Gulf Publication Company

4) Control system components By: M. D. Desai, Pearson Prentice Hall, Inc

5) Measurement systems: Applications & Design By: Ernest Doeblin, McGraw Hill

6) Instrumentation measurement & analysis By: B.C. Nakra & K. K. Chaudhary, McGraw Hill

7) Mechanical & Industrial Measurement, By: R. K. Jain, Khanna Publishers

8) Transducers & Instrumentation, By: D. V. S. Moorty, PHI Learning Pvt.Ltd

9) Instrumentation-Devices & Systems, By Rangan, Sharma & Mani, Tata McGraw Hill publication

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Application	Understand the basic hardware components used in feedback control system design
CO2	Application	Design and analyze P, PI, PD, PID Controllers
CO3	Understand, Analysis	Understand and identify the criteria for selection for pneumatic control valve upon various selection parameters.

E. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	0	1	1	0	0	0	0	2
CO2	3	0	3	0	3	2	0	0	0	0	0	2
CO3	3	0	3	0	3	2	0	0	0	0	0	2

F. CO AND PSO MATRIX

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3
CO2	3	3	2
CO3	2	2	2

G. LIST OF EXPERIMENTS

1 To perform the working of the given I to P Converter.

2 To perform the working of the given P to I Converter.

3 To study and develop various controller simulations using Simulink

4 To simulate the Proportional controller.

5 To simulate the Proportional Integral controller.

6 To simulate the Proportional Integral Derivative controller.

7 To study various control valve cut sections

8 To study various Pneumatic actuators

9 To study various Pneumatic Control valves

10 To perform characteristics of Control valves

B. TECH. SEMESTER – VI (IC)

SUBJECT: (IC6XX) AUTOMATION SYSTEM INTEGRATION

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PCC

A. COURSE OVERVIEW

Automation System Integration course makes a bridge between academics and industries in automation field. This subject is introduced to make students aware about the concept and components of Automation system and make students aware about basics of communication protocols used for automation application and also to enable students to write PLC program for a given application and also prepare the students to develop automation application using PLC and SCADA.

B. DETAILED SYLLABUS

NO. TOPIC

[1] PROGRAMMABLE LOGIC CONTROLLER

The PLC: A Overall look :-Introduction, Manufacturing and assembly process , PLC advantages and Disadvantages, Overall PLC system , CPU and Programmers , PLC Input/output modules, Solid state memory

General PLC programming Procedures

Devices connected with PLC I/O modules :-Input/output on/off switching devices **,** Input/ output Analog devices

Programming on/off inputs to produce on/off outputs

Relation to digital gate logic to contact/coil logic

Creating ladder diagrams from process control descriptions

PLC Basic functions :-PLC timer, counter, arithmetic functions

PLC Intermediate functions :-PLC Number comparison functions **,** Numbering systems and PLC number conversion functions

Data Handling Functions:-PLC skip and master control relay functions, JUMP functions, PLC data moves.

PLC functions working with bits:- Digital bits, Sequential, controlling a robot with PLC, Matrix functions

Advanced PLC functions :- Analog PLC operations, PID control of continuous process, networking of PLCs

PLC Installation, Trouble shooting and maintenance

PLC Auxiliary Commands and Functions Monitor Mode function, Force mode function, functions for different programming formats, print functions, Selection of PLC, Industrial control and rise of PLC, PLC versus PC, factors to consider in selecting a PLC

PLC Installation Practices Installation Practices, Consideration of the operating environment, receiving check, testing and assembly, electrical connections, grounding and suppression considerations, circuit protection and wiring, troubleshooting PLC malfunctions, PLC maintenance

[2] DATA ACQUISITION SYSTEM

Introduction of Data Acquisition system, sampling concept, digital to analog converters, analog to digital converters, Block diagram, Protections in DAS, Isolation in DAS, Data Acquisition Configuration

[3] SYSTEM INTEGRITY LEVEL IN AUTOMATION SYSTEMS

Conceptual design stage, ISA conceptual design stage, IEC 615108 on conceptual design, skills and resources, basic SIS configuration, shared functions, technology choices, pneumatics relays, safety relay, solid state systems,

[4] SAFETY PLC

Programmable systems for the logic solver, upgrading of PLCs for safety applications, characteristics of safety PLCs, hardware characteristics of safety PLC, software characteristics of safety PLC, design of safety PLC, Triple Modular Redundant (TMR) systems, safety PLC with 1oo3 architecture, communication features of safety controllers, classification and certification , SIS architecture conventions

[5] BASICS OF SCADA CONFIGURATION

Basic & Advance configuration of WONDERWARE SCADA, Detail study of SCADA configuration building blocks

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Programming Logic Controllers- Principles and applications, By John W. Webb & Ronald Reis, PHI, fifth Edition (2006)
2) PC based Instrumentation – Concepts and practice By N.Mathivanan, PHI, 2007 Edition
3) Practical Industrial safety, Risk Assessment and Shutdown Systems By- Dave Macdonald, Elsevier science technology,
4) User manual for Wonderware InTouch SCADA development software
5) Programming Logic Controllers- Programming methods and applications
   By John R. Hackworth & Frederick D. Hackworth Jr. , Pearson Education, Low Price Edition
6) Programming Logic Controllers and Industrial Automation – An Introduction,
   By Madhu chhanda, Samarjit sen Gupta, Tata Mc Graw Hill

D. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Describe the basic architecture of automation systems incorporating PLC, DAQ and SCADA
CO2	Application	Describe, design and develop PLC programs using ladder diagrams.
CO3	Create	Design and develop industrial automation applications using PLC

E. COURSE MATRIX

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	1	2	1	1	0	0	1
CO2	3	3	3	3	3	2	1	2	2	0	2	1
CO3	3	3	3	3	3	2	1	2	2	1	2	2

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	3	3	2
CO3	3	3	3

G. LIST OF EXPERIMENTS

1. Introduction to Wonderware InTouch SCADA
2. Study of basic features of SCADA
3. Study of Advanced features of SCADA
4. Programming in SCADA using scripts
5. Study and understand RSLogix 500 software.
6. Development of ladder program using bit instructions
7. Development of ladder program using Timer Functions
8. Development of ladder program using counter and compare Functions
9. Development of ladder program using Advance (Arithmetic) Functions
10. Development of ladder program using Advance (Analog) Functions
11. Development of ladder program using Advance (Program control and Sequencer) Functions
12. Project Development

B. TECH. SEMESTER – VI (IC)

SUBJECT: (IC6XX) ECONOMICS AND MANAGEMENT

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
2	0	0	2	2	40	0	0	0	40

Reference Code: HSMC

A. COURSE OVERVIEW

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To acquire knowledge of economics to facilitate the process of economic decision making. Acquire knowledge on basic financial management aspects. Develop the skills to analyze financial statements. This course introduces the basic concepts of management and organisation structure of an industry, Material management cost analysis, engineering economics and project management.

B. DETAILED SYLLABUS

NO TOPIC

[1] INTRODUCTION

Introduction: The Scope and Method of Managerial economics –Fundamental Economics concepts – Managerial Economics with other subjects – Objectives of the Firm

[2] DEMAND AND SUPPLY ANALYSIS

Meaning, Types and Determinants – Demand estimation- Demand elasticities for decision making – Business and Economic forecasting: Qualitative and Quantitative methods – Supply analysis: Meaning, elasticities and determinants – Market equilibrium and price determination

[3] PRODUCTION ECONOMICS

Production and Production function – Types – Estimation – Returns to Scale – Economies and Diseconomies of Scale and Economies of Scope. Factor Inputs – Input-Output Analysis

[4] MARKET STRUCTURE

Perfect Competition – Imperfect Competition: Monopoly – Monopolistic – Oligopolistic Strategy, Cartels, Cournot, Kinked Demand and Price Leadership. Oligopolistic Rivalry & Theory of Games – Measurement of economic concentration – Policy against monopoly and restrictive trade practices – Competition Law – Pricing Practices: Objectives – Determinants – Pricing Methods – Government Policies and Pricing

[5] INTRODUCTION TO MICRO ECONOMICS

Circular Flow of Income and Expenditures – Components of National Income and its significance – Measuring Gross Domestic Product (GDP) – Inflation and Business Cycles – Government Fiscal and Monetary Policy – Balance of payments – Foreign exchange markets

C. RECOMMENDED TEXT / REFERENCE BOOKS

1) P.L. Mehta – Managerial Economics Analysis, Problems and cases, Sultan Chand & Co. Ltd., 2001
2) Peterson and Lewis: Managerial Economics, 4th Ed., Prentice Hall , 2004
3) Dholakia and Oza: Microeconomics for Management Students, 2nd Edition, Oxford University Press
4) Gregory Mankiw: Principles of Microeconomics, Havcourt Asia Publishers, 2001
5) Mote and paul – Managerial Economics, Tata McGraw Hill, 2001

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Analysis	Evaluate the economic theories, cost concepts and pricing policies
CO2	Analysis	Understand the market structures and integration concepts
CO3	Analysis	Understand the measures of national income, the functions of banks and concepts of globalization.
CO4	Analysis	Apply the concepts of financial management for project appraisal
CO5	Analysis	Understand accounting systems and analyze financial statements using ratio analysis
CO6	Analysis	Understand the impact of inflation, taxation, depreciation. Financial planning,

E. COURSE MATRIX

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	0	0	0	0	2	2	0	0	0	3	3
CO2	0	1	0	2	0	0	2	0	0	0	3	0
CO3	0	0	0	0	0	0	2	0	0	0	2	2
CO4	0	0	0	2	0	0	0	0	0	0	3	3
CO5	0	0	0	0	0	0	1	0	0	0	3	3
CO6	0	0	0	0	0	0	0	0	0	0	1	3

F. CO AND PSO MATRIX

PSO CO	PSO1	PSO2	PSO3
CO1	2	2	2
CO2	3	2	2
CO3	2	2	2
CO4	2	1	1
CO5	2	2	2
CO6	2	1	1

B. TECH. SEMESTER – VI (IC)

SUBJECT: (IC6XX) INTRODUCTION TO R PROGRAMMING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
2	0	2	4	3	60	0	25	25	110

Reference Code OEC

Type of Course: Open Elective

Prerequisite: Basic Programming, C Programming

Rationale: Since the world is marching towards a future that would be highly dependent on to data in order to analyze, evaluate the underlying information. R is an open source programming language which is widely accepted and used for data analysis and graphics design. R lets you clean, organize, analyze, visualize, and report data in new and more powerful ways. In this course the students will learn how to program in R and how to use R for data analysis.

A. OBJECTIVES OF THE COURSE

- To utilize R for basic programming
- To employ R programming for statistical analysis
- To familiarize R programming as a tool for data visualization and representation.

B. DETAILED SYLLABUS

NO TOPIC

[1] INTRODUCTION
Introduction, Overview and History, R Console Input and Evaluation, Data Types, Reading Tabular Data, Textual Data Formats, Subsetting, Vectorized Operations

[2] PROGRAMMING IN R
Control Structures - If-else, Control Structures - For loops, Control Structures - While loops, Control Structures - Repeat, Next, Break, Functions, Scoping Rules, Statistical analysis in R : Descriptive Statistics, Measures of Central Tendency and variability, Skewness, Correlations, Simple Linear Regression

[3] LOOP FUNCTIONS & DEBUGGING
Loop Functions – lapply, apply, mapply, tapply, split ; Diagnosing problems, Basic Tools

[4] DATA VISUALIZATION
Using ggplot, Enhancing visualizations, Aesthetics, Saving visualizations

C. RECOMMENDED TEXTBOOKS

1. R for Data Science, Hadley Wickham, Garrett Grolemund, O' Reilly Publications.
2. The Book of R, Tilman M. Davies, No Starch Publications.
3. Learning Statistics with R, Daniel Joseph Navarro, Lulu Press Incorporated.
4. Hands on Programming with R,Garett Grolemund, , O' Reilly Publications.

D. REFERENCE BOOKS AND NOTES

.1. Advanced R, Hadley Wickham, CRC Press.

E. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Analysis	To comprehend critical programming language concepts
CO2	Analysis	To analyse data and discover meaningful information
CO3	Application	To implement techniques for data analysis and visualization

F. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	3	0	0	0	0	0	0	0	0	2
CO2	0	3	3	3	3	0	0	0	0	0	0	0
CO3	3	3	2	3	3	0	0	0	0	0	0	0

G. CO AND PSO MATRIX

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2
CO2	3	3	2
CO3	3	2	2

G. LIST OF EXPERIMENTS

1. Study of basic Syntaxes in R
2. Vector data objects operations
3. Matrix, array and factors and perform va in R
4. Use of data frames in R
5. Data manipulation with R
6. Data Manipulation with dplyr package
7. Data Manipulation with data.table package
8. Control structures in R
9. Data Visualization with ggplot
10. Lab Project

B. TECH. SEMESTER – VII (IC)

SUBJECT: (IC-7XX) BIOMEDICAL INSTRUMENTATION

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PCC

TYPE OF COURSE: Program Core
PREREQUISITE: Knowledge of Instrumentation and Measurement

A. COURSE OVERVIEW

The course is designed to give the basic concepts of Instrumentation involved in medical field and human physiology. Biomedical Instrumentation is application of technology for Medical field. During the course, students will explore Electro-physiological measurements, medical imaging etc. The course will make the students understand the devices used in diagnosing the diseases.

B. DETAILED SYLLABUS

NO **TOPIC**

[1] **Measurement, Recording and Monitoring:**
Fundamentals of Medical Instrumentation:
Anatomy and Physiology, Physiological system of Body, Sources of Biomedical Signals, Basic Medical Instrumentation System, Performance requirement of Medical Instrument system, General Constraints of Medical Instrument system, Regulations of Medical Devices

[2] **Bioelectric signals and Electrodes:**
Origin of Bioelectric signals, Recording Electrodes, Electrodes for ECG, EEG, EMG, Electrical conductivity of electrodes jellies and creams, Micro-electrodes, Skin surface electrodes and needle electrodes

[3] **Recording systems :**
Basic recording system, General considerations for signal conditioners, Preamplifiers, Sources of noise in low level measurement, Biomedical signal analysis techniques, Signal processing techniques, The main amplifier and driver stage, Different types of recorders, VCG, PCG, EEG, EMG, ECG

[4] **Patient monitoring Systems:**
System concepts, Cardiac monitor, Bedside Patient Monitoring system, Central Monitors, Measurement of Heart Rate, Measurement of Blood Flow, Measurement of Pulse Rate, Blood Pressure Measurement, Measurement of Temperature, Measurement of Respiration rate, Catherization lab instrumentation

[5] **Modern Imaging Systems:**
X-Ray Machines and Digital Radiography:
X-Rays, X-Rays Machine, X-Ray Computed Tomography, Nuclear Medical Imaging Systems, Emission Computed Tomography (ECT),Single Photon Emission Computed Tomography (SPECT),Positron Emission Tomography (PET), Magnetic Resonance Imaging (MRI)

[6] **Ultrasonic Imaging Systems:**
Diagnostic Ultrasound, Physics of Ultrasonic waves, Medical Ultrasound, Basic Pulse echo apparatus, A- scan, Echocardiograph, Real time Ultrasonic Imaging Systems, Biological effects of ultrasound

[7] Cardiac Pacemakers:
Need for Cardiac Pacemakers, External Pacemakers, Implantable Pacemakers, Recent Development in Pacemakers

[8] Cardiac Difibrillators:
Need for Cardiac defibrillator, DC Defibrillator, Implantable Defibrillator, Pacer-Cardioverter-Defibrillator

Instruments for Surgery:
Surgical Diathermy, Surgical Diathermy Machine, Safety aspects in Surgical Diathermy machine, Surgical Diathermy Analyzers

[9] LASER Application in Biomedical Engineering:
What is LASER?, Different types of LASER, Effects of Tissues and related issues, Selection of LASER for surgery, Application in different areas, Safety Aspects

[10] Haemodialysis machine:
Function of Kidneys, Artificial Kidneys, Dialyzer, Haemodialysis machine

Electrical Safety of Medical Equipment:
Physiological effect of electrical current, Shock hazard form electric equipment, Methods of accident prevention

Latest Issues in BME:
Biomaterials, Telemedicine, Artificial heart

C. RECOMMENDED TEXT / REFERENCE BOOKS

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co
2. Ltd., 2003.
3. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.
4. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
5. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.

E. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Understand	Understand the physiology of biomedical system by studying different bio electric signals of human body.
CO2	Understand	To measure biomedical and physiological information and study various electronic devices and Instruments.
CO3	Understand	Discuss the application of Electronics in diagnostics and therapeutic area and to study various imaging and body scan techniques.

F. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	2	0	1	1	1	1	0	0	1
CO2	1	3	3	2	0	1	0	0	0	1	1	1
CO3	3	3	2	2	0	1	1	1	1	1	1	1

G. CO AND PSO MATRIX

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	2
CO2	2	2	2
CO3	1	2	2

H. LIST OF EXPERIMENTS

1. To perform the Blood Pressure Measurement Unit.
2. To perform the Blood Flow Measurement.
3. To perform the Respiration Rate Meter.
4. To perform the D.C. Defibrillator.
5. To perform the Heart Rate Indicator.
6. To perform the Single channel ECG Machine.
7. To perform the Medical Telemetry Machine.
8. To perform the Multi-parameter Monitor.
9. To perform the Tread Mill Tester.
10. To perform the External Pacemaker.
11. To perform the Phonocardiograph System.

B. TECH. SEMESTER – VII (IC)

SUBJECT: (IC7XX) DIGITAL SIGNAL PROCESSING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

PEC

Program Elective-V

A. COURSE OVERVIEW

"Digital signal processing" is a core course in the field of data processing. Course starts from the basic concepts of discrete-time signals and proceed to learn how to analyze data via the Fourier transform, how to manipulate data via digital filters and how to convert analog signals into digital.

B. DETAILED SYLLABUS

NO. TOPIC

[1] DISCRETE-TIME SIGNALS AND SYSTEMS
Introduction, Representation of Discrete-Time Signals, Basic Operations on Sequences, Classification of Discrete-time Signals, Classification of Discrete-Time Systems

[2] DISCRETE CONVOLUTION AND CORRELATION
Impulse Response and Convolution Sum, Analytical evaluation of Discrete Convolution, Convolution of finite sequences, Methods to compute the convolution sum of two sequences, Deconvolution using tabular method, Interconnection of LTI System, Discrete Correlation

[3] THE Z-TRANSFORMS
Z-transforms by summation of left, right and two-sided sequences, Regions of convergence and z-transform properties, inverse z-transforms

[4] SYSTEM REALIZATION
Introduction, Realization of discrete time systems, Structure for realization of IIR systems, Structures for Realization of FIR Systems

[5] DISCRETE –TIME FOURIER TRANSFORM
Discrete – Time Fourier Transform(DTFT), Existence of DTFT, Relation between Z-Transform and Fourier Transform, Relation between Z- Transform and Fourier Transform, Inverse DTFT, Properties of DTFT

[6] DISCRETE FOURIER SERIES AND DISCRETE FOURIER TRANSFORM
Discrete Fourier Series, Properties of DFS, Relation between DFT and Z transform, Comparison between DTFT and DFT, IDFT, Properties of DFT

[7] INTRODUCTION OF INFINITE DURATION IMPULSE RESPONSE (IIR) FILTERS AND FIR FILTERS
Introduction, Requirements for Transformation, Design of IIR Filters, Specification of the Low-pass Filter, Design of digital low–pass butterworth and chebyshev filters, Characteristics of FIR filters

C. RECOMMENDED TEXT / REFERENCE BOOKS

1. Digital Signal Processing: A. Anand Kumar, PHI Publication

2. Discrete Time Control Systems: Katsuhiko Ogata, Pearson Edition,2nd Edition

3. Digital Signal Processing: A Computer-Based Approach, S. K. Mitra, McGraw-Hill, Third edition, 2006.

4. Analog and Digital Signal Processing by Ashok Ambardar, THOMSON Books/Ole

5. Discrete-Time Signal Processing by A. V. Oppenheim and R. W. Shafer, PHI,2/E, 2000

6. Digital Signal Processing: Principles, Algorithms and Applications, J. Proakis, D. Manolakis, Prentice-Hall, 2006 (4-th edition)

7. Digital Filters – Analysis, Design & Applications by Andreas Antoniou, Tata McGrow Hill, 2nd Edition

D. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Classify discrete time signal systems based on their properties, to understand and use the implications of linearity, time-invariance, causality, memory, gain knowledge about Z transform tool for discrete system for analysis
CO2	Analyze	Describe Fourier transforms, convolution and correlation for continuous-time and discrete-time signals, apply system realization methods and z transformation tools for design and analysis of discrete time system for IIR and FIR filters,
CO3	Application	Describe DTFT and DFT for analysis of discrete time systems, understand and apply the design techniques for IIR and FIR filter using transformation technique

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	1	0	2	2	1	1
CO2	3	3	1	1	3	2	1	0	1	2	1	1
CO3	3	3	3	3	3	1	2	0	2	2	1	1

	PSO1	PSO2	PSO3
CO1	2	1	2
CO2	1	1	1

CO2	2	2	1

F. LIST OF TUTOTRIALS

1. Introduction to signals and systems
2. Basic operations on Discrete time signals
3. Convolution and Correlation
4. Z-Transformation
5. Inverse Z- Transformation
6. Discrete System Realization
7. Discrete time Fourier Transform and Discrete Fourier Transform
8. Introduction to FDA Tool
9. IIR/ FIR Filter design (Butterworth filter)
10. IIR/ FIR Filter design (Chebyshev filter)

B. TECH. SEMESTER – VII (IC)

SUBJECT: (IC7XX) INDUSTRIAL ELECTRONICS & DRIVES

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

PEC

Program Elective-V

A. COURSE OVERVIEW

Electronics adapted to industrial plant, in terms of timings action switching or parameter control is called Industrial Electronics. The student should study this subject with a view to understand the use of electronics and drives to bring about faster and more accurate responses in industrial plants.

B. DETAILED SYLLABUS

NO. TOPIC

[1] **POLYPHASE RECTIFIERS:** Three phase controlled converters, Three pulse Converters(M3 Connection), Six Pulse Converters, Three Phase fully Controlled Bridge Converters, Three phase half Controlled Bridge Converter, Selection of Converter Circuits

[2] **CONVERTERS & INVERTERS:** Chopper Classification & Operation, Chopper Control Strategies, Chopper Configuration, Thyristor based Chopper Circuits, AC Choppers, Classifications of Inverters, Single phase Voltage source inverters, Performance Parameters of Inverters, PWM Inverter, 3 Phase Inverter, Thyristor based Inverters, Series Inverter, Self Commutated Inverter, Parallel Inverter, Current Source Inverter

[3] **AC & DC DRIVES:** Introduction, Speed Control of Induction Motors, Stator Voltage Control, Variable Frequency Control, Schemes for DC motor Speed Control, PLL Control of DC Drives, DC Chopper Drives

[4] **INDUSTRIAL APPLICATIONS:** Introduction, Introduction Heating, Dielectric Heating, Welding, HVDC Transmission, Smart UPS, Hybrid and Elecrtical Vehicles

[5] **CYCLOCONVERTER & DUAL CONVERTER:** Introduction, Basic Principle of Cycloconverters and Dual Converters, Single phase to single phase cycloconverter, Dual converter with and without circulating current Operation, Dual mode dual Converter

C. RECOMMENDED TEXT / REFERENCE BOOKS

1. A Text book on Power Electronics – Devices, Circuits, Systems and Applications, 2 nd Edition, by Dr. H. C. Rai
2. Industrial Electronics and Control, PHI Publication, Biswanath Paul
3. Power Electronics By: M.D. Singh, K.B. Khandchandani Tata Mcgrawhill, 2nd Edition Industrial Electronics, 11th Edition, by G. K. Mithal
4. Calculations in Industrial Electronics and Instrumentation, by V. K. M. John
5. Engineering Electronics, by John D. Ryder
6. Electric Motor Drives - Modeling, Analysis, And Control, by R. Krishnan

D. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the application of Induction heating & Dielectric Heating
CO2	Application	Develop designing skill of different types of choppers , inverters and polyphase rectifiers
CO3	Analysis	Analyse industrial applications of DC & AC Drives

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	0	0	0	1	0	1	1
CO2	3	3	1	1	1	1	1	0	0	1	0	2
CO3	3	3	3	3	2	1	2	0	1	1	0	2

	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	3	3
CO2	3	2	2

F. LIST OF EXPERIMENTS

1. operation of forced commutation Class A, Class- B and Class –C
2. Perform the operation of forced commutation Class D and Class -E
3. Perform the operation of DC motor Speed Control
4. Perform the operation of Jone's Chopper
5. Perform the operation of Morgan's Chopper
6. Single Phase full wave Controlled bridge Rectifier with R Load
7. single Phase full wave Controlled bridge Rectifier with RL Load
8. Perform the operation of Series Inverter
9. Perform the operation of Parallel Inverter
10. Perform the operation of Cycloconverter

B. TECH. SEMESTER – VII (IC)

SUBJECT: (IC-7XX) ADVANCED CONTROL THEORY & DESIGN

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	0	3	3	60	00	00	00	60

Reference Code PCC

TYPE OF COURSE: Program Core
PREREQUISITE: Basic Engineering Mathematics, Basics of Control Theory

A. COURSE OVERVIEW

This course provides knowledge about selection and design of controllers. Using this learning, students can build and analyze stability of different models of control systems. Also the course provides knowledge of advanced process control methods/models for automation and control.

B. DETAILED SYLLABUS

NO TOPIC

[1] System compensation
Introduction to system compensation, Time domain compensation technique using root locus, Frequency domain compensation, Techniques using Bode Plots, Minor-loop Design of Control System

[2] State variable analysis
Introduction, State modes of linear continuous-time systems, Diagonalization, Solutions of state equations, Concept of controllability & Observability, Direct method of Liapunov's stability analysis.

[3] Optimal control systems
Introduction, Performance indices, Parameter optimization: Servomechanisms

[4] Network synthesis
Introduction, Positive Real Function, Synthesis of One Port LC, RC, RL and RLC passive networks

[5] Advanced process control
Introduction to Advance Control Systems – Adaptive Control, Model Reference Adaptive Control (MRAC), Internal Model control

C. RECOMMENDED TEXT / REFERENCE BOOKS

1. Control system engineering by I. J. Nagrath & M. Gopal
2. Modern Network Synthesis by Van Valkenburg
3. Control system principles and design by M. Gopal

D. REFERENCE BOOKS AND NOTES

1. State space analysis of control system by Ogata
2. Modern control theory by J. T. Tou
3. Modern control system theory by M. Gopal
4. Linear Control System (Analysis & Design conventional & Modern) by D'azzo & Houpis
5. Design of Feedback System by Thaler G. J. Digital control and state variable methods by M. Gopal

E. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Application	To apply state variable analysis techniques with Parameter optimization control problems
CO2	Create	To design Network synthesis and compensator/controller using various approaches
CO3	Analysis	To understand and differentiate the Adaptive control strategy and conventional PID controller with their characteristics

F. COURSE MATRIX

POs COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	2	0	1	1	1	1	0	0	1
CO2	2	3	3	2	0	0	0	0	0	1	1	0
CO3	3	2	2	2	0	1	1	1	1	1	1	1

G. CO AND PSO MATRIX

PSO CO	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2
CO2	2	2	1
CO3	1	2	2

H. LIST OF TUTORIALS

1. Introduction to state space models of control systems
2. State model Controllability and Observability
3. State model analysis
4. Describing function method
5. Introduction to Optimal control systems
6. Introduction to compensation in control systems
7. Compensation in Time domain
8. Compensation in Frequency domain
9. Testing driving point functions
10. Passive network synthesis

B. TECH. SEMESTER – VII (IC)

SUBJECT: (IC-7XX) PROCESS CONTROL

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

Reference Code PCC

A. COURSE OVERVIEW

For ensuring safety along with high quality production in huge quantities, efficient control of the manufacturing process and unit operation is mandatory. In context with basic control algorithm of PID, the course provides useful knowledge regarding control strategies and advanced control strategies for solving complex industrial process control problems. This course provides knowledge about conceptual and advanced level knowledge for development of industrial process control strategies. The course discusses in depth the nature and intricacies of different widely employed industrial equipments, their process details, relevant critical parameters and their interaction; and suggests efficient control schemes.

B. DETAILED SYLLABUS

NO TOPIC

[1] Introduction to Process Control and Fundamental Concepts

Introduction to process control, Evolution of process control, Laplace transforms in process control, open loop v/s closed loop systems, open loop response, feedback v/s feed forward control configuration

[2] Study and Analysis of Open Loop Response

Open loop response of simple systems, Effects of P, PI, PD & PID controllers on the transient response of control systems, Complex control systems

[3] Study and Analysis of Transient Response and Control Dynamics

Transient response of control systems, Level control.

[4] Control of Key Critical Equipments

Boiler controls, Distillation column controls, Steam turbine controls, Heat exchanger controls

[5] Control Strategies

Ratio control, Cascade control, Feed-forward control, Inverse-derivative control, Split range control, etc.

[6] Advanced Control Strategies

Advance Control Systems – Adaptive Control, Valve Position Control (VPC), etc.

C. RECOMMENDED TEXT / REFERENCE BOOKS

1. Process Control, by Peter Harriot
2. Applied Instrumentation in Process Industries, Vols. I, II & III, by Andrews & Williams
3. Process Control-Principles and Applications, by Surekha Bhanot
4. Instrument Engineer's Handbook (Process Control), by Bela G. Liptak (Vol. II)
5. Chemical Process Control, by Stephanopoulos
6. Process Modeling, Simulation & Control for Chemical Engineers, by W. Luyben
7. Chemical Process Control, by Coughnour & Copel
8. Chemical Process Control, by Shinskey
9. Principles of Process Control, by Patranabis
10. Automatic Control of Power & Process, by Manifold
11. Process Control, by Pollard

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Understand	To understand the fundamental concepts of process control, characteristics and behaviour of typical variable and loop, and complex process control
CO2	Application	To learn operation of most widely used industrial equipments and their suggested control schemes
CO3	Application	To develop awareness regarding limitations of basic PID control, and useful understanding of various control strategies and advance control strategies

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	0	1	1	0	0	0	0	0
CO2	3	0	3	0	3	2	0	0	0	0	0	1
CO3	3	3	3	3	3	0	0	0	0	0	0	0

F. CO-PSO MAPPING

	PSO1	PSO2	PSO3
CO1	3	3	2
CO2	3	3	3
CO3	3	3	2

G. LIST OF EXPERIMENTS

1. Performance analysis of the response of a bare thermometer
2. Performance analysis of the response of thermometer with thermo-well
3. Simulation analysis of the open loop response of a first order system
4. Simulation analysis of the open loop response of a second order system
5. Simulation analysis of the response of Ratio Control Scheme
6. Simulation analysis of the response of Cascade Control Scheme
7. Simulation analysis of the response of Feed Forward Control Scheme
8. Simulation analysis of the response of a first order mixing process
9. Simulation analysis of the response of transportation lag
10. Simulation analysis of the responses of single tank and two tank systems

B. TECH. SEMESTER – VII IC

SUBJECT: (IC-7XX) ROBOTICS ENGINEERING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

PEC

Type of Course: Program Elective -VI

Prerequisite: Mathematics, Electronic Measurement

Rationale: Nowadays, majority of the industries are transitioning towards automation. The industrial manipulators are controlled to perform the required task and operations. This course will equip students with the fundamental aspects of coordinate mapping, transforms, trajectory planning besides sensing and applications

A. OBJECTIVES OF THE COURSE

- To impart knowledge about basic concepts required to understand robot motion
- To familiarize students with approaches to robot modeling and trajectory planning
- To impart knowledge about hardware components, applications involved in robotics

B. DETAILED SYLLABUS

[A] INTRODUCTION

Evolution of Robot and Robotics, Laws of Robotics, Progressive advancement in Robot, Robot Anatomy, Human Arm characteristics.

[B] CO ORDINATE FRAMES, MAPPING & TRANSFORMS

Co ordinate frames, Description of objects in space, Transformation of vectors, Inverting of Homogeneous Transforms, Fundamental rotation Matrices.

[C] MODELING OF ROBOT - DIRECT KINEMATIC MODEL

Mechanical structure and notations, Description of links & joints, Kinematic modeling of the manipulator, Denavit- Hartenberg notation, Kinematic relationship between adjacent links

[D] TRAJECTORY PLANNING

Joint space techniques, Cartesian space techniques

[E] ROBOTIC ACTUATORS, SENSOR & VISION

Sensors in robots , Actuators, Kinds of sensors used in Robotics, Robotic vision

[F] ROBOT SAFETY, ROBOT-ECONOMY & INSTALLATION

Introduction, plant survey, potential safety hazards ,Safety planning checklist, Safety guidelines

C. COURSE OUTCOMES

CO NUMBER	SKILL	STATEMENT
CO1	Understand	To understand basic concepts associated with robots/robotics
CO2	Analysis	To analyze and evaluate various methods for robot description modeling and planning
CO3	Understand	To understand aspects of robot hardware, installation and operation

D. Mapping of CO's and PO's (number grading)

POs COs	A	B	C	D	E	F	G	H	I	J	K	L
i	3	2	2	2	1	1	1	1	1	1	1	1
ii	3	3	3	3	1	1	1	1	1	1	1	1
iii	3	1	3	2	1	2	1	1	1	1	1	1

E. Mapping of CO's and PSO's

PSOs COs	PSO1	PSO2	PSO3
i	2	2	3
ii	3	3	2
iii	2	2	2

F. RECOMMENDED TEXTBOOKS

6. Robotics and Control by I.K.Mittal & I.J.Nagrath ,Second Reprint 2005, Tata McGrawHill

I. Introduction to robotics by Saeed B.Niku, First Indian reprint 2002, Pearson Education

J. Electronic Communication Systems, George Kennedy, Tata McGraw-Hill Education Pvt. Ltd.

G. REFERENCE BOOKS AND NOTES

[24] Robotics by K. S. Fu , R. C. Gonzalez & C.S. G. Lee.

[25] Robotics principles & Practice by K.C.Jain & L.N.Aggarwal, Khanna publishers 2003 edition

H. LIST OF EXPERIMENTS

1. Introduction to Robotics
2. Mapping and Transforms.
3. Kinematic Modelling - I
4. Kinematic Modelling - II
5. Trajectory Planning
6. Robot sensors
7. Robot Vision System
8. Robot Applications
9. FireBird V Robot Buzzer Beep Application
10. FireBird V Robot Line follower Application

B. TECH. SEMESTER – VII IC

SUBJECT: (IC-7XX) FUNDAMENTALS OF MACHINE LEARNING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext.	Sess	TW	Pract.	Total
3	0	2	5	4	60	40	25	25	150

PEC

Type of Course: Program Elective -VI

Prerequisite: Mathematics

Rationale: Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us self-driving cars, practical speech recognition, effective web search, and a vastly improved understanding of the human genome. Machine learning is so pervasive today in various fields and continues to find its way to newer domains. In this course, the students will learn about the most effective machine learning techniques, how to implement them and getting them to work. Additionally, the students will learn about the theoretical underpinnings of most frequently used ML algorithms.

A. OBJECTIVES OF THE COURSE

- To impart knowledge about various algorithms in the domain of machine learning
- To conceptually understand mathematical relationships of various machine learning algorithms
- To familiarize with various aspects that need to be considered for applying ML to different problems

B. DETAILED SYLLABUS

[A] INTRODUCTION

Introduction, Motivation and applications, Basics of supervised and unsupervised learning

[B] REGRESSION TECHNIQUES

Basic concepts and applications of Regression, Simple Linear & Multiple Regression, Gradient Descent, Hyper-parameters tuning, Evaluation Measures for Regression Techniques

[C] CLASSIFICATION TECHNIQUES

Naïve Bayes Classification, K-Nearest Neighbors, Classification Trees, Support Vector Machines, Evaluation Measures for Classification Techniques

[D] ARTIFICIAL NEURAL NETWORKS

Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptron, Back-propagation Neural Networks

[E] DIMENSIONALITY REDUCTION & CLUSTERING

PCA, k-means clustering

C. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To comprehend, differentiate supervised and unsupervised machine learning problems and relevant algorithms
CO2	Understand	To understand mathematical relationships within and across machine learning algorithms
CO3	Analyze	To analyze fundamental issues and application aspects of ML algorithms to various problems

D. Mapping of CO's and PO's

POs COs	A	B	C	D	E	F	G	H	I	J	K	L
i	3	2	2	2		2						
ii	3	3	3	3								
iii	3	3	3	3	3	3						

E. Mapping of CO's and PSO's

PSOs COs	PSO1	PSO2	PSO3
i	2	2	2
ii	3	3	2
iii	3	2	2

F. RECOMMENDED TEXTBOOKS

A. Tom Mitchell, Machine Learning, TMH Publications.
B. C. Bishop, Pattern Recognition and Machine Learning, Springer Publications
C. Simon Rogers, Mark Girolami, First Course in Machine Learning, CRC Press

G. REFERENCE BOOKS AND NOTES

1. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International Publishers.
2. Athem Ealpaydin, Introduction to Machine Learning, PHI Publications
3. Simon Haykin, Neural Networks and Learning Machines, Pearson

H. LIST OF EXPERIMENTS

Simple regression
Multiple regression
Bayes Classification
k nearest neighbours (kNN)
Support Vector Machines
Neural networks for Regression
Neural Networks for Classification
Managing data/accessing data
Dimensionality reduction techniques
Evaluation methods/parameters of ML algorithms

B. TECH. SEMESTER – VII (IC)

SUBJECT: (IC-7XX) SMART INSTRUMENTATION

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
3	0	0	3	3	60	0	0	0	60

OEC

A. OBJECTIVES OF THE COURSE

Modern world manufacturing facilities are upgraded and leading towards smart factories. To equip the factories with state-of-the-art facilities meeting global standards, it is imperative to upgrade the existing instrumentation with smart instrumentation. This course provides knowledge regarding different types of smart sensors and their usage for transducer design. The course also discusses usage of microprocessors for development of smart instrumentation and networking. Relevant international standards are also included in the discussion employed in realization of smart sensor networking. The course intends to make students aware about classification, fabrication and recent trends in sensor technologies, sensor-networking techniques and relevant standards, protocols and technologies.

B. DETAILED SYLLABUS

NO TOPIC

[1] Smart Sensors

Sensors and their classification, Sensor fabrication techniques, Sensors fabrication process details and latest trends in sensor fabrication, some special types of sensors: Fiber optic sensors, Chemical sensors, Biosensors, Characterization of sensors

[2] Sensor Networks:

Basic concepts, Sensor networking, industrial networking, sensor networking solutions, ISO/OSI model of 7-layers, Smart Sensors, Smart Sensor manufacturing technologies, Smart transducers and smart valve actuators

[3] LAN: Technologies, Protocols, and Topologies

Wired and wireless networking, Various topologies, Wired network protocols, wireless network protocols

[4] WSNs and their applications

Basic concepts, purposes, usage, Factors and considerations for applications, Practical implementation issues, WSN standard IEEE 802.15.4, WSN applications in emerging areas

[5] IEEE 1451 Family of Standards

Brief discussions on IEEE 1451.0 standard, IEEE 1451.1 standard, IEEE 1451.2 standard, IEEE 1451.3 standard, IEEE 1451.4 standard, IEEE 1451.5 standard, IEEE 1451.6 standard and IEEE 1451.7 standard

C. RECOMMENDED TEXT / REFERENCE BOOKS

[1] Understanding Smart Sensors by R. Frank, Artech House

[2] Smart Material Systems and MEMS: Design and Development Methodologies: Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan , John Wiley & Sons Ltd.

[3] Data and computer communication by William Stallings, Pearson

[4] Wireless Sensor Networks – Architecture and Protocols, by Edger H. Callaway, CRC Press

[5] Measurement and Instrumentation: Theory and Application, by AS Morris, R Langari and Butterworth-Heinemannm, Elsevier

[6] Intelligent Instrumentation, by G. Barney, PHI

[7] Chemical Sensors and Bio-Sensors, by Brayan Eggins, John Wiley & Sons.

[8] Fiber Optic Sensors, by Eric Udd, Wiley

[9] Smart Sensors, by Chapman P., ISA Publications
[10] John G. Webster, Editor-in-chief, "Measurement, Instrumentation, and Sensors Handbook", CRC Press.

D. COURSE OUTCOMES

CO NUMBER	Skill	Statement
CO1	Understand	To develop awareness regarding sensor technologies, special types of sensors, and relevant terminologies
CO2	Understand	To familiarize regarding wired-wireless networking techniques along with relevant terminologies and technical specifications
CO3	Understand	To study IEEE 1451 family of standards with each sub-standard information and their application for smart transducers development

E. CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	0	1	0	1	0	0	0	0	0	0	1
CO2	1	0	1	0	1	0	0	0	0	0	0	0
CO3	1	0	1	0	1	0	0	0	0	0	0	0

F. CO-PSO MAPPING

	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	2	2
CO3	2	2	1

B. TECH. SEMESTER – VII(IC)

SUBJECT: (IC7XX) INDUSTRIAL EXPOSURE & PRACTICE

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
0	1	2	3	2	0	0	25	25	50

Reference Code PORJ

Type of Course: Project

.A. DETAILED SYLLABUS

The students will undertake vocational training in industries after completion of 6th semester for the period of minimum 3 week and maximum 6 week. They should understand the instrumentation engineer's role in industries. They are supposed to prepared and submit a project report as a part of their term-work for the industrial training and give seminars on their training work.

.B. COURSE OUTCOMES

After completion of the course students should be able to:

CO NUMBER	Skill	Statement
CO1	Understand	Ability to understand of roll of instrumentation engineer in various industries
CO2	Understand	An ability to share knowledge effectively in oral and written form and formulate documents adapt to real time industry exposure and experience
CO3	Understand	value the health, environment, safety and ethical practices during the internship
CO4	Understand	develop lifelong learning skills for productive career / entrepreneurship
CO5	Apply	Identify, formulate and solve a problem of Instrumentation and Control Engineering

C. Mapping of CO's and PO's (number grading)

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	1	2	1	1	1	1	1
CO2	3	3	2	1	1	1	2	1	1	0	0	1
CO3	3	3	2	1	1	1	1	1	1	0	0	0
CO4	3	2	2	1	1	1	1	1	1	1	1	1
CO5	3	2	2	1	1	1	1	1	1	1	1	1

D. Mapping of CO's and PSO's (number grading)

PSOs COs	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2
CO2	3	3	2
CO3	3	2	2
CO4	3	2	2
CO5	3	2	1

B. TECH. SEMESTER – VIII(IC)

SUBJECT: (IC8XX) INDUSTRIAL INTERNSHIP & PROJECT

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
0	0	24	24	12	0	0	0	350	350

PROJ

Type of Course: Program Core

A. DETAILED SYLLABUS

The students will undertake project work for the period of one semester. They should design/develop & fabricate the project. They are supposed to prepared and submit a project report as a part of their term-work for the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance. They should arrange for demonstration of the project work at the time of examination They are to be examined based on viva and/or demonstration.

B. COURSE OUTCOMES

After completion of the course students should be able to:

CO NUMBER	Skill	Statement
CO1	Understand	Make use of acquired knowledge of instrumentation for the problem identification and definition related to current industrial trends
CO2	Analysis	Industrial aspects of the project in a systematic way
CO3	Understand	Selection of modern tools and techniques for problem solving
CO4	Create	Perceive the possibility of scalability and scope of intellectual property rights
CO5	Apply	Demonstrate and conclude the project with effective communication amongst peers and mentors

C. Mapping of CO's and PO's (number grading)

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	0	0	1	2	0	1	1	1	2
CO2	2	3	3	1	1	0	2	1	0	1	0	2
CO3	3	2	2	1	0	0	1	1	1	0	1	1
CO4	2	2	2	0	1	1	1	1	0	1	1	1
CO5	2	2	2	0	1	1	1	1	1	1	1	2

D. Mapping of CO's and PSO's (number grading)

PSOs COs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3
CO2	3	3	2
CO3	2	2	3
CO4	2	2	2
CO5	2	2	2

B. TECH. SEMESTER – VIII(IC)

SUBJECT: (IC8XX) SEMINAR

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Pract.	Total		Ext.	Sess.	TW	Pract.	Total
0	0	12	12	6	0	0	150	0	150

PROJ

Type of Course: Program Core

A. DETAILED SYLLABUS

The aim of this course is to use the industrial internship experience to enable students to develop their engineering skills and practice. The students will be placed in industry / Construction site / Consultancy/ research organization and assessed for academic credit. The internship will be aligned with the aims of the engineering program and its areas of specialization. Students are expected to experience a real-life engineering workplace and understand how their engineering and professional skills and knowledge can be utilized in industry. The internship focuses upon the demonstration of functioning engineering knowledge, both new and existing, and identification of areas of further development for future careers.

B. COURSE OUTCOMES

After completion of the course students should be able to:

CO NUMBER	Skill	Statement
CO1	Apply	An ability to share technical knowledge effectively in oral and written form and formulate project report and presentation
CO2	Understand	Develop work habits, technical skills and attitudes necessary for professional success
CO3	Understand	appraise the importance of an individual and team efforts for effective project execution
CO4	Understand	develop lifelong learning skills for productive career / entrepreneurship

C. Mapping of CO's and PO's (number grading)

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	1	1	1	2	1	1	1	1	1
CO2	2	3	2	1	0	1	2	0	1	1	1	0
CO3	2	2	3	1	1	0	1	1	0	0	1	1
CO4	2	2	2	1	1	1	1	1	1	1	0	1

D. Mapping of CO's and PSO's (number grading)

PSOs COs	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2
CO2	3	2	2
CO3	2	2	2
CO4	2	2	2