Semester IV

Electronic Circuits

1.1 Course Number: EIE206
1.2 Contact Hours: 3-1-0 Credits: 11
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Fundamental of Electrical and Electronics Engineering and Analog Electronics
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

2. Objective:

i) To present application-oriented approach to the students in the field of electronic circuits.
ii) To understand the basics of feedback amplifiers, oscillators.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lecture
1	**Concept of transistor biasing**	Concept of transistor biasing and selection of operating point. Need for stabilization of operating point. Different types of biasing circuits. D.C and A.C load line	8
2	**Single stage transistor amplifier and h-parameters**	Single stage transistor amplifier circuit, calculation of currents and voltage gain of a single stage amplifier circuit. h and r-parameters and their significance. Calculation of current gain, voltage gain, input impedance and output impedance using hand r-parameter. Analysis of high frequency response of CE amplifier. High frequency equivalent circuits of BJT (CE configuration), Short circuit current gain, cut-off frequency, Miller effect, multistage amplifier.	10
3	**Feedback amplifiers**	Effect of positive and negative feedback on gain, frequency response and distortion, Feedback topologies and its effect on input and output impedance, Feedback amplifier circuits in each feedback topologies (no analysis required)	8
4	**Oscillators & Tuned Amplifiers**	Classification of oscillators, Barkhausen criterion, Analysis of RC phase shift and Wien bridge oscillators, Working of Hartley, Colpitts and Crystal oscillators.	8
5	**Power amplifiers**	Classification, Transformer coupled class A power amplifier, push pull class B and class AB power amplifiers, efficiency and distortion, Transformer-less class B and Class AB power amplifiers, Class C power amplifier (no analysis required).	8
Total			**42**

4. Readings

4.1 Textbooks:

1.Sedra A. S. and K. C. Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2013
2. Millman J. and C. Halkias, Integrated Electronics, 2/e, McGraw-Hill, 2010

4.2 Reference Books:

1.Neamen D., Electronic Circuits - Analysis and Design, 3/e, TMH, 2007
2. Rashid M. H., Microelectronic Circuits - Analysis and Design, Cengage Learning, 2011.
3. Spencer R. R. and M. S. Ghausi, Introduction to Electronic Circuit Design, Pearson, 2003
4. Razavi B., Fundamentals of Microelectronics, Wiley, 2015

5. Outcome of the Course:

1) The student can acquire the basic knowledge of electronic circuits, semiconductor devices, thus being prepared to pursue any area of Electronics and Instrumentation engineering spectrum in depth as desired.

2) The students will be able to effectively understand electronic circuits and lead the exploration of new applications and techniques for their use.

Basics of Control System

1.1 Course Number: EIE208
1.2 Contact Hours: 3-0-0 Credits:9
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Mathematics-I & II and Transform Calculus
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

2. Objective:

i) To understand the operation of manual and automatic control systems.
ii) To analyse and understand the stability aspects of physical systems using transfer function model.
iii) To provide adequate knowledge to understand the time response specifications of second order systems and multiloop control systems.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction**	Basic elements of the control system, open loop and closed-loop control systems, manually controlled closed loop systems, automatic controlled closed loop systems, control system examples from mechanical systems, electrical systems.	7
2	**Control system representation**	Transfer function, block diagram, reduction of block diagram, Mason's formula signal flow graph.	8
3	**Time Response Analysis**	Standard test signals, time response of first and second-order system, time constant, time response of second other system, time response specifications, steady-state errors and error constants.	8
4	**Stability**	Routh Hurwitz Criterion, Root Locus, Bode Plotting	8
5	**Multiloop Control System**	Introduction to feed forward, cascade, ratio, split range, control system.	8
Total			**39**

4. Readings

4.1 Textbooks:

1. Control Systems by Nagrath and Gopal.
2. Control Systems by B.C. KUO.
3. Control Systems by Ogata.
4. Control Systems by RC Shukla.

4.2 References Books:

1. Chemical Process Control by Stephenapolis.

5. Outcome of the Course:

1) Illustrate different applications of manual and automatic control systems.
2) Develop the transfer function model of physical system and analyse their stability.
Analyse the time response of a second order system and multiloop control systems.

Microprocessors and Applications

1.1 Course Number: EIE209
1.2 Contact Hours: 3-0-0 Credits: 9
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Digital Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. S. K. Verma.

2. Objective:

i) Understand the architecture of 8085 and 8086.
ii) Impart the knowledge about the instruction set.
iii) Understand the basic idea about the data transfer schemes and its applications.
iv) Develop skill in simple program writing for 8085 & 8086 and applications.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Introduction to microprocessor 8085**	Introduction to Microprocessor, Basic Block diagram of Microcomputer system, Architecture of 8085, Pin Diagram of 8085, Interrupts.	8
2	**Instructions and Programmingi n 8085**	The instruction set of 8085, Timing Diagram, Programming of 8085.	9
3	**Introduction to Microprocessor 8086**	Introduction to 16-bit microprocessor, Introduction to 8086, Pin Diagram and Block Diagram of 8086 and Interrupts.	7
4	**Peripheral Interface**	Interfacing and I/O ports, PPI e.g. 8255 A, 8155 in detail, 8257 in detail, Serial I/O data communication.	8
5	**Semiconductor Memories**	RAM, SRAM, DRAM, ROM, EPROM, EEPROM, Flash Memory.	7
Total			**39**

4. Readings

1. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar
2. Microprocessor and Applications by B Ram
3. Comprehensive Study of Microprocessor by Naresh Grover
4. Introduction to Microprocessor by Adithya P Mathur, Tata McGraw Hill Publishers, New Delhi
5. Microprocessors and Microcontrollers by Krishna Kant, PHI Learning Private Limited.

5. Outcome of the Course:

After the completion of this course the student will be able to:

1) Understand and demonstrate the basic architecture of 8085 and 8086.
2) Impart the knowledge about the instruction set.
3) Understand the basic idea about the data transfer schemes and its applications.
4) Develop skill in simple program writing for INTEL 8085 and INTEL 8086.

Electronic Instruments and Measurements

1.1 Course Number: EIE210
1.2 Contact Hours: 3-0-0 Credits: 9
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: NA
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K.Verma.

2. Objective:
i) To learn the basic principles of all measuring instruments.
ii) To understand the voltage, current and resistance measurement using multimeter and electronic voltmeter.
iii) To understand the operation of digital storage oscilloscope and digital meters.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Multimeter**	Movingcoil and moving iron type instruments (voltmeter and ammeter), Multimeter. Specifications of multimeter and their applications, wheat stone Bridge, AC bridges,: Maxwell's induction bridge, Hay's bridge, Schering bridge and Anderson bridge.	8
2	**Electronic voltmeter**	Advantages over conventional multimeter for volt measurement with respect to input impendence and sensitivity. Principles of voltage, current and resistance measurement (block diagram only) Specifications of electronics voltmeter. Types of AC milli voltmeters and their block diagram description. Typical specification and their significance.	8
3	**Cathode Ray Oscilloscope**	Block diagram description of a basic CRO and triggered sweep oscilloscope, front panel controls specifications of CRO and their explanation. Measurement of current, voltage, frequency, time period and phase using CRO.CRO probes, special features of dual beam, dual trace, delay sweep. Digital storage oscilloscope: block diagram and working.	7
4	**Signal Generators and Analysis Instruments**	Explanation of block diagram specifications of low frequency and RF generators, Pulse generator, function generator. Distortion factor meter; wave analyzer and spectrum analyser.	7
5	**Digital Instruments**	Comparison of analog and digital instruments. Working principle of ramp, dual slope and integration type digital voltmeter. Working principle of logic probe, logic pulser, logic analyzer, logic comparator, Signature analyzer and logic analyser.	8
Total			**38**

4. Readings

4.1 Textbooks

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai & Sons, Delhi
2. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi

4.2 Reference Books:

1. Electronics Instrumentation by Cooper, Prentice Hall of India

5. Outcome of the Course:

1) Describe operation of electronic measuring instruments.
2) Measure the voltage, current and resistance through multimeter and electronic voltmeter.
3) Explain the principle of operation of DSO and digital meters.

Principles of Communication Engineering

1.1 Course Number: EIE211
1.2 Contact Hours: 3-0-0 Credits: 9
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Transform Calculus
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

2. Objective:

i) Distinguish various analog Modulation techniques used in various Communication systems.
ii) To understand basics about noise and it's impact on the communication systems.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	**Introduction**	Overview of Communication system, Communication channels, Need for modulation, Baseband and Pass band signals, Amplitude Modulation: Double sideband with Carrier (DSB-C), Double side band without Carrier DSB-SC, Single Side Band Modulation SSB, Modulators and Demodulators, Vestigial Side Band (VSB), Radio Transmitter and Receiver.	8
2	**Angle Modulation and its types**	Angle Modulation, Bandwidth of FM and PM Signals, Modulators and Demodulators of FM and PM (block diagram, working principle)	6
3	**Pulse Modulation and its types**	Pulse Modulation, Digital Transmission of Analog Signals: Sampling Theorem and its applications, Pulse Amplitude Modulation (PAM), Pulse Width Modulation, Pulse Position Modulation, Their generation and Demodulation, Pulse Code Modulation (PCM), Time Division and Frequency Division Multiplexing	9
4	**Differential Pulse Code Modulation and Noise**	Differential Pulse Code Modulation, Delta Modulation. Adaptive Delta Modulation	7
5	**Certain parameters of noise**	Sources of Noises, Noise in Amplitude Modulation: Analysis, Signal to Noise Ratio, Figure of Merit. Noise in Frequency Modulation, Introduction to mobile communication (an overview)	8
Total			**38**

4. Readings

4.1 Textbooks:

1. Rishabh Anand, Communication Systems, Khanna Publishing House, Delhi
2. B.P. Lathi, "Modern Digital and Analog communication Systems", 3rd Edition, Oxford University Press.
3. H.P. Hsu & D. Mitra "Analog and Digital Communications", 2nd Edition, Tata McGraw-Hill.
4. Communication Systems (Analog and Digital), Sanjay Sharma, Katson Books.

4.2 Reference Books:

1. Herbert Taub and Donald L. Schilling, "Principles of Communication Systems", Tata McGraw Hill.
2. Simon Haykin, "Communication Systems", 4th Edition, Wiley India.

5. Outcome of the Course:

1) Analyze the Amplitude and Frequency Modulated signals.
2) Familiarize the process of reproduction of base band signal.
3) Analyze various pulse analog and pulse digital Modulation Techniques.
4) Understand the noise and its impact on the various process involved in the communication systems

Industrial Process Control and Automation

1.1 Course Number: EIE212
1.2 Contact Hours:3-0-0 Credits:9
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Physics-I and II
1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani, Dr. S. K. Verma.

2. Objective:

i) To understand the operation and selection of flow and level sensors.
ii) To study the operation of pressure and temperature sensors.
iii) To study programmable logic controller and various programming languages.
iv) To induce concept of Supervisory Control and Data Acquisition Systems & distributed control systems and their applications

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-Topic	Lectures
1	**Flow and Level Measurement**	Trends in process control, selection of key variables for process control, hydraulic, pneumatic and electronic instrumentation. Construction, working principle, selection criteria and application of flow measurement with orifices, magnetic, ultrasonic, vortex flow meters, turbine flow meter and rotameter. Construction, working principle, selection criteria and application of level detectors, float level devices, level gauges, optical level devices.	**7**
2	**Temperature and Pressure Measurement**	Construction, working principle, selection criteria and application of temp sensors – thermocouples, RTD's thermistors, IR detectors. Construction, working principle, selection criteria and application of pressure sensors – bellows, diaphragm, bourdon and helical types, electronic pressure sensor, manometers, pressure gauges, high pressure sensors.	**8**
3	**Introduction automation and Computer aided measurement system**	Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, Computer based data acquisition system, Internet of things (IoT) for plant automation.	**7**

4	**Programmable logic controllers**	Programmable controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.	**8**
5	**Supervisory Control and Data Acquisition Systems & Distributed Control System**	Introduction SCADA, Typical SCADA architecture, Benefits of SCADA, Types of SCADA, RTU & MTU functions, Interfacing SCADA system with PLC and Application of SCADA. Overview of DCS, DCS software configuration, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.	**8**
Total			**38**

4. Readings

4.1 Textbooks:

1. Mechanical measurements by AK Sawhney; Dhanpat Rai and Co. New Delhi
2. Mechanical and Industrial measurements by RK Jain, Khanna Publisher, New Delhi
3. Industrial Instrumentation and Control By. S.K. Singh; McGraw Hill Companies

4.2 Reference Books:

1. Process control instrumentation technology by Custis D Johnson: Joh Wiley and sons
2. Process/Industrial Instruments and Control Handbook by considine: Douples M: Magraw Hill
3. Mechanical Measurement by Becwith and Buch: pearson
4. Programmable logic controller, Dunning, Delmar
5. Industrial control handbook, Parr, Newnem.

5. Outcome of the Course:

1) Demonstrate the flow and level sensors.
2) Classify and choose the pressure and temperature sensors for realtime measurements.
3) Develop a logic for various industrial applications using PLC.
4) Understand and demonstrate the Supervisory Control and Data Acquisition Systems & distributed control systems for industrial automation.

Microprocessors and Applications Laboratory

1.1 Course Number: EIE209L
1.2 Contact Hours: 0-0-2 Credits: 2
1.3 Semester-offered: 2nd Year –Even
1.4 Pre-requisite: Digital Electronics
1.5Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

1. Study of 8085 Microprocessor kit.
2. Write a program using 8085 and verify for: a. Addition of two 8-bit numbers. b. Addition of two 8-bit numbers (with carry)
3. Write a program using 8085 and verify for: a. 8-bit subtraction (display borrow) b. 16-bit subtraction (display borrow).
4. Write a program using 8085 for multiplication of two 8- bit numbers by repeated addition method.
5. Check for minimum number of additions and test for typical data and write a program using 8085 for multiplication of two 8- bit numbers by bit rotation method and verify.
6. Write a program using 8085 for division of two 8- bit numbers by repeated subtraction method and test for typical data.
7. Write a program using 8085 for dividing two 8- bit numbers by bit rotation method and test for typical data.
8.Write a program to interface a two-digit number using seven-segment LEDs. Use 8085 microprocessor and 8255 PPI.
9. Write a program to control the operation of stepper motor using 8085 microprocessor and 8255 PPI.
10. Write a program for traffic light controller using 8085 microprocessor and 8255 PPI.

Recommended Books:

1. Microprocessor Architecture, Programming and Applications with 8085 by RS Gaonkar
2. Microprocessor and Applications by B Ram
3. Comprehensive Study of Microprocessor by Naresh Grover
4. Introduction to Microprocessor by Adithya P Mathur, Tata McGraw Hill Publishers, New Delhi
5. Microprocessor by SK Goel.
6. 8051 by Mcakenzie, Prentice Hall of India, New Delhi.

Electronic Instruments and Measurements Laboratory

1.1 Course Number: EIE210L

1.2 Contact Hours: 0-0-2 Credits:2

1.3 Semester-offered: 2nd Year –Even

1.4 Pre-requisite: NA

1.5 Syllabus Committee Members: Dr. Chinmayee Hazarika, Dr. M. Chakkarapani & Dr. S. K. Verma.

1. Measurement of DC/AC current and voltage by Ammeter
2. To study block wise construction of a multimeter and measuring voltage, current and resistance using multimeter.
3. Study of the AC Mill voltmeter.
4. Study of the Electronic voltmeter
5. Measurement of Capacitance using Schering Bridge
6. Measurement of Inductance using Maxwell Bridge
7. Measurement or unknown resistance using kelvin's Bridge.
8. Study the working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (ii) C.R.O. Probes
9. Study of distortion factor meter and determination of the % distortion of the given oscillator.
10. Study the working and applications of Function Generator

Recommended books:

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai & Sons, Delhi
2. Electronics Instrumentation by Cooper, Prentice Hall of India
3. Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala
4. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi