St. PETER'S UNIVERSITY

Chennai – 600 054.

B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING
3 & 4 SEMESTERS CURRICULUM AND SYLLABI
Regulations – 2008

SEMESTER III

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	Credit	L	T	P	Marks		
Theory						**CA**	**EA**	**Total**
308EIT01	Transforms and Partial Differential Equations I	3	3	1	0	25	75	100
308EIT02	Environmental Science and Engineering	2	3	0	0	25	75	100
308EIT03	Electrical Machines	2	3	0	0	25	75	100
308EIT04	Electronic Devices and Circuits	2	3	0	0	25	75	100
308EIT05	Data Structures and Algorithms	3	3	0	0	25	75	100
308EIT06	**Electrical Measurements**	3	4	0	0	25	75	100
Practical								
308EIP01	Electron Devices and Circuits Laboratory	1	0	0	3	25	75	100
308EIP02	Data Structures and Algorithms Laboratory	1	0	0	3	25	75	100
308EIP03	Electri**cal Machines Laboratory**	1	0	0	3	25	75	100
	Total	**18**	**19**	**1**	**9**	**225**	**675**	**900**

SEMESTER IV

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

Code No.	Course Title	Credit	L	T	P	Marks		
Theory						**CA**	**EA**	**Total**
408EIT01	Control Systems	3	3	1	0	25	75	100
408EIT02	Industrial Instrumentation - I	2	3	0	0	25	75	100
408EIT03	Transducer Engineering	2	3	0	0	25	75	100
408EIT04	Digital logic Circuits	3	3	1	0	25	75	100
408EIT05	Linear Integrated Circuits and Applications	2	3	0	0	25	75	100
408EIT06	**Applied Thermodynamics**	3	3	1	0	25	75	100
Practical								
408EIP01	Transducers and Measurements Laboratory	1	0	0	3	25	75	100
408EIP02	Thermodynamics Laboratory	1	0	0	3	25	75	100
408EIP03	Linear and Digital **Integrated circuits Lab**	1	0	0	3	25	75	100
	Total	**18**	**18**	**3**	**9**	**225**	**675**	**900**

308EIT01 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 3 1 0 4
(Common o all branches)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

1. FOURIER SERIES 9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

2. FOURIER TRANSFORM 9

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

3. PARTIAL DIFFERENTIAL EQUATIONS 9

Formation of partial differential equations - Lagrange's linear equation - Solution of standard types of first order partial differential equations – Linear partial differential equations of second and higher order with constant coefficients.

4. APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat equation (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

5. Z -TRANSFORM AND DIFFERENCE EQUATIONS 9

Z-transform - Elementary properties – Inverse Z – transform – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TUTORIALS = 15
TOTAL = 60

TEXTBOOKS

1. Grewal B.S, 'Higher Engineering Mathematics', 39th Edition, Khanna Publishers, Delhi, 2007.

REFERENCE BOOKS

1. Bali.N.P. and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications (P) Ltd.

2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company Limited, New Delhi.

3. Glyn James ' ADVANCED MODERN ENGINEERING MATHEMATICS', Third edition – Pearson education – 2007.

4. ERWIN KREYSZIG ' ADVANCED ENGINEERING MATHEMATICS' Eighth Edition – WILEY INDIA – 2007.

308EIT02 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

(Common to EEE, EIE, ICE, Biotech, Chemical, Fashion, Plastic, Polymer & Textile)

AIM

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make him/her sensitive to the environment problems in every professional endeavour that he/she participates.

OBJECTIVES

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity.

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Definition, Scope and Importance – Need For Public Awareness – Forest Resources:- Use and Over - Exploitation, Deforestation, Case Studies, Timber Extraction, Mining, Dams and their Ground Water, Floods, Drought, Conflicts Over Water, Dams - Benefits and Problems – Mineral Resources:- Use Effects on Forests and Tribal People – Water Resources:- Use and Over-Utilization of Surface 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 for Sustainable Lifestyles. Field Study of Local Area to Document Environmental assets – River/Forest/Grassland/Hill/ Mountain.

ECOSYSTEMS AND BIODIVERSITY 9

Concepts of an Ecosystem – Structure and Function of an Ecosystem – Producers, Consumers and Decomposers – Energy Flow in the Ecosystem – Ecological Succession – Food Chains, Food Webs and Ecological Pyramids – Introduction, Types, Characteristic Features, Structure and Function of the (A) Forest Ecosystem (B) Grassland Ecosystem (C) Desert Ecosystem (D) Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries) – Introduction to Biodiversity – Definition: Genetic, Species and Ecosystem Diversity – Biogeographical Classification of India – Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values – Biodiversity at Global, National and Local Levels – 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 – Conservation of Biodiversity: In-Situ and Ex-Situ conservation of Biodiversity.

Field Study of Common Plants, Insects and Birds - Field Study of Simple Ecosystems – Pond, River, Hill Slopes, etc.

ENVIRONMENTAL POLLUTION **9**

Definition – Causes, Effects and Control Measures of:- (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Soil Waste Management:- Causes, Effects and Control Measures of Urban and Industrial Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management:- Floods, Earthquake, Cyclone and Landslides.
Field Study of Local Polluted Site – Urban/Rural/Industrial/Agricultural

SOCIAL ISSUES AND THE ENVIRONMENT **9**

From Unsustainable To Sustainable Development – Urban Problems Related To energy – Water conservation, Rain Water Harvesting, Watershed Management – Resettlement and Rehabilitation of People, Its Problems and Concerns, Case Studies – Environmental Ethics:- Issues and Possible Solutions – Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust, Case Studies – Wasteland Reclamation – Consumerism and Waste Products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and Control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues Involved in enforcement of Environmental Legislation – Public Awareness.

HUMAN POPULATION AND THE ENVIRONMENT **9**

Population Growth, Variation Among Nations – Population Explosion – Family Welfare Programme – environment and Human Health – Human Rights – Value Education – HIV /AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health – Case Studies.

L = 45 TOTAL = 45

TEXT BOOKS

1. Masters, G.M., “Introduction to Environmental Engineering and Science”, Pearson Education Pvt., Ltd., 2nd Edition, 2004.
2. Miller, T.G. Jr., “Environmental Science”, Wadsworth Pub. Co.
3. Townsend C., Harper, J. and Begon, M., “Essentials of Ecology”, Blackwell Science, 2003.
4. Trivedi, R.K., and Goel, P.K., “Introduction to Air Pollution”, Techno- Science Publications.

REFERENCE BOOKS

1. Erach, B., “The Biodiversity of India”, Mapin Publishing Pvt. Ltd., Ahmedabad, India.
2. Trivedi, R.K., “Handbook of Environmental Law’s, Rules, Guidelines,Compliances and Standards”, Vol - I and II, Envio Media.
3. Cunningham., Cooper, W.P. and Gorhani, T.H., “Environmental Encyclopedia”, Jaico Publishing House, Mumbai, 2001.
4. Wages, K.D., “Environmental Management”, W.B. Saunders Co., Philadelphia, USA, 1998.

308EIT03 **ELECTRICAL MACHINES** **3 0 0 3**

(Common to EIE & ICE)

AIM

To impart basic knowledge on Electrical machines, principles and its behavior.

OBJECTIVES

At the end of this course, student would have been exposed to:

- Theory of structures, operating principle, characteristics, and applications of D.C and A.C rotating machines and transformers in detail.
- Introductory knowledge on Special Machines.

D.C. MACHINES **12**

Construction of D.C. Machines - Principle and theory of operation of D.C. generator - EMF equation - Characteristics of D.C. generators - Armature reaction – Commutation - Principle of operation of D.C. motor - Voltage equation - Torque equation - Types of D.C. motors and their characteristics –Starters - Speed control of D.C. motors - Applications.

TRANSFORMERS **9**

Principle - Theory of ideal transformer - EMF equation - Construction details of shell and core type transformers - Tests on transformers - Equivalent circuit - Phasor diagram - Regulation and efficiency of a transformer - Introduction to three - phase transformer connections.

SYNCHRONOUS MACHINES **8**

Principle of alternators:- Construction details, Equation of induced EMF and Vector diagram - Synchronous motor:- Starting methods, Torque, V curves, Speed control and Hunting.

INDUCTION MACHINES **9**

Induction motor:- Construction and principle of operation, Classification of induction motor, Torque equation, Condition for maximum torque, Equivalent Circuit, Starting methods and Speed control of induction motors.

SPECIAL MACHINES **7**

Types of single phase motor –Double revolving field theory – Cross field theory – Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor – Universal motor – Hysteresis motor - Permanent magnet synchronous motor – Switched reluctance motor – Brushless D.C motor.

L = 45 TOTAL = 45

TEXT BOOKS

1. Nagrath, I.J., and Kothari, D.P., " Electrical Machines", Tata McGraw - Hill, 1997.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery", McGraw- Hill, Singapore, 2000.

REFERENCE BOOKS

1. Theraja, B.L., "A Text book of Electrical Technology", Vol.II, S.C Chand and Co., New Delhi, 2007.
2. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi, 1995.
3. Cotton, H., "Advanced Electrical Technology", Sir Isaac Pitman and Sons Ltd., London, 1999.

308EIT04 **ELECTRONIC DEVICES AND CIRCUITS** **3 0 0 3**

(Common to EIE & ICE)

AIM

To provide an exposure to various electronic devices and electronic circuits.

OBJECTIVES

- At the end of the course, students' will have the knowledge about functioning of various types of devices and design of various electronic circuits.

SEMICONDUCTOR DIODE AND BJT **9**

PN Junction – Current components in a PN diode – Junction capacitance – Junction diode switching time – Zener diode – Varactor diode – Tunnel diode – Schottky diode – Transistor Structure – Basic Transistor operation – Transistor characteristics and parameters – The transistor as a switch, as an amplifier – Transistor bias circuits:- Voltage divider bias circuits, base bias circuits, emitter bias circuits, collector feedback bias circuits – DC load line – AC load line- bias stabilization, thermal runaway and thermal stability.

FET, UJT and SCR **9**

JFET characteristics and parameters – JFET biasing, self bias, voltage divider bias – Q point, stability over temperature – MOSFET D-MOSFET, E-MOSFET – MOSFET characteristics and parameters – MOSFET biasing, zero bias, voltage divider bias method, drain feedback bias – Characteristics and applications of UJT, SCR, DIAC, TRIAC.

AMPLIFIERS **9**

CE, CC and CB amplifiers - Small signal low frequency transistor amplifier circuits - h parameter representation of a transistor - Analysis of single stage transistor amplifier using parameters voltage gain, current gain, input impedance and output impedance-frequency response - RC coupled amplifier.

Classification of Power amplifiers:- Class A, B, AB and C Power amplifiers-Push-Pull and Complementary Symmetry Push-Pull amplifiers - Design of power output, efficiency and cross-over distortion.

FEEDBACK AMPLIFIERS AND OSCILLATORS **9**

Advantages of negative feedback - Voltage/current, series/shunt feedback-Positive feedback - Condition for oscillators - Phase shift - Wein Bridge – Hartley - Colpitts and crystal oscillators.

PULSE CIRCUITS AND POWER SUPPLIES **9**

RC wave shaping circuits - Diode clampers and clippers – Multivibrators -Schmitt triggers - UJT - Saw tooth oscillators - Single and polyphase rectifiers and analysis of filter circuits - Design of zener and transistor series voltage regulators - Switched mode power supplies.

L = 45 TOTAL = 45

TEXT BOOKS

1. Millman and Halkias, “Electronic Devices and Circuits”, Tata McGraw– Hill, 2007.
2. Floyd, T.L, “Electronic Devices” 6th Edition, Pearson Education, 2003.
3. Millman and Halkias, “Integrated Electronics”, McGraw-Hill, 2004.

REFERENCE BOOKS

1. Mottershead, A., “Electronic Devices and Circuits an Introduction”,Prentice Hall of India, 2003.
2. Boylsted and Nashelsky, “Electronic Devices and Circuit Theory”, Prentice Hall of India, 6th Edition, 1999.
3. Streetman, B. and Sanjay, B., “Solid State Electronic Devices”, Prentice- Hall of India, 5th Edition, 2005.
4. Bell, D.A., “Electronic Devices and Circuits”, Prentice Hall of India, 4th Edition, 1999.
5. Millman, J., Prakash Rao., M.S. and Taub, H., “Pulse Digital and Switching Wave Forms”, McGraw-Hill, 2007.

308EIT05 DATA STRUCTURES AND ALGORITHMS 3 0 0 3

(Common to EEE, EIE & ICE)

AIM: To master the design and applications of linear, tree, and graph structures. To understand various algorithm design and analysis techniques.

1. LINEAR STRUCTURES 9

Abstract Data Types (ADT) – List ADT – array-based implementation – linked list implementation – cursor-based linked lists – doubly-linked lists – applications of lists – Stack ADT – Queue ADT – circular queue implementation – Applications of stacks and queues

2. TREE STRUCTURES 9

Need for non-linear structures – Tree ADT – tree traversals – left child right sibling data structures for general trees – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT

3. BALANCED SEARCH TREES AND INDEXING 9

AVL trees – Binary Heaps – B-Tree – Hashing – Separate chaining – open addressing – Linear probing

4. GRAPHS 9

Definitions – Topological sort – breadth-first traversal - shortest-path algorithms – minimum spanning tree – Prim's and Kruskal's algorithms – Depth-first traversal – biconnectivity – euler circuits – applications of graphs

5. ALGORITHM DESIGN AND ANALYSIS 9

Greedy algorithms – Divide and conquer – Dynamic programming – backtracking – branch and bound – Randomized algorithms – algorithm analysis – asymptotic notations – recurrences – NP-complete problems

L = 45 Total = 45

TEXT BOOKS

1. M. A. Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education Asia, 2002.
2. ISRD Group, “Data Structures using C”, Tata McGraw-Hill Publishing Company Ltd., 2006.

REFERENCES

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
2. R. F. Gilberg, B. A. Forouzan, “Data Structures: A Pseudocode approach with C”, Second Edition, Thomson India Edition, 2005.
3. Sara Baase and A. Van Gelder, “Computer Algorithms”, Third Edition, Pearson Education, 2000.
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Second Edition, Prentice Hall of India Ltd, 2001.

308EIT06 **ELECTRICAL MEASUREMENTS** **4 0 0 4**

(Common to EIE & ICE)

AIM

To provide adequate knowledge in electrical measurements and instrumentation.

OBJECTIVES

To make the students to gain a clear knowledge of the basic laws governing the operation of electrical instruments and the measurement techniques.

i. Emphasis is laid on the meters used to measure current & voltage.
ii. To have an adequate knowledge in the measurement techniques for power and energy, power and energy meters are included.
iii. Elaborate discussion about potentiometer & instrument transformers.
iv. Detailed study of resistance measuring methods.
v. Detailed study of inductance and capacitance measurement.

1. MEASUREMENT OF VOLTAGE AND CURRENT 9

Galvanometers – Ballistic, D'Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type & thermal type meter, rectifier type – Extension of range and calibration of voltmeter and ammeter – Errors and compensation.

2. MEASUREMENT OF POWER AND ENERGY 9

Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading – Induction type kWh meter – Induction type energy meter – Calibration of wattmeter.

3. POTENTIOMETERS & INSTRUMENT TRANSFORMERS 9

DC potentiometer – Basic circuit, standardization – Laboratory type (Crompton's) – AC potentiometer – Drysdale (polar type) type – Gall-Tinsley (coordinate) type – Limitations & applications – C.T and P.T construction, theory, operation and characteristics.

4. RESISTANCE MEASUREMENT 9

Measurement of low, medium & high resistance – Ammeter, voltmeter method – Wheatstone bridge – Kelvin double bridge – Series and shunt type ohmmeter – High resistance measurement – Megger – Direct deflection methods – Price's guard-wire method – Earth resistance measurement.

5. IMPEDANCE MEASUREMENT 9

A.C bridges – Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Schering bridge – Anderson bridge – Campbell bridge to measure mutual inductance – Errors in A.C. bridge methods and their compensation – Detectors – Excited field – A.C. galvanometer – Vibration galvanometer

L = 45 T = 15 Total = 60

TEXT BOOKS

1. E.W. Golding & F.C.Widdis, 'Electrical Measurements & Measuring Instruments', A.H.Wheeler & Co, 2001
2. A.K. Sawhney, 'Electrical & Electronic Measurements and Instrumentation', Dhanpath Rai & Co (P) Ltd, 2004.

REFERENCE BOOKS

1. J.B.Gupta, 'A Course in Electronic and Electrical Measurements and Instrumentation', S.K. Kataria & Sons, Delhi, 2003.
2. S.K.Singh, 'Industrial Instrumentation and control', Tata McGraw Hill, 2nd edn.,2002.
3. H.S.Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 2004.
4. Martin U. Reissland, 'Electrical Measurement – Fundamental Concepts and Applications', New Age International (P) Ltd., 2001.

308EIP01 ELECTRON DEVICES AND CIRCUITS LABORATORY L T P C
(B.E. (EEE), B.E. (E&I) and B.E. (I & C) 0 0 3 2
(Revised)

1. Characteristics of Semiconductor diode and Zener diode.
2. Characteristics of Transistor under common emitter, common collector and common base configurations.
3. Characteristic of FET
4. Characteristic of UJT.
5. Characteristics of SCR, DIAC and TRIAC.
6. Photo diode, phototransistor Characteristics and study of light activated relay circuit..
7. Static characteristics of Thermistors.
8. Single phase half wave and full wave rectifiers with inductive and capacitive filters.
9. Differential ampliers using FET.
10. Study of CRO
11. Series and Parallel reasonance circuits.
12. Realization of Passive filters.

P: 45 Total : 45

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Regulated Power Supply	15		
2.	Dual Tree CRO (20 MHz)	15		
3.	Function Generator	15		
4.	$3^{1/2}$ Digit digital multimeter	10		
5.	Bread Boards	40		
6.	Transistor	25 Nos.		
7.	JFET	10 Nos.		
8.	Diode	10 Nos.		
9.	Zener Diode	5 Nos.		
10.	UJT	5 Nos.		
11.	Photo Diode	5 Nos.		
12.	Photo Transistor	5 Nos.		
13.	Thermistors	5 Nos.		
14.	OP-amp	10 Nos.		
15.	Milli Ammeter (0-100mA)	15 Nos.		
16.	Micro Ammeter (0-50μA)	10 Nos.		
17.	Low range voltmeter (0-30V)	10 Nos.		
18.	Resistor of various ranges	50 Nos.		
19.	Capacitors of various ranges	50 Nos.		
20.	Connecting wires	Sufficient Nos		

308EIP02 DATA STRUCTURES AND ALGORITHMS LABORATORY 0 0 3 2

(Common to EEE, EIE &ICE)

Aim: To develop skills in design and implementation of data structures and their applications.

1. Implement singly and doubly linked lists.
2. Represent a polynomial as a linked list and write functions for polynomial addition.
3. Implement stack and use it to convert infix to postfix expression
4. Implement array-based circular queue and use it to simulate a producer-consumer problem.
5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6. Implement binary search tree.
7. Implement insertion in AVL trees.
8. Implement priority queue using heaps
9. Implement hashing techniques
10. Perform topological sort on a directed graph to decide if it is acyclic.
11. Implement Dijkstra's algorithm using priority queues
12. Implement Prim's and Kruskal's algorithms
13. Implement a backtracking algorithm for Knapsack problem
14. Implement a branch and bound algorithm for traveling salesperson problem
15. Implement any randomized algorithm.

P = 45 Total = 45

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Computer(Pentium 4)	40 Nos with one server		
2.	Dot matrix printer	3 Nos		
3.	Laser Printer	2 Nos		
4.	UPS (5 KVA)	2		
5.	Turbo C	40 Nodes		

308EIP03 **ELECTRICAL MACHINES LABORATORY** **0 0 3 2**

(Common to EIE & ICE)

1. Open circuit characteristic of DC Shunt Generator.
2. Load test on DC Shunt Generator.
3. Speed control of DC Shunt Motor.
4. Brake test on DC Shunt Motor.
5. Brake test on DC Series Motor.
6. Regulation characteristic of three - phase Alternator.
7. Open circuit and short circuit tests on Single - phase Transformer.
8. Load test on Single - phase Transformer
9. Load test on Three - phase Induction Motor.
10. Brake test on Single - phase Induction Motor.
11. 'V' curves of Synchronous Motor.
12. Power measurement in three - phase circuit using two - wattmeter method.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	D.C motor – Generator set D.C motor – Shunt Generator D.C motor – Compound Generator	 2 set 2 set		
2.	D.C. Shunt Motor	2 Nos.		
3.	D.C. Series Motor	1 No.		
4.	D.C. Compound Motor	1 No.		
5.	Single phase transformers	7 Nos.		
6.	Three phase transformers	2 Nos.		
7.	D.C. Motor – Alternator set	4 sets		
8.	Three phase Induction Motor (Squirrel cage)	3 Nos.		
9.	Three phase slip ring Induction Motor	1 No.		
10.	Single phase Induction Motor	2 Nos.		
11.	Resistive load 3 phase – 2 , single phase - 3	5 Nos.		
12.	Inductive load	1 No.		
13.	Single phase Auto transformer	5 Nos.		

14.	Three phase Auto transformer	3 Nos.		
15.	Moving Coil Ammeter of different ranges	20 Nos.		
16.	Moving Coil Voltmeter of different ranges	20 Nos.		
17.	Moving Iron Ammeter of different ranges	20 Nos.		
18.	Moving Iron voltmeter of different ranges	20 Nos.		
19.	Wire wound Rheostats of different ratings	30 Nos.		
20.	Tachometers	10 Nos.		
21.	Single element wattmeters of different ranges UPF / LPF	20 Nos.		
22.	Double element wattmeters of different ranges	4 Nos.		
23.	Power factor meter	2 Nos.		
24.	Digital multimeter	5 Nos.		
25.	Three point starter, four point starter,DOL starter, manual star / delta starter, semi automatic and fully automatic star / delta starter	1 No each for study experiment		
26.	SCR based semi and fully controlled rectifier module	2 Nos.		
27.	SCR based chopper module	2 Nos.		
28.	SCR based inverter module	2 Nos.		
29.	SCR based AC voltage regulation module	2 Nos.		
30.	SCR, MOSFET, IGBT Trainer module	Each 2 Nos.		

SEMESTER IV

408EIT01 CONTROL SYSTEMS 3 1 0 4

(Common to EEE, EIE & ICE)

AIM

To provide sound knowledge in the basic concepts of linear control theory and design of control system.

OBJECTIVES

i To understand the methods of representation of systems and to desire their transfer function models.

ii To provide adequate knowledge in the time response of systems and steady state error analysis.

iii To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.

iv To understand the concept of stability of control system and methods of stability analysis.

v To study the three ways of designing compensation for a control system.

1. SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

2. TIME RESPONSE 9

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feed back control.

3. FREQUENCY RESPONSE 9

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

4. STABILITY OF CONTROL SYSTEM 9

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

5. COMPENSATOR DESIGN 9

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
2. Benjamin C. Kuo, Automatic Control systems, Pearson Education, New Delhi, 2003.

REFERENCE BOOKS

1. K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.
2. Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, New Delhi, 2007.
3. Samarajit Ghosh, Control systems, Pearson Education, New Delhi, 2004
4. M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi, 2002.

408EIT02 INDUSTRIAL INSTRUMENTATION – I 3 0 0 3

(Common to EIE & ICE)

AIM

To equip the students with relevant knowledge to suit the industrial requirements.

OBJECTIVES

To provide sound knowledge about various techniques used for the measurement of industrial parameters.

i. Discussion of load cells, torque meter and various velocity pick-ups.
ii. Exposure to various accelerometer pick-ups, vibrometers, density and viscosity pick-ups.
iii. To have an adequate knowledge about pressure transducers.
iv. To have an idea about the temperature standards, calibration and signal conditioning used in RTD's.
v. To have a sound knowledge about thermocouples and pyrometry techniques.

1. MEASUREMENT OF FORCE, TORQUE AND VELOCITY 9

Electric balance – Different types of load cells – Hydraulic, pneumatic strain gauge-Magneto elastic and Piezo electric load cell – Different methods of torque measurements: strain gauge-Relative angular twist-Speed measurement:-Capacitive tacho-Dragcup type tacho-D.C and A.C tachogenerators – Stroboscope.

2. MEASUREMENT OF ACCELERATION, VIBRATION AND DENSITY 9

Accelerometers:- LVDT, Piezo-electric, Strain gauge and Variable reluctance type accelerometer – Mechanical type vibration instruments – Seismic instruments as an accelerometer – Vibrometers : Calibration of vibration pickups – Units of density and specific gravity – Baume scale, and API scale- Pressure head type densitometers- Float type densitometers – Ultrasonic densitometer- Bridge type gas densitometer.

3. PRESSURE MEASUREMENT 9

Units of pressure-Manometers-Different types –Elastic type pressure gauges: Bourdon tube, bellows and diaphragms-Electrical methods: Elastic elements with LVDT and strain gauges –Capacitive type pressure gauge –Piezo-resistive pressure sensor-Resonator pressure sensor-Measurement of vacuum:-McLeod gauge-Thermal conductivity gauges-Ionization gauges:– Cold cathode type and hot cathode type-Testing and calibration of pressure gauges-Dead weight tester.

4. TEMPERATURE MEASUREMENT 9

Definitions and standards-Primary and secondary fixed points –Calibration of thermometers - Different types of filled in system thermometer-Sources of errors in filled in systems and their compensation-Bimetallic thermometers – Electrical methods of temperature measurement-Signal conditioning of industrial RTDs and their characteristics-3 lead and 4 lead RTDs - Thermistors.

5. THERMOCOUPLES AND RADIATION PYROMETERS 9

Thermocouples-Laws of thermocouple –Fabrication of industrial thermocouples –Signal conditioning of thermocouple output-Isothermal block reference junctions – Commercial circuits for cold junction compensation-Response of thermocouple –Special techniques for measuring high temperature using thermocouples – Radiation fundamentals-

Radiation methods of temperature measurement –- Total radiation pyrometers-Optical pyrometers-Two colour radiation pyrometers – Fiber optic temperature measurement.

L = 45 Total = 45

TEXT BOOKS

1. Doebelin, E.O., “Measurement systems Application and Design”, International Student Edition, 5th Edition, McGraw Hill Book Company,2004.
2. Jone’s Instrument Technology, Vol.2, Butterworth-Heinemann, International Edition, 2003.
3. A.K. Sawhney, ‘A course in Electrical & Electronic Measurements and Instrumentation’, Dhanpath Rai & Co (P) Ltd, 2004.

REFERENCE BOOKS

1. Liptak, B.G., “Instrumentation Engineers Handbook (Measurement)”, CRC Press, 2005
2. Patranabis,D., “Principles of Industrial Instrumentation”, 2nd Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1999.
3. Holman,P., “Experimental methods for Engineers”, 6th Edition, McGraw Hill Book Company, 2000.
4. Nakra, B.C., and Chaudry, K.K., “Instrumentation measurement and Analysis”, TataMcGraw Hill publishing Company Limited, 2004.

408EIT03 TRANSDUCER ENGINEERING 3 0 0 3

(Common to EIE & ICE)

AIM

To provide adequate knowledge in sensors and transducers.

OBJECTIVES

i. To impart knowledge about the principles and analysis of sensors.
ii. Discussion of errors and error analysis.
iii. Emphasis on characteristics and response of transducers.
iv. To have an adequate knowledge in resistance transducers.
v. Basic knowledge in inductance and capacitance transducers and exposure to other transducers.

1. SCIENCE OF MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS 9

Units and standards – Calibration methods – Static calibration – Classification of errors – Error analysis – Statistical methods – Odds and uncertainty – Classification of transducers – Selection of transducers.

2. CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics – Accuracy, precision, resolution, sensitivity, linearity -Dynamic characteristics – Mathematical model of transducer – Zero, I and II order transducers. Response to impulse, step, ramp and sinusoidal inputs.

3. VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and application of potentiometer, strain gauge, resistance thermometer, Thermistor, hot-wire anemometer, piezoresistive sensor and humidity sensor.

4. VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE RANSDUCERS 9

Induction potentiometer – Variable reluctance transducers – EI pick up – Principle of operation, construction details, characteristics and application of LVDT –Capacitive transducer and types – Capacitor microphone – Frequency response.

5. OTHER TRANSDUCERS 9

Piezoelectric transducer, Hall Effect transducer – Different types of Photo detectors- Digital transducers – Smart sensors - Fibre optic sensors, SQUID sensors, Film sensors, MEMS – Nano sensors.

L = 45 Total = 45

TEXT BOOKS

1. E.A. Doebelin, ‘Measurement Systems – Applications and Design’, Tata McGraw Hill, New York, 2000.
2. A.K. Sawhney, ‘A course in Electrical & Electronic Measurement and Instrumentation’, Dhanpat Rai and Co (P) Ltd., 2004.

REFERENCE BOOKS

1. D. Patranabis, ‘Sensors and Transducers’, Prentice Hall of India, 1999.
2. John P. Bentley, ‘Principles of Measurement Systems’, III Edition, Pearson Education, 2000.

408EIT04 DIGITAL LOGIC CIRCUITS 3 1 0 4

AIM

To introduce the fundamentals of digital circuits, combinational and sequential circuit.

OBJECTIVES

i. To study various number systems and to simplify the mathematical expressions using Boolean functions – simple problems.
ii. To study implementation of combinational circuits
iii. To study the design of various synchronous and asynchronous circuits.
iv. To expose the students to various memory devices.

1. NUMBER SYSTEMS AND BOOLEAN ALGEBRA 9

Review of number systems; types and conversion, codes. Boolean algebra: De-Morgan's theorem, switching functions and simplification using K-maps and Quine McCluskey method.

2. COMBINATIONAL CIRCUITS 9

Design of Logic gates. Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates and multiplexers.

3. SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip flops - SR, D, JK and T. Analysis of synchronous sequential circuits; design of synchronous sequential circuits – Completely and incompletely specified sequential circuits - state diagram; state reduction; state assignment, Counters – synchronous, a synchronous, updown and Johnson counters; shiftregisters.

4. ASYNCHRONOUS SEQUENCTIAL CIRCUITS 9

Analysis of asynchronous sequential machines, state assignment, asynchronous Design problem.

5. **MEMORY DEVICES, PROGRAMMABLE LOGIC DEVICES AND LOGIC FAMILIES 9**

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA, digital logic families: TTL, ECL, CMOS.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. M. Morris Mano, 'Digital Logic and Computer Design', Prentice Hall of India, 2002.
2. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.

REFERENCE BOOKS

1. Charles H.Roth, 'Fundamentals Logic Design', Jaico Publishing, IV edition, 2002.
2. Floyd, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
3. John F.Wakerly, 'Digital Design Principles and Practice', 3rd edition, Pearson Education, 2002.

408EIT05 LINEAR INTEGRATED CIRCUITS AND APPLICATIONS 3 0 0 3

(Common to EEE, EIE & ICE)

AIM

To introduce the concepts for realizing functional building blocks in ICs, fabrications & application of ICs.

OBJECTIVES

i. To study the IC fabrication procedure.
ii. To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
iii. To study the applications of Op-amp.
iv. To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.

1. IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

2. CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp – summer, differentiator and integrator.

3. APPLICATIONS OF OPAMP 9

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter - Dual slope, successive approximation and flash types.

4. SPECIAL ICs 9

555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase lock loop circuit functioning and applications, Analog multiplier ICs.

5. APPLICATION ICs 9

IC voltage regulators - LM317, 723 regulators, switching regulator, MA 7840, LM 380 power amplifier, ICL 8038 function generator IC, isolation amplifiers, opto coupler, opto electronic ICs.

L = 45 Total = 45

TEXT BOOKS

1. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. (2000)
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.

REFERENCE BOOKS

1. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', Tata McGraw Hill, 2003.
2. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson Education, 4th edition, 2002 / PHI.
3. David A.Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2nd edition, 1997

408EIT06 **APPLIED THERMODYNAMICS** **3 1 0 4**

(Common to EIE & ICE)

OBJECTIVES

i. To expose the fundamentals of thermodynamics and to be able to use it in accounting for the bulk behaviour of the sample physical systems.

ii. To integrate the basic concepts into various thermal applications like IC engines, gas turbines, steam boiler, steam turbine, compressors, refrigeration and air conditioning.

iii. To enlighten the various modes of heat transfer and their engineering applications.

Use of standard steam tables, refrigeration tables and heat transfer data book are permitted)

1. BASIC CONCEPTS AND LAWS OF THERMODYNAMICS 12

Classical approach: Thermodynamic systems – Control volume - System and surroundings – Universe – Properties - State-process – Cycle – Equilibrium - Work and heat transfer – Point and path functions - First law of thermodynamics for open and closed systems - First law applied to a control volume - SFEE equations [steady flow energy equation] - Second law of thermodynamics - Heat engines - Refrigerators and heat pumps - Carnot cycle - Carnot theorem.

2. IC ENGINES 8

Air standard cycles: Otto, diesel and dual cycles and comparison of efficiency - Working Principle of four stroke and two stroke engines - Working principle of spark ignition and compression ignition engines - Application of IC engines.

3. STEAM BOILERS AND TURBINES 8

Formation of steam - Properties of steam – Use of steam tables and charts – Steam power cycle (Rankine) - Modern features of high-pressure boilers – Mountings and accessories – Testing of boilers.

Steam turbines: Impulse and reaction principle – Velocity diagrams – Compounding and governing methods of steam turbines (qualitative treatment only) - Layout and working principle of a steam power plant.

4. COMPRESSORS, REFRIGERATION AND AIR CONDITIONING 8

Positive displacement compressors – Reciprocating compressors – Indicated power – Clearance volume – Various efficiencies – Clearance ratio - Volume rate - Conditions for perfect and imperfect intercooling - Multi stage with intercooling – Rotary positive displacement compressors – Construction and working principle of centrifugal and axial flow compressors.

Refrigeration - Various methods of producing refrigerating effects (RE) – Vapour compression cycle: P-H and T-S diagram - Saturation cycles - Effect of subcooling and super heating - (qualitative treatment only) - Airconditioning systems – Basic psychrometry - Simple psychrometric processes - Types of airconditioning systems - Selection criteria for a particular application (qualitative treatment only).

5. HEAT TRANSFER 9

One-dimensional Heat Conduction: Plane wall – Cylinder – Sphere - Composite walls – Critical thickness of insulation –Heat transfer through extended surfaces (simple fins).

Convection: Free convection and forced convection - Internal and external flow –Simple Empirical relations.

Radiation: Black–Gray bodies - Radiation Shape Factor (RSF) - Cooling of electronic components - Thermoelectric cooling – Chip cooling.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. R.S.Khurmi & J.K.Gupta, Thermal Engineering, S.Chand & Co. Ltd., 2006.
2. S.Domkundwar, C.P.Kothandaraman & A.V.Domkundwar, Thermal Engineering, Dhanpat Rai & Co.2002.

REFERENCE BOOKS

1. Rogers and Mayhew, 'Engineering Thermodynamics – Work and Heat Transfer', Pearson Education Pvt. Ltd. New Delhi, 2006.
2. Eastop and McConkey, 'Applied Thermodynamics', Pearson Education Pvt. Ltd. New Delhi, 2002.
3. P.K.Nag, 'Engineering Thermodynamics Tata McGraw Hill, New Delhi, 2003.
4. Rajput, B.K. Sankaar, Thermal Engineering, S.Chand & Co. Ltd., 2003.

408EIP01 TRANSDUCERS AND MEASUREMENTS LABORATORY 0 0 3 2

(Common to EIE & ICE)

OBJECTIVES

The aim of this lab is to train the students in handling the different kinds of transducers like LVDT, Hall effect, Thermocouple etc., which he often meets in his study and also to impart the students an adequate knowledge and work experience of the different types of AC and DC bridges, electronic measurement methods for different electronic instruments.

1. Displacement versus output voltage characteristics of a potentiometric transducer.
2. Characteristics of Strain gauge and Load cell.
3. Characteristics of LVDT, Hall effect transducer and Photoelectric tachometer.
4. Characteristic of LDR, thermistor and thermocouple.
5. Step response characteristic of RTD and thermocouple and Study of smart transducers.
6. Wheatstone and Kelvin's bridge for measurement of resistance.
7. Schering Bridge for capacitance measurement and Anderson Bridge
8. for inductance measurement.
9. Calibration of Single-phase Energy meter and wattmeter.
10. Calibration of Ammeter and Voltmeter using Student type potentiometer.
11. Design, Construction and calibration of series and shunt type
12. ohmmeters.

P = 45 TOTAL = 45

Detailed syllabus

1. Loading effect on potentiometer

Aim

To study the loading effect on potentiometer circuit.

Objectives

i. To observe the output, input calibration curve using FET voltmeter has the output device.

ii. To observe the output, input characteristic with an voltmeter whose input impedance is finite.

iii. To observe the linearity which decreases with a decrease in the input impedance of the output meter.

Exercise

1. In the potentiometer circuit, displacement is given to the wiper arm and the corresponding output is observed with 2 meters (one is a FET voltmeter and the other is meter with a finite input impedance)
2. For various input displacements, output voltage from the two different meters are recorded and tabulated.
3. Plot the graph output Vs input displacement for both cases.

Equipment

1. Potentiometer – Linear displacement transducer kit – 1 No
2. Regulated power supply – 1 No
3. FET voltmeter, ordinary voltmeter – 1 No

2. Characteristics of Strain gauge and Load cell

Aim

To study the characteristics of strain guage and load cell.

Objectives

1. To identify and study the characteristics of strain guage and load cell.
2. To determine the sensitivity of strain guage and load cell.
3. To determine the Young's modulus and hence the guage factor of the given strain guage.

Exercise

1. Load and Unload the load cell and strain guage.
2. Measure the corresponding voltages during both loading and unloading and plot the calibration curve.
3. Find the Young's Modulus and gauge factor from the graph.

Equipment

1. Strain guage and Load cell kit. – 1 No
2. Variable power supply – 1 No
3. Loads for measurement - A set

3.Characteristics of LVDT, Hall effect transducer and Photoelectric tachometer.

3.(a) Characteristics of LVDT

Aim

To study the operation and characteristics of LVDT

Objective

1. To study the displacement of the core from its null position.
2. To study the variation of output voltage with change in displacement.

Exercise

1. Adjust the potentiometer knob present in the LVDT kit to bring the core to Null position (set the output voltage to be '0' volts)
2. Rotate the knob in the positive direction such that the LVDT scale moves in steps of 1cm and measure the corresponding output voltage.
3. Tabulate the readings.
4. Repeat the above procedure for negative displacement.
5. Plot the characteristic curve between displacement and output voltage.

Equipments

1. LVDT trainer kit – 1 No
2. Power supply – 1 No

3.(b) Hall effect Transducer

Aim

To study the characteristics of Hall effect transducer.

Objective

1. To determine the positive hall voltage at the bottom of the transducer.
2. To determine the negative hall voltage.
3. To identify and study the characteristics of hall effect transducer.
4. To measure the displacement of a structural element .

Exercise

1. Study the internal configuration of Hall effect IC.
2. Patch the circuit diagram as per patching diagram.
3. Place the north pole of the magnet above the scale and take the reading air gap between hall IC and magnet to output voltage.
4. Place the south pole of the magnet above the scale and take the reading for different distances and plot the graph between air gap voltmeter readings.

Equipments

1. Hall effect characteristics trainer – 1 No
2. Power supply – 1 No
3. Voltmeter – 1 No

3.(c) Photoelectric tachometer

Aim

To study the characteristics of photoelectric tachometer using the servo motor speed control trainer kit.

Objective

1. To calculate the number of pulses generated in the photoelectric pick up.
2. To study the variation of speed with the variation of the input voltage.

Exercise

1. Connect the circuit as per instructions given in the manual.
2. Adjust the power supply.
3. Vary the speed of the motor by using rotary potentiometer and note down the readings.
4. Calculate number of pulses generated in the photoelectric pick up.
5. Draw the graph between voltage and speed.

Equipments

1. Speed control trainer kit – 1 No
2. Power supply – 1 No
3. Wires - Some
4. Multimeter – 1 No

4.Characteristic of LDR, thermistor and thermocouple.

(a) Characteristics of LDR

Aim

To determine the characteristics of LDR

Objectives

1. To determine the change in resistance for corresponding change in light intensity.
2. To determine the output voltage for corresponding change in voltage.

Exercise

1. The lamp for LDR is selected by using a select switch.
2. Initially the lamp is kept away from LDR.
3. Now the distance is decreased gradually and the corresponding values of voltages and resistances are taken.
4. Repeat the above steps for various positions of lamp.

Equipments

Photo conductive trainer kit – 1 No
Multimeter – 1 No
Connecting wires – 1 No

(b) Characteristics of thermistor

Aim

To determine the characteristics of thermistor

Objectives

To measure the resistance value for the corresponding changes in temperature.

Exercise

1. Measure the initial temperature of water.
2. Take another vessel full of water and boil it to100^0C.
3. Note down the readings for every 5^0C fall of temperature in thermistor, thermometer and output voltage readings.
4. Plot the Thermistor characteristics.

Equipments

1. Thermistor Trainer kit – 1 No
2. Heater – 1 No
3. Thermistor – 1 No
4. Thermometer – 1 No
5. Voltmeter – 1 No

4(c) Characteristics of Thermocouple

Aim

To determine the characteristics of thermocouple.

Objectives

1. To determine the voltage for corresponding change in temperature.

Exercise

1. Measure the initial temperature and temperature of boiling water (100^0C)
2. Calibrate the thermocouple in the hot water and measure the 5^0C temperature fall in thermocouple.
3. The output voltage is noted for corresponding fall in temperature.

Equipment

1. Thermocouple trainer kit – 1 No
2. Thermocouple – 1 No
3. Voltmeter – 1 No
4. Heater – 1 No

5.Step response characteristic of RTD and thermocouple and Study of smart transducers.

(a).Step response characteristics of RTD and Thermocouple

Aim

To study the step response characteristic of RTD and thermocouple.

Objective

a. To analyse the change in temperature due to change in emf in case of thermocouple.
b. To analyse the change in temperature due to change in resistance in case of RTD.
c. To observe the transients when step input [i.e sudden change in the input] is given.

Exercise

1. Calibrate the RTD and thermocouple at room temperature and 100^0C alternatively.
2. Bring down the sensor to room temperature and provide a sudden change of input temperature to boiling point (i.e) 100^0C.
3. Start the stop clock and tabulate the time taken for every 5^0C rise of temperature.
4. Plot the step response for both the sensors.

Equipment

1. Thermocouple and RTD trainer kit – 1 No
2. Thermometer – 1 No
3. Heater – 1 No
4. Thermocouple and RTD sensors – 1 No
5. Voltmeters – 1 No

I/P trainer kit – 1 No
Pressure source – 1 No
Control valve etc – 1 No

6. Wheatstone and Kelvin's bridge for measurement of resistance.

(a) Measurement Of Medium Resistance Using Wheatstone's Bridge

Aim

To measure the value of unknown resistance using Wheatstone's Bridge.

Exercise

Find the value of unknown resistance.

Procedure

1. Connections are given as per the circuit diagram.
2. Supply is switched on.
3. When the unknown resistance s connected, the bridge becomes unbalanced.
4. The bridge is balanced by varying standard resistance.
5. The value of unknown resistance is calculated by the given formula.
6. The above steps are repeated for different value of unknown resistances.

Equipment

1. Resistors – 1 No
2. Galvanometer – 1 No
3. Regulated Power supply – 1 No
4. Bread board – 1 No
5. Decade resistance box – 1 No
6. Multimeter – 1 No

(b) Kelvin's Double Bridge

Aim

To find the unknown value of low resistance using Kelvin's Double Bridge.

Exercise

Find the unknown value of low resistance.

Procedure

1. Connections are given as per the circuit diagram.
2. Supply is switched on.
3. The bridge becomes unbalanced when unknown resistance R is connected.
4. The bridge is balanced by varying standard resistance.
5. Unknown resistance is calculated using balance equation.
6. The above steps are repeated for various values of unknown resistance.

Equipment

1. Power supply – 1 No
2. Fixed resistance – 1 No
3. Unknown resistors – 1 No
4. Decade resistance box – 1 No
5. Multimeter – 1 No
6. Galvanometer – 1 No
7. Bred board - 1 No

7. Schering Bridge for capacitance measurement and Anderson Bridge for inductance measurement.

(a) Schering's Bridge

Aim

To measure the unknown value of capacitance using Schering's bridge

Exercise

Measure the unknown value of capacitance.

Procedure

1. Connections are given as per the circuit.
2. Supply is witched on.
3. When unknown value of capacitance is connected, bridge becomes unbalanced.
4. The bridge is balanced by varying the standard.
5. The unknown value of capacitance is calculated using the balance equation.
6. The above steps are repeated for different values of unknown capacitances.

Euipment

1. Resistors - Some set.
2. Capacitors – Some set.
3. Decade Resistance box – 1 No.
4. Decade Capacitance box – 1 No.
5. CRO – 1 No.
6. Function Generator – 1 No.

(b) Anderson's Bridge

Aim

To measure the unknown value of inductance using Anderson's Bridge

Exercise

Measure the unknown value of inductance.

Procedure

1. Connections are given as per the circuit diagram.
2. Supply is switched on.
3. When unknown value of inductance is connected the bridge becomes unbalanced.
4. The unknown value of inductance is calculated by using the balance equation.
5. The above step are repeated for different values of unknown inductance.

Equipment

1. Resistors – Some set
2. Decade Inductance box – 1 No.
3. Decade Condenser box – 1 No.
4. Regulated power supply – 1 No.
5. CRO – 1 No.
6. Bread board - 1 No.

8.Calibration of Single-phase Energy meter and wattmeter.

(a) Calibration of Single Phase Energy Meter

Aim

To calibrate the given energy meter using two substandard wattmeters and to obtain percentage error.

Exercise

Calibrate the given energy meter and draw % error Vs load graph.

Procedure

1. Connections are given as per the circuit diagram.
2. The value of load current is adjusted to desire value.
3. When the red mark on the disk of the energy meter passes the observation point, the stopwatch is started and the number of revolution made by the disc is noted.
4. The load current is maintained by adjusting the load.
5. When the disc of the energy meter completes desired number of revolutions the stopwatch is stopped and the time taken is noted.
6. The procedure is repeated for different values of wattmeter reading and time taken, number of revolutions of the disc is noted down.
7. The graph is plotted between percentage error and load.

Equipment

1. Wattmeter – 2 No
2. Voltmeter – 1 No
3. Ammeter – 1 No
4. Resistive load – 1 No

(b) Calibration of Wattmeter

Aim

To calibrate the given wattmeter using direct loading.

Exercise

Calibrate the given wattmeter and draw the graph between % error and load current.

Procedure

1. Connections are given as per the circuit diagram.
2. Supply is given at no load condition.
3. Resistive load is applied in steps and the readings are tabulated.
4. Graph is drawn between % error and load current.

Equipment

1. Ammeter – 1 No
1. Voltmeter – 1 No
2. Wattmeter – 1 No
4. Load – 1 No

9.Calibration of Ammeter and Voltmeter using Student type potentiometer.

(a) Calibration of Ammeter

Aim

To calibrate the given ammeter using standard ammeter

Exercise

Calibrate the given ammeter and draw the graph between % error and A_s.

Procedure

1. Connections are given as per the circuit diagram.
2. The standard ammeter should be selected properly.
3. Supply is switched on.
4. At no load condition the readings of all the meters are noted.
5. By gradually increasing the load, the respective readings are taken from the meters.
6. The readings are tabulated and % error is calculated from the formula.
7. Graph is drawn between A_s and % error.
8. The procedure is repeated for both ac and dc supply.

Equipment

1. Standard ammeter – 1 No.
2. Ammeter – 1 No.
3. Variable resistive load – 1 No.
4. RPS – 1 No.

(b) Calibration of Voltmeter

Aim

To calibrate the given voltmeter using standard voltmeter.

Exercise

Calibrate the given voltmeter and draw the graph between % error and V_S.

Procedure

1. Connections are given as per the circuit diagram.
2. The standard voltmeter should be selected properly.
3. Supply is switched on.
4. At no load condition the readings of all the meters are noted.
5. By gradually increasing the voltage, the respective readings are taken from the meters.
6. The readings are tabulated and % error is calculated from the formula.
7. Graph is drawn between V_s and % error.
8. The procedure is repeated for both ac and dc supply.

Equipment

1. Standard voltmeter – 1 No.
2. Voltmeter – 1 No.
3. Auto transformer – 1 No.
4. RPS – 1 No.

10. Design and calibration of series and shunt type ohmmeters.
(a) SERIES TYPE OHMMETERS

AIM
To conduct a suitable experiment to measure an unknown medium resistance (1Ω - 0.1MΩ) with the series type ohmmeter.

OBJECTIVE
The instrument most commonly used to check the continuity (a complete circuit), or to measure the resistance of a circuit or circuit element, is the **OHMMETER.** The ohmmeter is widely used to measure resistance and check the continuity of electrical circuits and devices.

OHMMETER SAFETY PRECAUTIONS
The following safety precautions and operating procedures for ohmmeters are the **MINIMUM** necessary to prevent injury and damage.
 Be certain the circuit is deenergized and discharged before connecting an ohmmeter.
 Do not apply power to a circuit while measuring resistance.
 When you are finished using an ohmmeter, switch it to the OFF position if one is provided and remove the leads from the meter.
 Always adjust the ohmmeter for 0 (or in shunt ohmmeter) after you change ranges before making the resistance measurement.

Exercise
1. Place the resistance to be measured is in series with the internal resistors and the meter movement of the ohmmeter.
2. Note down the reading of the meter and calculate the practical value.
3. Calculate the theoretical value
4. Find the difference and error between the theoretical and practical values.
5. Measure the Resistor using Ammeter – Voltmeter method and compare the result with the Ohmmeter method.
6. Calculate the difference and %error.
7. To implement the continuity test, consider any one electronic circuit and check the continuity

Equipment
1. Ohmmeter (Analog Multimeter) – 1No
2. Voltmeter - 1 No
3. Ammeter - 1 No
4. Resistor - 1 No
5. RPS - 1 No

(b) SHUNT TYPE OHMMETER

AIM

i. To conduct a suitable experiment to measure an unknown medium resistance (1Ω - 0.1MΩ) with the series type ohmmeter.

ii. To compare the result with the Ammeter – Voltmeter method

Exercise

1. Place the resistance to be measured in shunt (in parallel) with the meter movement of the ohmmeter.
2. Note down the reading of the meter and calculate the practical value.
3. Calculate the theoretical value
4. Find the difference and error between the theoretical and practical values.
5. Measure the Resistor using Ammeter – Voltmeter method and compare the result with the Ohmmeter method.
6. Calculate the difference and %error.
7. To implement the continuity test, consider any one electronic circuit and check the continuity

Equipment

1. Ohmmeter(Analog Multimeter) – 1No
2. Voltmeter - 1 No
3. Ammeter - 1 No
4. Resistor - 1 No
5. RPS - 1 No

408EIP02 THERMODYNAMICS LABORATORY 0 0 3 2

(Common to EIE & ICE)

THERMODYNAMICS LAB

1. Valve timing and port timing diagrams for IC Engines.
2. Performance test on a Petrol Engine.
3. Performance test on a Diesel Engine.
4. Heat Balance test on an IC Engine.
5. Boiler – performance and Heat Balance Test.
6. Performance test on a Refrigerator (Determination of COP)
7. Determination of heat transfer Coefficient (Free and forced convection)
8. Test to estimate frictional losses in pipe flow.
9. Test on reaction turbine for obtaining the characteristics curves and to design values of specific speed, discharge, output and efficiency.
10. Test on impulse turbine to obtain its characteristics curves and hydraulic design values.

LIST OF EQUIPMENTS

S.No	Apparatus	Quantity
1.	Engine – cut section models.	1 Set
2.	Single cylinder petrol engine with Mechanical dynamometer.	1 Set
3.	Multi cylinder petrol engine with hydraulic dynamometer.	1 Set
4.	Multi cylinder diesel engine with Electrical dynamometer.	1 Set
5.	Steam boilers with suitable mountings and accessories.	1 Set
6.	Refrigeration Test Rig.	1 No.
7.	Forced convection Heat transfer Test set up.	1 No.
8.	Free convection Heat transfer test set up.	1 No.
9.	Apparatus for measuring pipe friction	1 No.
10.	Francis turbine	1 No.
11.	Pelton wheel	1 No.
12.	Turgo impulse wheel	1 No.
13.	Stop watches	6 Nos.

408EIP03 LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB 0 0 3 2

(Common to EEE, EIE & ICE)

AIM

To study various digital & linear integrated circuits used in simple system configuration.

1. Study of Basic Digital IC's. (Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF, D FF)

2. Implementation of Boolean Functions, Adder/ Subtractor circuits.

3a) Code converters, Parity generator and parity checking, Excess-3, 2s Complement, Binary to Gray code using suitable IC's .

3(b) Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.

4. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.

5 Shift Registers:
Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.

6 Multiplex/ De-multiplex:
Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer

7 Timer IC application:
Study of NE/SE 555 timer in Astable, Monostable operation.

8. Application of Op-Amp:
Slew rate verifications, inverting and non-inverting amplifier, Adder, comparator, Integrater and Differentiator.

9 Study of Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's.

10 Study of VCO and PLL ICs:
i. Voltage to frequency characteristics of NE/ SE 566 IC.
ii. Frequency multiplication using NE/SE 565 PLL IC.

P = 45 Total = 45

Detailed Syllabus

1. Study of Basic Digital IC's.
(Verification of truth table for AND, OR, EXOR, NOT, NOR, NAND, JK FF, RS FF, D FF)

Aim
To test of ICs by using verification of truth table of basic ICs.

Exercise
Breadboard connection of ICs with truth table verification using LED's.

2. Implementation of Boolean Functions, Adder/ Subtractor circuits.
[Minimizations using K-map and implementing the same in POS, SOP from using basic gates]

Aim
Minimization of functions using K-map implementation and combination Circuit.

Exercise
1. Realization of functions using SOP, POS, form.
2. Addition, Subtraction of atleast 3 bit binary number using basic gate IC' s.

3a) Code converters, Parity genertor and parity checking, Excess 3, 2s Complement, Binary to grey code using suitable ICs .

Aim
Realizing code conversion of numbers of different bar.

Exercise
1 Conversion Binary to Grey, Grey to Binary;
1's. 2's complement of numbers addition, subtraction,
2. Parity checking of numbers using Gates and with dedicated IC's

3b) Encoders and Decoders: Decimal and Implementation of 4-bit shift registers in SISO, SIPO,PISO,PIPO modes using suitable ICs.

Exercise
1. Decimal to binary Conversion using dedicated ICs.
2. BCD – 7 Segment display decoder using dedicated decoder IC& display.

4. Counters: Design and implementation of 4-bit modulo counters as synchronous and asynchronous types using FF IC's and specific counter IC.
Aim
Design and implementation of 4 bit modulo counters.

Exercise
1. Using flipflop for up-down count synchronous count.
2. Realization of counter function using dedicated ICs.

5. Shift Registers:

Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.

Aim

Design and implementation of shift register.

Exercise

1. Shift Register function realization of the above using dedicated IC's For SISO, SIPO, PISO, PIPO, modes of atleast 3 bit binary word.
2. Realization of the above using dedicated IC's.

6. Multiplex/ De-multiplex.

Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer

Aim

To demonstrate the addressing way of data channel selection for multiplex De-multiplex operation.

Exercise

1. Realization of mux-demux functions using direct IC's.
2. Realization of mux-demux using dedicated IC's for 4:1, 8:1, and vice versa.

7. Timer IC application. Study of NE/SE 555 timer in Astable, Monostable operation.

Aim

To design a multi vibrater circuit for square wave and pulse generation.

Exercise

1. Realization of Astable multivibrater & monostable multivibrater circuit using Timer IC.
2. Variation of R, C, to vary the frequency, duty cycle for signal generator.

8. Application of Op-Amp-I

Slew rate verifications, inverting and non-inverting amplifier,
Adder, comparator, Integrater and Differentiator.

Aim

Design and Realization of Op-Amp application.

Exercise

1. Verification of Op-Amp IC characteristics.
2. Op-Amp IC application for simple arithmetic circuit.
3. Op-Amp IC application for voltage comparator wave generator and wave shifting circuits.

9. Study of Analog to Digital Converter and Digital to Analog Converter: Verification of A/D conversion using dedicated IC's.

Aim

Realization of circuit for digital conversions.

Exercise

1. Design of circuit for analog to digital signal conversion using dedicated IC's.
2. Realization of circuit using dedicated IC for digital analog conversion.

10. Study of VCO and PLL ICs

i) Voltage to frequency characteristics of NE/ SE 566 IC.
ii) Frequency multiplication using NE/SE 565 PLL IC.

Aim

Demonstration of circuit for communication application

Exercise

1. To realize V/F conversion using dedicated IC's vary the frequency of the generated signal.
2. To realize PLL IC based circuit for frequency multiplier, divider.

REQUIREMENT FOR A BATCH OF 30 STUDENTS

\S.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	Interface such as, A/D, D/A converter, DMA, PIC Serial, Interface, Temperatures controller, Stepper motor, Key board	4 each		
2.	CRO and function generator	3 each		
3.	IC trainer Kit	15		
4.	Analog AC trainer kit	4		
5.	Components and bread boards	10 each		
6.	Chips IC – 7400	10		
7.	Chips IC – 7402	10		
8.	Chips IC – 7408	10		
9.	Chips IC – 7432	10		

10.	Chips IC – 7410	25		
11.	Chips IC – 555	10		
12.	Chips IC – 741	10		
13.	Chips IC – 74153	10		
14.	Chips IC – 7474	10		
15.	Chips IC – 7490	10		
16.	Chips IC – 7447	10		
17.	Chips IC – 7476	10		
18.	Chips IC – 7420	10		
19.	Chips IC – 7404	15		
20.	Chips LM – 317	10		
21.	Chips LM – 723	10		
22.	Chips MA – 7840	10		
23.	Chips LM – 380	10		
24.	Chips ICL - 8038	10		
25.	Traffic light control kit	2		
26.	VDU	2		
27.	7 segment Display	5		
28.	Interfacing card such as keyboard etc.	3 each		
29.	Work tables	15		