Semester V

Power Electronics

1.1 Course Number: EIE301
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: FEEE and Analog Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. S. K. Verma.

2. Objective:

i) To get an overview of thyristors and other power electronics devices and their switching characteristics.
ii) To understand the operation of half wave and full wave-controlled rectifiers.
iii) To study the operation of inverters, choppers, dual converters and cycle converters.
iv) To study the operation of thyristorised control of electric drives.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Thyristors and other power electronics devices**	Power Diode-Characteristics and Principle of working, SCR: Construction and working principles, two transistor analogy, VI characteristics, specifications & ratings, Turn-On and Turn-off methods. Construction & working principle of DIAC, TRIAC & their V-I characteristics. Construction, working principle of UJT, VI characteristics. Brief introduction to Gate Turn off thyristor (GTO), MOSFET, IGBT.	10
2	**Controlled Rectifiers**	A Single-phase half wave-controlled rectifier with load (R, R-L), Single Phase half controlled and fully controlled full wave bridge/centre tap rectifier.	8
3	**Inverters, Choppers, Dual Converters and Cycloconverters**	Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel, Inverters & their application. Choppers: Introduction, types of choppers. Step up and step-down choppers. Dual Converters & cyclo converters: Introduction, types & basic working principle of dual converters & cyclo converters & their application.	10
4	**Thyristorised Control of Electric drives**	DC drive control, Half wave and Full wave drives. Chopper drives (Speed control of DC motor using choppers), AC drive control, Phase control (Speed control of induction motor using variable frequency). Types of braking-regenerative braking, plugging, dynamic braking.	8
5	**Uninterrupted Power supplies**	UPS, on-line, offline & its specifications, Automatic battery charger circuit for UPS.	6
Total			**42**

4. Readings

4.1 Textbooks:

1. Power Electronics by P.C. Sen Tata McGraw Hill. New Delhi
2. Power Electronics by P.S. Bhimbhrah, Khanna Publishers, New Delhi
3. Power Electronics by M.S. Berde, Khanna Publishers, New Delhi
4. Power Electronics by MH Rashid
5. Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi
6. Power Electronics by S Rama Reddy, Narosa Publishing House Pvt.Ltd., New Delhi
7. Power Electronics by Sugandhi and Sugandhi

4.2 Reference Books:

1. Power Electronics – Principles and Applications by J Michael Jacob, Vikas Publishing House, New Delhi

5. Outcome of the Course:

1) Illustrate the process of selection of different power semiconductor switches.
2) Analyze the performance of controlled rectifier circuits.
3) Illustrate the operation of different topologies in inverters, choppers, dual converters and cyclo converters.
4) Analyse the operation of thyristor-based DC and AC drives.

PCB Design and Embedded System

1.1 Course Number: EIE302
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Analog Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

2. Objective:

i) To understand the operation of electrical and electronic circuits by simulation.
ii) Familiarize the PCB software for PCB layout design.
iii) To understand what is an Embedded System and then define it
iv) Look at certain applications & purposes of embedded systems

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Simulation of electrical and electronic circuits**	Getting started with simulation software, ending, commonly used blocks, creating a model, Storing/Saving Data, Creating and Masking Sub-systems Series and parallel R-L circuit, Series and parallel R-C circuit, Series and parallel R-L-C circuit Resonance in AC Circuit, Plot, sub plot, label, legend etc. Half wave, full wave and bridge rectifier, Buck converter, Power amplifier and voltage amplifier Different types of oscillators circuits.	9
2	**Computer Aided PCB Design**	Need for PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer), PCB Materials. Overview of software for PCB design PCB layout of rectifier circuit PCB layout of amplifier circuit PCB layout of oscillator circuit.	9
3	**Introduction to embedded system**	History & need of Embedded System; Basic components of Embedded System; Block diagram, Pin diagram. Programming Language Classification of Embedded System	8
4	**Registers, memory of at89c51 and Introduction to assembly language**	Description of RAM; Description of CPU Registers; Functions of SFR. Assembly language programming – macros - Data representation, Basic structure of programming in assembly language.	8
5	**Introduction of embedded c, Timers, Interrupts, Interfacing**	Introduction to Embedded C; Difference between C & Embedded C; Programming style; Basic structure of C program. Timers/Counters, polling, Interrupts, Serial Communications, Interfacings with LCD, Keyboard.	7
Total			**41**

4. Readings

4.1 Textbooks:

1. AutoCAD 2013 for Engineers and Designers, Sham Tickoo Dream tech press, New Delhi, Latest edition.
2. Introduction to PSpice Using OrCAD for Circuits and Electronics by Muhammad H; Rashid PHI Learning, New Delhi, Latest edition
3. Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata MC Graw-Hill.

4.2 Reference Books:

1. Mastering AutoCAD 2013 and AutoCAD LT 2013 George Omura Sybex, New Delhi, Latest edition.
2. Mastering electronics workbench: Version 5 and Multisim Version 6 John Adams McGraw-Hill, New Delhi, Latest edition.
3. Designing Embedded Systems with PIC Microcontrollers: principles and applications by Tim Wilmshurst, Elsevier.
4. 8051 microcontroller,3rd edition, Kenneth Ayala, Cengage Learning
5. Embedded Systems Design by Steve Heath, II edition, Newness publications
6. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers by Tammy Noergaard, Elsevier.

5. Outcome of the Course:

1) Simulate and analyze electrical and electronic circuits.
2) Design PCB layout for rectifier, amplifier and oscillator circuits.
3) Better understanding of microcontroller which will help the students to develop various projects
4) To further develop embedded application using Embedded C Programming

Humanities

1.1 Course Number: HU301
1.2 Contact Hours: 2-0-0 Credits: 6
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: Diploma level English
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) Foster intellectual curiosity, global knowledge, critical thinking, personal responsibility, and ethical and cultural awareness.
ii) Prepare students to use language effectively.
iii) Establish a framework for students to develop an aesthetic appreciation for fine arts.
iv) Prepare students to be responsible citizens, lifelong learners, and world-ready leaders in their chosen fields.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Sociology**	Definition of sociology, some sociological concepts: social structure, status, role, norms, values etc. Socialization, and culture and change. Social stratification - various approaches and concept of social mobility. Population and society - Trends of demographic change in India and the world, Human Ecology, Trends of Urbanization in the developing countries and the world. Major social institutions - Family and marriage, caste and tribe and organizations: (i) formal organization (bureaucracy) (ii) informal organization. Processes of social change - Modernization (including Sanskritization), industrialization, environmental/ecological changes and development. Social movements - protest movements, reformist movement and radical movements in India.	9
2	**Introduction to Literature**	Nature of Literature: Literature as a Humanistic Experience. Definitions: (i) Humanities: concern with culture, values,	7

		ideologies; (ii) Literature: concepts of imitation, expression, intuition & imagination. Major Themes of Literature: Nature, Science, Selfhood, Love, Rebellion. The Language of Literature: Modes of literary and non-literary expression. The concepts of Figurative language, imagery, symbolism, style. The Forms of Literature: Prose Narratives (short stories & novels) Poetry, Drama and Essays (Suitable texts are to be chosen by the instructors), Use of a Learner Dictionary.	
3	**Introduction to Philosophy**	Philosophy and History of Science: Growth of scientific knowledge: factors leading to the emergence of modern science. Conceptual evolution: internal and external history. Methodology of science: induction, falsifications, confirmation and probability. Nature of scientific laws and theories: realism, instrumentalism, and under-determination. Relationship between scientific observation, experiment and scientific theory. Nature of scientific explanation: teleological explanations and the covering law model. Selected case studies on scientific theories. Logic and the nature of mathematical reasoning: Inductive and deductive forms of reasoning. Nature of axioms: formal axiomatic systems. Concept of consistency, independence, and completeness. Nature of rules of inference and proof. Selected examples of axiomatic systems and proof procedures. Cognition: Current approaches to the understanding of mind and mental processes: empiricist, rationalist, behaviorist and cognitivist. Ethics: Impact of science and technology on man and society: elements of environmental and professional ethics	7
Total			**23**

4. Readings:

4.1 Textbook/Reference Books:

(A) Introduction to Sociology:

(a) L. Broom, P. Selznick and D. Dorrock, Sociology, 11th Edn. 1990 (Harper International).
(b) M. Haralambos, Sociology: Themes and Perspectives, Oxford University Press, 980.
(c) M.S.A. Rao (ed) Social movements in India, vols. 1-2, 1984, Manohar.
(d) David Mandelbaum, Society in India, 1990, Popular.

(e) M.N. Srinivas, Social change in modern India, 1991, Orient Longman.
(f) Guy Rocher, A. General Introduction to Sociology, MacMillan, 1982.

(B) Introduction to Literature:
(a) David Murdoch (ed.). The Siren's Song: An Anthology of British and American Verse, Orient Longman, 1988.
(b) S. Alter & W. Dissanayake (eds.) The Penguin Book of Modern Indian Short Stories. Penguin Books (India), 1989.
(c) Bertrand Russell, Impact of Science on Society. Allen &Unwin, 1952.
(d) Henrik Ibsen, A Doll's House, Macmillan India, 1982.
(e) George Orwell, Animal Farm, Penguin, 1951.
(f) J. Bronowski. The Ascent of Man, BBC, 1973.

(C) Introduction to Philosophy:
(a) A.C. Grayling (ed.) Philosophy: A Guide through the Courses/Subjects, Oxford Univ. Press, London, 1995.
(b) Marx W. Wartofsky, Conceptual Foundations of Scientific Thought: An Introduction to the Philosophy of Science, Macmillan, London, 1968.
(c) I.B. Cohen, The Birth of a New Physics, Vakils, Feffer and Simons Pvt. Ltd., Bombay, 1968.
(d) H. Eves and C.V. Newsom, Foundations and Fundamental Concepts of Mathematics, Boston, PWS-Kart Pub. Co., 1990.
(e) K.E. Goodpaster and K.M. Sayre (eds.) Ethics and Problems of 21st Century, Univ. of Notre Dame Press, London, 1979.
(f) S.D. Agashe, A. Gupta & K. Valicha (eds.) Scientific Method, Science, Technology and Society: A Book of Readings, Univ. of Bombay Press, 1963.

5. Outcome of the Course:

Students will demonstrate:

Knowledge of the conventions and methods of at least one of the humanities in addition to those encompassed by other knowledge areas required by the General Education program.

Engineering Economics

1.1 Course Number: MT301
1.2 Contact Hours: 2-1-0 Credits: 8
1.3 Semester-offered: 3rd Year –Odd
1.4 Prerequisite: Diploma level Mathematics
1.5 Syllabus Committee Members: DUGC

2. Objective:

i) To make fundamentally strong base for decision making skills by applying the concepts of economics.
ii) Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.
iii) Prepare engineering students to analyze profit/revenue data and carry out make economic analysis in the decision-making process to justify or reject alternatives/projects.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Economics**	Introduction to economics – Flow in an economy – Law of supply and demand – Concept of engineering economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic analysis – Material selection for product design selection for a product – Process planning.	10
2	**Value Engineering**	Make or buy decision – Value engineering – Function – Aims – Value engineering procedure – Interest formulae and their applications –Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series payment Present worth factor – Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples all methods.	8
3	**Cash Flow**	Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram) – Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Annual equivalent method	8

		(Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Rate of return method – Examples all methods.	
	Total		**26**

4. Readings:

4.1 Textbooks:

1. Panneer Selvam, R., "Engineering Economics", Prentice Hall of India Ltd, 2001.
2. Smith, G.W., "Engineering Economy", Lowa State Press, 1973.

4.2 Reference books:

1. Park, C.S., "Contemporary Engineering Economics", Prentice Hall of India, 2002.
2. Newman, D.G. and Lavelle, J.P., "Engineering Economics and Analysis", Engineering Press, 2002.
3. Degarmo, E.P., Sullivan, W.G. and Canada, J.R, "Engineering Economy", Macmillan, 1984.
4. Grant, E.L., Ireson, W.G. and Leavenworth, R.S., "Principles of Engineering Economy", Ronald Press, 1976.

5. Outcome of the Course:

Upon completing the course, students will be able to:

1) Understand major principles of economic analysis for decision making among alternative courses of action in engineering.
2) Apply economic principles to prices and quantities in competitive supply and demand for goods and for money.
3) Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit-cost ratio and breakeven analysis.

Power Electronics Laboratory

1.1 Course Number: EIE301L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: FEEE and Analog Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

1. Study of Characteristics of SCR, MOSFET & amp; IGBT.
2. Test the variation of R, C in R and RC triggering circuits on firing angle of SCR.
3. Single Phase half with R and RL loads
4. Fully controlled bridge converter with R and RL loads.
5. Single Phase Cyclo converter with R and RL loads.
6. Step up and step-down choppers.
7. Series & parallel Inverter
8. DC drive control
9. AC drive control
10. Test the performance of given UPS.

Recommended Books:

1. Power Electronics by P.C. Sen Tata McGraw Hill. New Delhi
2. Power Electronics by P.S. Bhimbhrah, Khanna Publishers, New Delhi
3. Power Electronics by M.S. Berde, Khanna Publishers, New Delhi
4. Power Electronics by MH Rashid
5. Industrial Electronics and Control by SK Bhattacharya and S. Chatterji, New Age Publications. New Delhi
6. Power Electronics by S Rama Reddy, Narosa Publishing House Pvt.Ltd., New Delhi
7. Power Electronics by Sugandhi and Sugandhi
8. Power Electronics – Principles and Applications by J Michael Jacob, Vikas Publishing House, New Delhi

PCB Design and Embedded System Laboratory

1.1 Course Number: EIE302L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Analog Electronics, Microprocessors and Applications
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

1. Study of simulation software and generation of various signals (Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp)
2. Transient responses of series RLC, RL, RC circuits with Sine and Step inputs
3.Simulation of diode bridge rectifiers with R, RL load
4. Simulation of Buck and boost converter
5. Study of PCB Lay-Out Preparation software
6. PCB layout for bridge Rectifier.
7. PCB layout for Buck converter.
8. Addition, subtraction, multiplication and division of two 8-bit numbers
9. Addition of two 16-bit numbers
10. BCD to seven segments
11. Generation of 5ms delay with and without interrupt for timer.
12. Counting no of pulses in the external clock using counter.
13. Send a string serially with 9600 baud rate & receive a string serially and storing in internal RAM.
14. ADC interfacing.

Recommended Books:

1. AutoCAD 2013 for Engineers and Designers, by Sham Tickoo Dream, Tech press, New Delhi, Latest edition.
2. Mastering electronics workbench: Version 5 and Multisim Version 6 by John Adams, McGraw-Hill, New Delhi, Latest edition
3. Introduction to PSpice Using OrCAD for Circuits and Electronics by Muhammad H Rashid PHI Learning, New Delhi, Latest edition
4. Programmable logic controller, Dunning, Delmar.
5.Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata MC Graw-Hill.
6. 8051 microcontroller, 3rd edition, Kenneth Ayala, Cengage Learning

Control and Automation Laboratory

1.1 Course Number: EIE306L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Mathematics-I & II and Transform Calculus
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

1.study of open loop and closed loop position control using a servo motor.
2. Time response of second order system
3. Transfer function of DC motor
4. Plot unit step response of given transfer function and find Peak overshoot, peak time
5. Using MATLAB plot Bode plots and analyze system stability and gain/phase margins.
6.To study cascade control system
7. To study ratio control system
8. To study feedforward control system
9. To study split-range control system
10. Study of PLC Programming Software.
11. Implementation of Basic Logic Gates using PLC.
12. Operation of Relay and Switches using PLC.
13. Speed Control of DC Motor by PLC

Recommended Books:

1. AutoCAD 2013 for Engineers and Designers, by Sham Tickoo Dream, Tech press, New Delhi, Latest edition.
2. Mastering electronics workbench: Version 5 and Multisim Version 6 by John Adams, McGraw-Hill, New Delhi, Latest edition
3. Introduction to PSpice Using OrCAD for Circuits and Electronics by Muhammad H Rashid PHI Learning, New Delhi, Latest edition
4. Programmable logic controller, Dunning, Delmar.
5.Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata MC Graw-Hill.
6. 8051 microcontroller, 3rd edition, Kenneth Ayala, Cengage Learning

Departmental Elective/ Open Elective

Biomedical Electronics and Instrumentation

1.1 Course Number: EIE303
1.2 Contact Hours: 3-0-0 Credits:9
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Class-X level Science and FEEE
1.4 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

2. Objective:

i) To introduce the fundamentals of transducers as applicable to physiology.
ii) To explore the human body parameter measurements setups.
iii) To make the students understand the basic concepts of forensic techniques.
iv) To give basic ideas about how multimedia evidences are useful in crime investigation.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Fundamentals of Biomedical Engineering**	Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers	7
2	**Non-Electrical Parameters Measurement and Diagnostic Procedures**	Measurement of blood pressure - Cardiac output - Heart rate, Heart sound, Pulmonary function measurements, Spirometry, Photo Plethysmography, Body Plethysmography, Blood Gas analyzers, pH of blood – measurement of blood pCO2, pO2, Finger-tipOxymeter - ESR, GSR measurements.	7
3	**Electrical Parameters Acquisition and Analysis**	Electrodes for Biomedical Applications, Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier - ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards – leakage current-Instruments for checking safety parameters of biomedical equipment.	8
4	**Imaging Modalities and Analysis**	Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography –Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.	7
5	**Life Assisting, Therapeutic**	Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine –	7

	and Robotic Devices	Audio meters – Dialysers – Lithotripsy - ICCU patient monitoring system, Introduction to Nano Robots - Robotic surgery – Advanced 3D surgical techniques- Orthopedic prostheses fixation.	
Total			**36**

4. Readings

4.1 Textbooks:

1. "Handbook of Biomedical Instrumentation", R.S. Khandpur, Second Edition, Tata McGraw Hill, 2003.
2. "Handbook of Analytical Instruments", Khandpur R S, Tata McGraw Hill,1989
3. "Biomedical Instrumentation", Shakthi Chatterjee & Aubert Miller, CENGAGE Learning, 2010.
4. "Handbook of Biomedical Instrumentation", Chandralekha Goswami, Manglam Publications, 2010.

4.2 Reference Books:

1. "Principles of Applied Biomedical Instrumentation", L.A.Geddes & L.E.Baker, Wiley India Pvt. Ltd, Third Edition, 1989.
2. "Medical Instrumentation: Application and Design", John G.Webster, Wiley India Pvt. Ltd, Third Edition, 2002.
3. "The Biomedical Engineering Handbook", Joseph D. Bronzino, CRC Press, 1995.
4. "Encyclopedia of Medical Devices and Instrumentation", John G. Webster, Second Edition, Wiley Inter science, 2006.
5. "Principles of Biomedical Instrumentation and Measurements", Richard Aston, Merril Publishing Co, 1990.
6. "Telemedicine: Medicine and Communication", Thorsten M Buzug, Heinz Handels, Dietrich Holz, Springer Verlag, 2001.

5. Outcome of the Course:

After the completion of this course the student will be able to:
1) Understand the physiology of biomedical system.
2) Measure biomedical and physiological information.
3) Discuss the application of Electronics in diagnostics and therapeutic area.

Troubleshooting of Electronic Equipment

1.1 Course Number: EIE304
1.2 Contact Hours: 3-0-0 Credits:9
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Instrumentation and Transducers, Electronic Circuits
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

2. Objective:

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences so as to maintain different types of electronic equipment.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Fundamental Troubleshooting Procedures**	Inside an Electronic Equipment: Reading Drawings and Diagrams – Block Diagram, Circuit Diagram, Wiring Diagram; Dis-assembly and re-assembly of equipment, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions	8
2	**Nature of faults**	Nature of faults, Fault location procedure, Fault finding aids – Service and maintenance manuals and instruction manuals, Test and Measuring instruments, special tools Troubleshooting techniques, approaching components for tests, Grounding systems in Electronic Equipment, Temperature sensitive Intermittent problems Corrective actions, Situations where repairs should not be attempted.	8
3	**Passive Components and Their Testing**	Passive Components- Resistors, Capacitors, Inductors Failures in fixed resistors, testing of resistors, variable resistors, variable resistors as potentiometers, failures in potentiometers, testing of potentiometers, servicing potentiometers, LDRs and Thermistor Types of capacitors and their performance	7

4	**Failures in components**	Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, Testing of inductors and inductance measurement	7
5	**Testing of Semiconductor Devices**	Types of semiconductor devices, Causes of failure in Semiconductor Devices, Types of failure, Test procedures for Diodes, special types of Diodes, Bipolar Junction Transistors, Field Effect Transistors, Thyristors Operational Amplifiers, Fault diagnosis in op-amp circuits.	6
Total			**36**

4. Readings

1. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 2006
2. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001
3. Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F. M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi
4. Consumer Electronics by S. P. Bali, Pearson
5. Op-amps - Design, Application and Troubleshooting by David L Terrell, Butterworth-Heinemann
6. Electronic Testing and Fault Diagnosis by G. C. Loveday, A. H. Wheeler Publishing

5. Outcome of the Course:

1) The students will be able to troubleshoot electronic equipment.
2) They will be able to troubleshoot analog components and circuits.
3) They will understand the basics about faults in semiconductor devices

Signals & Systems

1.1 Course Number: EIE305
1.2 Contact Hours: 3-0-0 Credits: 9
1.3 Semester-offered: 3rd Year –Odd
1.4 Pre-requisite: Laplace Transform and Transform Calculus
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

2. Objective:

i. To understand the basic properties of signal & systems and the various methods of classification
ii. To learn Laplace-transform & Fourier transform and their properties
iii. To know Z-transform & DTFT and their properties
iv. To characterize LTI systems in the Time domain and various Transform domains

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to Signals and Systems**	Classification of continuous and discrete time Signals & Signal operations, Classification of Systems. Linear convolution, discrete time convolution.	8
2	**Frequency Domain Representation Signals**	Fourier series, Fourier Transforms & its properties, Sampling & reconstruction, Discrete Fourier Transform & its properties.	7
3	**FFT Algorithms**	Fast Fourier Transform: DITFFT, DIFFFT algorithm, Inverse DFT& convolution using FFT.	8
4	**Analysis of Continuous Time Systems**	Laplace transform & its properties, Response of continuous time systems, Solution of LTI continuous time systems using Laplace transforms, Introduction to analog filters.	7
5	**Analysis of Discrete Time Systems**	Z-transforms & its properties, Inverse Z-transforms, System response using Z-transform, Two Port Networks, Attenuators, Introduction to digital filters.	8
Total			**38**

4. Readings

4.1 Textbook:

1. Lathi B P, Principles of Signal Processing & Linear Systems Oxford University Press, 2009.
2. Nagrath I J, Sharan S N, Ranjan Rakesh & Kumar S, Signals & Systems, Second Edition, TMH, 2001.

4.2 Reference Books:

1. A V Oppenheim, A S Willsky, Nawab S N, “Signals & Systems”, PHI, Second Edition, 2006

5. Outcome of the Course:

1) Course covers classification of Signals and systems, Fourier series and Fourier transform, Fast Fourier Transform, Sampling theorem, Z transform and inverse Z transform.