

DETAILED SYLLABUS

Under

Choice Based Credit System (CBCS) Scheme



For

B .Sc Programme in EEM

(Academic Session 2019 and onwards)

APPROVED by BOS, HELD on 17-02-2020

B .Sc EEM Course Outline

Course Structure						
Semester	Course Title	Course Code	Course Type	Credits		
				Theory	Lab	Total
1	Principles of Electronics I	EEM-DSC-1A	Core	4	2	6
2	Principles of Electronics II	EEM-DSC-2A	Core	4	2	6
3	Testing and Troubleshooting of Electronic and Electrical Equipment	EEM-DSC-3A	Core	4	2	6
	Troubleshooting of Electronic Equipment I	EEM-SEC3A	Skill Enhancement	2	2	4
4	Measuring Equipment and Troubleshooting of Electronic and Electrical Equipment	EEM-DSC-4A	Core	4	2	6
	Troubleshooting of Electronic Equipment II	EEM-SEC4A	Skill Enhancement	2	2	4
<i>Discipline Specific Electives</i>						
5	a) Transducers	EEM-DSE-5A	Discipline Specific Elective	4	2	6
	b) Audio Video and Office Equipment I	EEM-DSE-5B				
	c) Maintenance concepts, Instruments and Appliances I	EEM-DSE-5C				
	Surface Mount Assemblies and System Maintenance	EEM-SEC5A	Skill Enhancement	2	2	4
<i>Discipline Specific Electives</i>						
6	a) Process Control	EEM-DSE-6A	Discipline Specific Elective	4	2	6
	b) Audio Video and Office Equipment II	EEM-DSE-6B				
	c) Maintenance Concepts, Instruments and Appliances II	EEM-DSE-6C				
	Equipment Assembly and Circuit Wiring	EEM-SEC6A	Skill Enhancement	2	2	4

Total Credits: 52 (Core: 24, Discipline Specific Elective: 12, Skill Enhancement: 16)

Semester-I

EEM-DSC-1A: Principles of Electronics-I

(Credits: Theory-04, Practicals-02)

Theory: 60 Hours, practicals: 60 Hours

Learning Objectives:

- To prepare the students to have a basic knowledge of passive components and transducers.
- To understand the basics of semiconductors and diodes.
- To understand the operation of BJT, JFET and MOSFET.
- To know about the basics of amplifiers and oscillators.

Unit- I: Passive Devices & Semiconductor Diodes

Introduction to Components: Passive components (Resistor, Capacitor, Inductor), Transformer, Relay, Fuses, Switches and Cable Connectors, Transducers (LDR, Thermistor, Photodiode, IR Diode, LVDT). Conductor, semiconductor, Insulator, Intrinsic and Extrinsic Semi-Conductors (P, N type), Semiconductor Diodes, Diffused junctions, Depletion layer, Barrier Potential, Energy Band diagram. Rectifiers, Forward and Reverse Bias Characteristics, switching diode, Varactor diode, photo diode, light emitting diode, IR source and Detectors, Optical Isolators, Zener diode. **(15 hrs)**

Unit –II: Transistors & Amplifiers

Bipolar Junction Transistors: CB, CE, CC Configurations, Operating point, Biasing Circuits, Bias Stability, Thermal runaway and thermal stability. Field Effect Transistors: FET & MOSFET, Characteristics, biasing and small signal low frequency analysis of CD, CS and CG configurations. Amplifiers : Different terms used in Amplifiers (Signal, Source, Input Output voltage, Current Gain, Power Gain, Decibel, Input and Output Impedances), Amplifier Classifications according to Frequency response, RC coupled common emitter amplifier. **(15 hrs)**

Unit –III: Power Amplifiers

Power Amplifiers: Transistor Power Amplifier- Circuits and operations of Class-A, Class-B and Class-C amplifiers, Push-Pull amplifiers. Uni-junction Transistors: Basic Working Principle (Qualitative), Characteristics, Applications as switch. Power Control Devices: Silicon Controlled Rectifier (SCR), Triacs, Diacs, Principles and Characteristics. **(15 hrs)**

Unit-IV Oscillators

Feedback in Amplifiers and Oscillators: Concept of negative feedback, Voltage series, Voltage Shunt, Current series and Current Shunt feedbacks. Oscillators: Concept of positive feedback, Barkhausen Criterion, RC Phase Shift Oscillator, Hartley, Colpitt and Crystal oscillators. Power Supplies: Regulated Power Supply, Zener Regulated Power Supply, Series and Shunt Regulated Power Supply, 78xx and 79xx regulator series, Block diagram of IC 723 Regulated Power Supply, Study of Power Supply w.r. to variation in Load and Line Voltages). **(15 hrs)**

Recommended Books:

1. Electronic Devices and Circuits by Robert. Bolystead
2. Getting Started in Electronics by Forrest M. Mims.
3. Make Electronics by Charles Plattt
4. All New Electronics – Self Teaching Guide by Harry Kybett and Earl Boyseen
5. Analog Circuits by Robert Pease
6. Microelectronic circuits by A.S Sedra and K C Smith

List of Practical's (EEM- DSC-1A)

Practical work includes the detailed explanation of all the circuit components and blocks of the system. A full demonstration of the system is necessary before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

Practicals:

1. Study of Electronic components and analog multimeter.
2. Verification of KVL and KCL.
3. Study of CRO and determination of amplitude, frequency and time period of observed voltage waveform.
4. Verification of superposition theorem.
5. Verification of Thevenin's theorem.
6. Verification of Nortons' theorem.
7. Study of maximum power transfer theorem and determination of internal resistance of a source.
8. Study of P-N junction diode characteristics and determination of bulk resistance.
9. Study of zener diode characteristics and determination of breakdown voltage.
10. Study of Applications of diode as Clippers and Clampers.
11. Study of common-emitter transistors characteristics and determination of β_{dc} .
12. Study of series resonance circuit and determination of its bandwidth and Q factor.
13. Study of Half wave rectifier and determination of ripple factor and efficiency (η).
14. Study of Full wave rectifier and determination of ripple factor and efficiency (η).
15. Study of Zener shunt regulator, line and load regulation characteristics.
16. Study the I-V characters of JFET & MOSFET.

Semester-II
EEM-DSC-2A: Principles of Electronics-II
(Credits: Theory-04, Practicals-02)
Theory: 60 Hours, Practicals: 60 Hours

Learning objectives

- To acquire knowledge about number systems and their interconversion and study basics of Boolean algebra.
- To study various logic families and gain knowledge about various combinational and sequential logic circuits.
- To study basics of OP-AMPS and their applications.

Unit I: Number system & Boolean Algebra

Number Systems, Introduction to Decimal, Binary, Octal, Hexadecimal Number systems, BCD codes, Inter-conversions of Decimal, Binary and BCD numbers, Excess-3 and Gray codes, Logic Gates: Different Logic Gates (AND, OR, NOT, NAND, NOR, EXOR), Positive and Negative logic. Boolean Algebra: Boolean operations, logic expressions, DeMorgan's theorems, minterms, maxterms, SOP and POS form of Boolean expressions for gate network, simplification of Boolean expression using Boolean algebra and Karnaugh map techniques (upto 4 variables). **(15 hrs)**

Unit II: Logic Families & Circuits

Logic Families: TTL, ECL and CMOS parameters (power dissipation, speed, supply requirements, Logic level, Fan in, Fan out), Noise Immunity. Combinational Circuits: Encoders and Decoders, Multiplexers and Demultiplexers, Adders and Subtractors. **(15 hrs)**

Unit III: Digital Circuits

Sequential Logic Circuits: Flip Flops- SR latch using NAND gates, SR flip-flop, JK flip flop, Master Slave JK Flip Flop, D type flip-flop, T type flip-flop. Shift Register and Counters- serial in- serial out, serial in – parallel out, parallel in – serial out, parallel in-parallel out configurations-Ring counter, Asynchronous counters, synchronous counters, up/down asynchronous counter, Mod-counter. **(15hrs)**

Unit-IV: Operational Amplifiers

Operational Amplifiers and its Applications, Characteristics and Measurements, Emitter Coupled Differential Amplifier, Transfer Characteristics, Voltage gain, Inverting and Non-inverting amplifiers, Voltage follower, Phase inverter, Scale changer, integrator and Differentiator circuits, Summing and Difference Amplifier, 555 Timer: Astable and Monostable operation**(15 hrs)**

Recommended Books:

1. Morris M. Mano, Digital Design, Pearson Pub.
2. A.P. Malvino, Digital Principles and Applications, McGraw Hill International Editions (Fourth Edition)
3. R.P. Jain, Modern Digital Electronics, Tata McGraw Hill Pub (Third Edition).
4. Thomas L. Floyd, Digital Fundamentals-Universal Book stall.
5. R.A. Gayakwad, Operational Amplifiers and Linear Integrated Circuits, PHI
6. Operational Amplifiers by David Bell

List of Practical's (EEM- DSC-2A)

Practical work includes the detailed explanation of all the circuit components and blocks of the system. A full demonstration of the system is necessary before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

Practicals:

1. Study of basic gates (verification of truth table) using ICs.
2. Design and realization of AND, OR and NOT gates using diodes / transistors.
3. Construction of basic gates using NAND / NOR gates.
4. Construction and Study of half adder using NAND gates.
5. Study JK and D Flip Flop using IC's.
6. Design and realization of adder and subtractor (using basic gates).
7. Design and realization of adders and subtractor using universal gates.
8. Design and realization of Multiplexers.
9. Design and realization of De-multiplexers.
10. Design and realization of SR flip flop using NAND and NOR gates.
11. Design and realization of JK flip flop using NAND and NOR gates.
12. Design and realization of D flip flop using NAND and NOR gates.
13. Design and realization of T flip flop using NAND and NOR gates.
14. Study JK and D flip-flop using IC's.
15. To study the various characteristics of 741 OP-amp.
16. To study OP-amp as
 - (a) Adder
 - (b) Subtractor
 - (c) Differentiator
 - (d) Integrator
17. Study the Input Offset parameters of Op-Amp.
18. Study of inverting and Non Inverting Amplifier using Op-Amps.

Semester-III

EEM-DSC-3A: Testing and Troubleshooting of Electronic and Electrical Equipment

(Credits: Theory-04, Practicals-02)
Theory: 60 Hours, lab: 60 Hours

Learning objectives

- To familiarize students with the various passive components used in electrical circuits and study fundamentals of electric circuits.
- To acquire basic knowledge about testing and troubleshooting of various electrical and electronic equipments
- To study the steady state behavior and transient behaviour of various circuits.
- To gain practical knowledge about soldering and its various techniques.

Unit-I

Review of passive components, testing of fixed resistors, variable resistors, potentiometers, failures in potentiometers, servicing of potentiometers, testing of LDRs and Thermistors. Testing of capacitors, Failures in capacitors and precautions, measurement of inductance, testing of inductors, Simple circuits using resistors, capacitors and Inductors. Current and voltage measurement, simple capacitive circuits. **(15 hrs)**

Unit-II

Linear and Non Linear Elements, Active and Passive Elements, Unilateral and Bilateral Elements, Time variant and Time Invariant Elements, Dependent and Independent sources, Tellegan's Theorem, Star Delta Conversion, Superposition Theorem, Thevenin and Norton Theorems, Maximum Power Transfer Theorem, Reciprocity Theorem. **(15 hrs)**

Unit-III

Study of Transient and Steady State behavior of circuits, RL, RC & RLC circuits. Examples of DC transient and AC transient analysis using Source free and source induced circuit examples. Introduction to Phasor diagram for different circuits. Resonance, Series and Parallel type, Quality Factor. **(15 hrs)**

Unit- IV

Solder Joint, Dry Solder Joint, Cold Solder Joint, Good and Bad Solder Joints, Soldering Material, Soldering Tools, Soldering Iron, Soldering Gun, Soldering Station, Soldering Techniques, Testing a Soldering, Ultrasonic Soldering, Tools used for De-Soldering, De-Soldering Techniques Joint, Precautions during Soldering and De-Soldering. **(15 hrs)**

Recommended Books:

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. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku.

List of Practical's (EEM- DSC-1C)

Practical work includes the detailed explanation of all the circuit components and blocks of the system. A full demonstration of the system is necessary before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

Practicals:

1. Study of Oscilloscope.
2. Study of CRO and determination of amplitude, frequency and time of observed voltage waveform.
3. Experiments for the Development of Soldering/De-soldering skills for constructing a simple circuit on PCB.
4. Study of Electronic/Electric components: Resistors, Capacitors, Switches, Relays, Fuse.
5. Study of Oscilloscope.
6. Study of CRO and determination of amplitude, frequency and time of observed voltage waveform.
7. Study of Electronic/Electric components: Resistors, Capacitors, Switches, Relays, Fuse.
8. Design and study of a Regulated Power supply.
9. Testing of any electronic equipment (measuring voltages/currents at checkpoints).
10. Testing and troubleshooting of semiconductor devices (PN Junction diode, special purpose diodes).
11. Testing and troubleshooting of bipolar junction transistor.
12. Testing and troubleshooting of Field Effect Transistor.
13. Testing and troubleshooting of OP-Amp.
14. Testing and troubleshooting of linear and digital ICs.

EEM-SEC3A - Troubleshooting of Electronic Equipment's- I

(Credits: Theory-02 Practical-02)

Theory: 30 Hours, practicals: 60 Hours

Learning objectives

- To study the various passive components used in electric circuits, and their testing.
- To study reasons for failures in various components, techniques for failure detection and troubleshooting.

Unit I

Passive Components, Resistors, Capacitors, Inductors Failures in fixed resistors, testing of resistors, variable resistors, Failures in potentiometers, testing of potentiometers, servicing potentiometers, LDRs and Thermistors. **(6 hrs)**

Unit II

Testing of Components, Types of capacitors and their performance, Failures in capacitors, testing of capacitors and precautions therein, variable capacitor types, testing of inductors and inductance measurement. **(7 hrs)**

Unit III

Inside Electronic Equipment, Reading Drawings and Diagrams, Block Diagram, Circuit Diagram, and Wiring Diagram, Equipment Failures and causes such as poor design, production deficiencies, careless storage and transport, inappropriate operating conditions. **(7 hrs)**

Unit IV

Fault Detection and troubleshooting basics, Nature of faults, Fault location procedure, Fault finding aids, Service maintenance and instruction manuals, Test and Measuring instruments, special tools Troubleshooting techniques. Different components for tests, Grounding systems in Electronic equipment, Temperature sensitive intermittent problems, Corrective actions, Situations where repairs should not be attempted. **(10 hrs)**

Recommended Books:

1. Electronic Testing and Fault Diagnosis by G. C. Loveday, A. H. Wheeler Publishing.
2. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 2006
3. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001.

List of Practical's (EEM- SEC1)

Practical work includes the detailed explanation of all the circuit components and blocks of the system. A full demonstration of the system is necessary before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Study various types of resistances and capacitances.
2. Study different types of tools used in equipment maintenance (Wire stripper, Types of Pliers, Crimping tools, etc.)
3. Soldering, De-soldering, Multimeter testing for continuity of printed line in PCB.
4. Identification of different type of connectors and ports used in latest equipment's.
5. Construction of Digital multimeter.
6. Function and operation of regulated power supply.
7. Testing and Troubleshooting of CRO and Function Generator.
8. Steps of Single layer PCB Design.
9. Testing the different grounding system in Electronic Equipment's.
10. Testing potentiometer, LDR and thermistors.

Semester-IV

EEM-DSC-4A: Measuring Equipments and Troubleshooting of Electronic and electrical equipments

(Credits: Theory-04, Practicals-02)

Theory: 60 Hours, practicals: 60 Hours

Learning Objectives:

- To introduce students to the use of various electronic/electrical instruments their construction, applications, principles of operation.
- To study the basics of transducers and know about different types of transducers.
- To understand the basic concept of maintainance and the various challenges in maintainance.
- To enable students to know about the various test and measuring instruments and practical approaches to troubleshooting.

Unit I

Measurement error, accuracy and precision in analog and digital circuits, Relative and Absolute error, Transducers, classification modes in transducers, Passive and Active type, primary and secondary types. **(15 hrs)**

Unit II

Concept of maintenance, Principles of Maintenance, Benefits of Maintenance, System Approach to maintenance, challenges in Maintenance, Maintenance Objectives, Responsibilities of Maintenance Department, Types of Maintenance systems, Effects of Maintenance. **(15 hrs)**

Unit III

Analog Multimeter, Digital Multimeter, Frequency meters, Graphical Multimeter, Megger, Oscilloscope: dual beam Vs dual trace oscilloscopes, Digital storage oscilloscope, controls on digital oscilloscope, Measurements with oscilloscope, Precautions in use of an oscilloscope, Oscilloscope probes, Logic analyzer, Wattmeter. **(15 hrs)**

Unit IV

Nature of faults, Fault location procedure, Fault finding aids - Service and maintenance manuals and instruction manuals, Importance of Service Manual, Component Data Book. , Test and measuring instruments, special tools Troubleshooting techniques, approaching components for tests, Grounding systems in Electronic Equipment, Corrective actions. Practical Approach to trouble shooting of Voltage Stabilizers and inverters. **(15 hrs)**

Recommended Books

1. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH2006.
2. Engineering and Management by R C Mishra and K Pathak, Prentice Hall of India.
3. Electronic Instrumentation by A. K. Sahwney.
4. Consumer Electronics by S. P. Bali, Pearson
5. Electronic Testing and Fault Diagnosis by G. C. Loveday, A. H. Wheeler Publishing Handbook of electrical design by Neil Sclater, Publisher MC Graw Hill

List of Practical's (EEM- SEC1)

Practical work includes the detailed explanation of all the circuit components and blocks of the system. A full demonstration of the system is necessary before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Study and testing of PCB layout of any electronic circuit.
2. Practical on assembling/de-assembling of electronic equipment.
3. Design of regulated power supply using Op-amp.
4. Design of battery charger.
5. Design and study of AC Voltage Stabilizer.
6. Practical tests of repairing of DC-AC Inverter.
7. Testing of Electrical equipment.
8. Testing of Electronic equipment.
9. Design of UPS.
10. Design any electrical equipment using wiring diagram.

EEM-SEC4A - Troubleshooting of Electronic Equipment's-II

(Credits: Theory- 02 , Practical-02)

Theory: 30 Hours, lab: 60 Hours

Learning Objectives:

- To gain knowledge about the various types of semiconductor diodes.
- To understand fundamentals of digital IC design.
- To enable students to understand various concepts related to testing of digital ICs .
- To enable students to learn about practical approaches to troubleshooting.

Unit I

Diodes, ideal diode model, constant voltage model, exponential model, Zener diode, Schottky diode, Tunnel Diode, Varactor Diode. **(8 hrs)**

Unit II

Design metrics for Digital Design, Different costs, Die yield involved in IC fabrication, Fan in, Fan out, Noise Immunity, Noise Margin, Noise Sensitivity. **(8 hrs)**

Unit III

Testing Integrated Circuits, Testing digital ICs with multimeter, testing the static and dynamic parameters of IC. Different type of IC packaging, multiplexers and de-multiplexers, encoders and decoders, Tri-state logic **(8 hrs)**

Unit IV

Fault Diagnosis and Precautions, Special consideration for fault diagnosis in digital circuits, handling precautions for ICs sensitive to static electricity. **(6 hrs)**

Recommended Books:

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

List of Practical's (EEM- SEC1)

Practical work includes the detailed explanation of all the circuit components and blocks of the system. A full demonstration of the system is necessary before proceeding with the hands on experimentation..Atleast 10 experiments from the following:

1. Study of VI characteristics of Different type of Diodes.
2. Experiments on Rectification and voltage regulation using Diodes.
3. Experiments on Clipping and Clamping Circuit combinations.
4. Design of BJT based amplifier in Common Emitter configuration using voltage divider biasing.
5. Experiments on Crystal oscillator.
6. Use of gate IC's to generate different combinational logic.
7. Design of Encoder, Decoder, Comparators using logic ICs.
8. Experiments using MUX IC's to generate different logical functions.
9. Design of different types of Flip Flops.
10. Experiments on Counters, Registers and Memory Elements.

Semester-V

EEM-DSE-5A Transducers

(Credits: Theory-04, Practicals-02)

Theory: 60 Hours, lab: 60 Hours

Learning objectives:-

- To introduce students to the use of various electrical/electronic instruments, their construction, applications, principles of operation, standards and units of measurements.
- To gain basic knowledge about transducers and their application in measurement system

Unit I

Calibration methods, Static calibration and Generalized Measurement System, Sensor vs Transducer, Basic requirements of a transducer, Classifications of transducer. Statistical methods, Odds and uncertainty, Choice of transducer, factor influencing choice of transducer. **(15 hrs)**

Unit II

Static characteristics of transducer, Accuracy, Precision, Sensitivity, Linearity, Hysteresis, Threshold, Resolution, Dead time, Dead zone, Scale range, Scale span & dynamic characteristics. Speed of response, Measuring lag, Fidelity, Dynamic error, mathematical model of transducer, Zero, I, II, order transducer-Response to step, ramp, impulse inputs. **(15 hrs)**

Unit III

Principle of operation, construction, Characteristics and applications of potentiometer, loading effects, Strain gauge: theory, types, temperature compensation, applications of RTD, Thermistors, Hotwire anemometer, piezo-resistive sensor, load cell, LDR, Humidity sensor, Photo conductive cell. **(15 hrs)**

Unit IV

Self-inductance/Mutual inductance transducer, Induction potentiometer, Variable reluctance transducers, LVDT Capacitive transducers, Variable air gap type, Variable area type, Variable permittivity type, Capacitor displacement transducer, Capacitor microphone, Applications(Measurement of level, pressure, thickness, sound). **(15 hrs)**

Recommended Books:

1. Doebelin E.A., "Measurement Systems-Applications and Design", Tata McGraw Hill, New York
2. Sawhney A.K., "A course in Electrical & Electronic Measurement and Instrumentation", Dhanpat Rai and Co (P) Ltd, reprint 2013.
3. Patranabis D, "Sensors and Transducers", PHI, 2003.
4. Murthy, D.V.S., "Transducers and Instrumentation", PHI, 2011
5. Renganathan.S. "Transducer Engineering", Allied Publisher, Chennai, 1999.

List of Practical's (EEM-DSE-1A)

Practical work includes the detail explanation of all the circuit components and blocks of the system are included. A full demonstration of all the systems is a must before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Measurement of displacement using LVDT
2. Measurement of LVDT Sensitivity and Characteristics
3. Measurement of displacement and force using Strain Gauge.
4. Measurement of force and gauge factor using Strain Gauge.
5. Measurement of Resistance using Thermistor
6. Thermocouple For measurement of temperature and resistance.
7. Measurements of Force using Load Cell arrangement
8. Working of Solar Panel.
9. Measurement of Humidity using Hygroscopic Sensors
10. Photo-sensor for measurement of speed of a stepper motor.

EEM-DSE-5B Audio Video and Office Equipment-I

(Credits: Theory-04, Practicals-02)

Theory: 60 Hours, Practicals: 60 Hours

Learning objectives

- To study working and applications of various types of multimedia data projectors.
- To acquire knowledge about various types of computers and peripherals for use in laptop computers.
- To gain basic knowledge about various types of I/O devices like printers and scanners.
- To gain familiarity with CCTV, CATV and various application areas of HDTV.

Unit I

Construction, working and applications of Multimedia Data projector, LCD and DLP projectors, Large screen and Rolling display, Slide projector and Overhead projector. **(15 hrs)**

Unit II

Construction, working principle and applications of: Desktop PC, CPU, connectors on the CPU, motherboard, latest processors and peripherals. Block diagram of Laptop computer. Peripherals for use in Laptop computer. Use PC peripherals such as keyboard, different types of mouse. **(15 hrs)**

Unit III

Dot matrix printer, Inkjet laser printer. Concept of barcode- printers and different types of barcodes and readers, Video adapters and color displays and standards. Different types of scanners, FAX machine, Photocopying machine, EPABX system. **(15 hrs)**

Unit IV

CCTV and CATV, Application areas for HDTV such as Education, Research Finger touch machine, Iris scanner, Automatic door opening system, and biomedical instruments. **(15 hrs)**

Recommended Books:

1. Consumer Electronics by S P Bali, Pearson 2008.
2. CCTV Student Handbook "Introduction to Closed Circuit Television" by Kristina Irelan and J. Ehlers.
3. Computer Peripherals by Leo F. Doyle.
4. Computer Hardware Installation, Interfacing, Troubleshooting and Maintenance by K. L. Jmaes.
5. Printer: Introduction, Servicing and Troubleshooting By Manahar Lotia.

List of Practical's (EEM-DSE-2A)

Practical work includes the detail explanation of all the circuit components and blocks of the system are included. A full demonstration of all the systems is a must before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Study of practical arrangement of CCTV in public places, cameras used, range, coverage, area etc.
2. Identification of functional blocks/sections, preventive maintenance and minor repairs. 11 Multimedia Projector
3. Method of Data/Multimedia Projector: Setting up and connections to PC.
4. Study of EPABX and its programming.
5. Study of Mobile Phone – identification of parts, dismantling and reassembling of latest smart phones.
6. Identification of functional blocks/sections, preventive maintenance and minor repairs.
7. Study of motherboards with latest processor including Intel, CMOS setup
8. Troubleshooting of a PC.
9. Identification of functional blocks/sections, electrical interconnections, preventive maintenance and installation of drivers.
10. Study and inspect the hardware components of Scanner , FAX/Multifunction machine, Dot Matrix Printer
11. Study and inspect the hardware components of Inkjet Printer, Laser Printers.

EEM-DSE-5C Maintenance Concepts, Instruments and Appliances-I

(Credits: Theory-04, Practicals-02)

Theory: 60 Hours, lab: 60 Hours

Learning objectives

- To acquire knowledge about various types of electronic equipments and their design specifications.
- To study working and principles of various types of electrical machines.
- To study working and principles of various types of analog circuits.

Unit I

Electronic Equipment, Potential Problems, Quality, Terminology and definitions of : Reliability, Failure, Failure Rate, Mean Time between Failures (MTBF), Mean Time to Fail (MTF), Mean Time To Repair (MTR), Maintainability, Availability, Redundancy. **(15 hrs)**

Unit II

Construction of DC and AC generator , Equation for Generator Emf , Working of Dynamo , Construction of DC generator , Concept of Rotor and Stator .Study of tachogenerators. **(15 hrs)**

Unit III

Study of dc motor, construction and principle of operation, Study of motor windings, Introduction to transformers, autotransformer, dc to ac converter, chopper circuits. **(15 hrs)**

Unit IV

Analog to digital converters, Schmitt Trigger, Instrumentation Amplifiers, 555 Timer, Monostable and Bistable Multivibrators, Sweep generator and Square wave generator **(15 hrs)**

Recommended Books:

1. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta
Tata McGraw Hill Edition 2001.
2. Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F.M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick, Prentice Hall of India Pvt. Ltd. New Delhi.
4. Digital Instrumentation A. J. Bouwens, Tata McGraw Hill.
5. Electrical Machines by Nagrath Kothari.

List of Practical's (EEM-DSE-3A)

Practical work includes the detail explanation of all the circuit components and blocks of the system are included. A full demonstration of all the systems is a must before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Experiments on Rheostat, Potentiometer and Switches, EM Relay, Transformer, Autotransformer (Dimmerstat), Fuses.
2. Study and inspect all the parts of DC and AC generator circuit.
3. Working of DC and AC generator.
4. Working operation of Dynamo.
5. Study and inspect all the different type of Motor Circuits (Induction, synchronous etc.)
6. Study the operation of Chopper circuit using proper waveforms
7. Design of a stable and monostable multivibrators using 555 Timer.
8. Working of Instrumentation Amplifiers
9. Study of transformer action.
10. Analyze the output waveform for a square wave and sawtooth wave generators.

EEM-SEC5A– Surface Mount Assemblies and System Maintenance

(Credits: Theory-02 Practical-02)
Theory: 30 Hours, lab: 60 Hours

Learning objectives:-

- To acquaint students with the surface mount technology and packages of various types of surface mount semiconductors.
- To study various types of power supply circuits.
- To study principle of operation of various types of cordless phones and help students develop troubleshooting skills for Repairing of faults and maintenance of cordless telephones.

Unit I

Surface Mount Technology, its advantages/disadvantages and surface mount devices, Surface Mount Semiconductor packages – SOIC, SOT, SOD, LCCC, LGA, BGA, COB, MELF, Concept of reworking, SMD passive components, resistors and capacitors. **(8 hrs)**

Unit II

Flat packs and Quad Packs, Cylindrical Diode Packages, use of GRID arrays, introduction to SME, Packaging of Passive Components as SMDs Repairing Surface Mount PCBs, Rework Stations, Non Packaged devices such as COB, COF, COG. **(8 hrs)**

Unit III

Power supply Circuits – Types of Regulators, Power Supply Troubleshooting, Linear power supply and SMPS, SMPS types based on topologies. **(6 hrs)**

Unit IV

Cordless Telephone: Principle of Operation and detailed functional Block Diagram, Troubleshooting and maintenance of cordless telephone. Mobile Phone – faults in microphone, earpiece, ringer, vibrator etc. and solutions Digital Still Camera – typical faults and troubleshooting. **(8 hrs)**

Recommended Books:

1. Electronic Testing and Fault Diagnosis by G. C. Loveday, A. H. Wheeler Publishing.
2. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 2006
3. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001.
4. Consumer Electronics by S. P. Bali, Pearson.

List of Practical's (EEM-SEC3)

Practical work includes the detailed explanation of all the circuit components and blocks of the system. A full demonstration of the system is necessary before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Study of different packages like SOIC, SOT, LGA, BGA.
2. Study of Non Package devices such as COB, COF, COG.
3. Analysis and study of different class of electronic assemblies.
4. Study of SMT Pad soldering techniques.
5. PCB Handling and PCB testing for short and open circuits.
6. Mobile PCB parts testing and trouble shooting.
7. Flashing in Mobile Phones and its different styles.
8. Working and design of Inverter Circuits.
9. Study of SMPS and its different topologies.
10. Testing and Troubleshooting of Digital Still Camera.

Semester-VI
EEM-DSE-6A Process Control
(Credits: Theory-04, Practicals-02)
Theory: 60 Hours, Practicals: 60 Hours

Learning objectives:-

- To understand basic concepts of computer controlled systems.
- To gain knowledge of digital control interfacing and SCADA.
- To understand concept of feedback and learn about state space analysis.
- To understand key differences between adaptive controllers and linear controllers.

Unit I

Need of computer in a control system, Functional block diagram of a computer control system, Data loggers, Supervisory computer control, Direct digital control, Digital control interfacing, SCADA. **(15 hrs)**

Unit II

System modeling and identification, Mathematical model for processes, first order, and second order processes without and with pure delay, higher order systems, pulse testing for process identification, linear least square algorithm. Implementation of digital controller. Digital temperature control system, digital position control system, stepping motors and their control. **(15 hrs)**

Unit III

Concept of feedback, State space analysis, Linear and Non-Linear control, Controllability and Observability using Kalman test. State space equations. **(15 hrs)**

Unit IV

Adaptive control, Self Tuning, Gain Scheduling, Model Reference Adaptive Control, Self Tuning Regulator, Feed forward Control, Cascade Control. **(15 hrs)**

Recommended Books:

1. Instrumentation and Process Control by Terry Bartelt.
2. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 2006
3. Instrument Engineer's Handbook Process Control by Bela G. Liptak
4. Instrumentation for Process Measurement and Control by Norman A Anderson

List of Practical's (EEM-DSE-1B)

Practical work includes the detail explanation of all the circuit components and blocks of the system are included. A full demonstration of all the systems is a must before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Determine the time constant and transfer function of first order process using P.C. simulator.
2. To observe time response of closed loop second order process with proportional control.
3. Study time response of PI Controller
4. Study time response of PID Controller
5. Study the pressure control loop, pressure source control system
6. Study typical level control loop having level transmitter, motorized control valves.
7. Study air duct flow monitoring and control
8. Study PLC and design using digital ladder logic programming
9. Study DCS based Instrumentation
10. Study SCADA based instrumentation.

EEM-DSE-6B Audio Video and Office Equipment-II

(Credits: Theory-04, Practicals-02)

Theory: 60 Hours, Practicals: 60 Hours

Learning objectives:-

- To enable students to have basic knowledge of audio and video systems construction and working principle.
- To understand basics of TV transmission.
- To familiarize students about basics of VCD and DVD.

Unit I

Audio Systems Construction, principle of working and typical applications of: AM and FM radio receiver, receiver ICs, receiver characteristics and alignment, Use of these Receiver principles in mobile phone, satellite receiver (dish TV receiver) etc. High fidelity music systems, Principles of recording and replay of audio CD and ACD player. Blu-Ray player, Remote controls for these units, MP3 player, process of downloading mp3 in it. Different audio file formats and their comparison. **(15 hrs)**

Unit II

Video Systems Construction, principle of working and typical applications of: Principles of TV transmission, vestigial sideband transmission, standard TV channels in India.(Brief Review).Principles of scanning and synchronization, composite video signal, B/W TV receiver Block diagram. (Brief Review) Principles of color TV transmission and PAL-B color standard. Block diagram of color TV, B/W and color picture tubes. **(15 hrs)**

Unit III

Purpose of changing over from analog to digital TV and its timeline, the new Digital TV standards, SDTV / HDTV, Set-top box for cable TV and for DTH Construction of LCD and plasma panels for TV application. Working of LCD and plasma displays. Block diagram of digital LCD and plasma TV. Video monitors-CRT and LCD. **(15 hrs)**

Unit IV

Basic information of VCD and DVD. Block diagram of VCD player and DVD Player. Applications of TV, Typical Automotive infotainment system - block diagram Public address system and its components, Home Theater, Car entertainment system.**(15 hrs)**

Recommended Books:

1. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta
Tata McGraw Hill Edition 2001
2. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH 2006
3. Consumer Electronics by S P Bali, Pearson 2008.
4. Standard Handbook of Audio and Video Engineering by Jerry Whitaker and Blair Benson

List of Practical's (EEM-DSE-2B)

Practical work includes the detail explanation of all the circuit components and blocks of the system are included. A full demonstration of all the systems is a must before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Experiments on AM/FM radio receiver and its alignment.
2. Experiments on Music system: Study of hi-fi amplifier {LM 380}, stereo system, graphic equalizer, speaker system
3. Experiments on Color TV receiver: Observation of waveforms and voltages at various test points.
4. Tracing and study of block diagram of LCD TV/ Plasma TV. Group B Setting up, preventive maintenance, minor repairs and fault identification.
5. Experiments on MP3 player: Study of block diagram and various controls, downloading of songs
CD/DVD player: Identification of parts, study of various controls group parts.

EEM-DSE-6C Maintenance Concepts, Instruments and Appliances-II

(Credits: Theory-04, Practicals-02)

Theory: 60 Hours, Practicals: 60 Hours

Learning objectives:-

- To understand the importance of measurements and characteristics of measuring instruments.
- To know about AF and RF signal generators..
- To familiarize students with microwave devices and electrochemical cells.

Unit I

Language of Electrical Measurements, Experimental Data and Errors Measurement Recording and Reporting, Graphical Representation of Data, Precision and Accuracy, Resolution and Sensitivity, Errors in Measurement, Statistical Evaluation of Measurement Data and Errors. (15 hrs)

Unit II

Emergency lights, Circuit breakers, Home protector, spike protector, Stabilizers, Online UPS and Off Line UPS Standard operating method and safety precaution of - AF signal generator, RF signal generator. (15 hrs)

Unit III

Standard operating method and safety precaution and simple indicative numerical problems of Digital Clock (watch), Microwave oven, Mixer, grinder, Roaster, Electric geyser, Electric iron, Telephone instrument, Headphone, Hearing aids, Electronic ignition system, Washing machine, induction cooker. (15 hrs)

Unit IV

Electrochemical cells – Chargeable, non-rechargeable, AA, AAA, Button, Cellphone battery, Typical voltages, Amp-Hour rating, precautions during use and disposal Tools: Screw-drivers, Allen key, Automatic Centre punch, files, cutters, pliers, wire strippers, hacksaw, soft tools(chemicals for electronics).(15 hrs)

Recommended Books:

1. Troubleshoot And Repair Major Appliances By Eric Kleinert
2. Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F.M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick, Prentice Hall of India Pvt. Ltd. New Delhi.
4. Digital Instrumentation A. J. Bouwens, Tata McGraw Hill.
5. Battery reference book by T.R.Crompton.

List of Practicals (EEM-DSE-3B)

Practical work includes the detail explanation of all the circuit components and blocks of the system are included. A full demonstration of all the systems is a must before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Troubleshoot and repair MCB, ELCB (Demonstration of operation by creating test fault condition).
2. Working operation of Spike protector
3. Experiments on PMMC/ Analog multimeter /Digital multimeter.
4. Repairing of Single Power Supply or Dual Power Supply.
5. Repairing Electrical appliances such as electric fan, geysers, iron, motors etc.
6. Study of Electrical Wiring (including drawing schematic) of Home appliances (Schematic, Identification of parts, disassembly and assembly).
7. Experiment on repair of Tube light.
8. Experiment on recharging of battery.
9. Experiments on Error calculation (relative and absolute) using LVDT, Strain Gauge.
10. Study the working of UPS and inspect the components.

EEM-SEC6A– Equipment Assembly and Circuit wiring

(Credits: Theory-02 Practical-02)

Theory: 30 Hours, Practicals: 60 Hours

Learning objectives:-

- To understand basics of circuit wiring and gain knowledge about CAD tools for PCB Design.
- To gain practical knowledge about soldering and its various techniques.
- To understand use of equipment enclosures.

Unit I

Circuit boards, Types of PCB, Single sided, double sided and multilayer, Layout techniques (Examples of using discrete components and IC's to be used). Processes on PCB (Pattern transfer), CAD tool for PCB design. Breadboard, internal connections of breadboard, Assembling Circuit on breadboard. **(8 hrs)**

Unit II

Solder joint, dry solder joint, cold solder joint, Good and bad solder, solder material soldering tools, soldering gun, soldering station, ultrasonic soldering station soldering techniques, tools for desoldering, desoldering techniques, testing of soldering joints, Precautions during soldering and de-soldering. **(8 hrs)**

Unit III

Electrical wiring and Equipment enclosures/cabinets Types of Wires, Gauges, Selection of wires, Types of cables, UTP, STP, Armoured, flat ribbon type etc. with examples of common applications e.g. cables in a PC, safe voltage and current ranges, Color conventions, Wire harnessing. Typical Simple Household Wiring, Wiring of tube light, switchboard wiring, stair case wiring, fan regulator and fan wiring, Power cable wiring, grounding and shielding, Earthing – necessity and methods. Electric shock and precautions. **(8 hrs)**

Unit IV

Enclosure Types: Cabinet racks (incl. NEMA 12) ,Server racks, Co-location racks, Open racks (Large open racks, table-top racks, swing-frame, relay racks), Wall mount cabinets Rack mount enclosures, Card racks, Portable cabinets, Chassis, Small metal enclosures, Cast metal enclosures, Plastic boxes, NEMA 4x enclosures. **(6 hrs)**

Recommended Books:

1. Art of Electronics by Horowitz and Hill, Cambridge University Press.
2. Student Reference Manual for Electronic Instrumentation Laboratories by Stanley Wolf, and Richard F.M. Smith, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Electronics Shop Practices, Equipment and Materials by Clyde N. Herrick Prentice Hall Inc.

List of Practical's (EEM-SEC4)

Practical work includes the detailed explanation of all the circuit components and blocks of the system. A full demonstration of the system is necessary before proceeding with the hands on experimentation. Atleast 10 experiments from the following:

1. Experiment on PCB Design steps (schematic , layout , power and ground plane) and generation of CAM files
2. Design half wave rectifier and full wave rectifier using discrete components on Bread Board.
3. Design half wave and full wave rectifier using PCB generation.
4. Testing and Analysis of different type of cabling for equipment maintenance.
5. Testing and Troubleshooting for household wiring Switchboard Wiring , staircase wiring)
6. Testing and Troubleshooting Fan regulator and motor.
7. Experiments on Different troubleshooting schemes for grounding and shielding in equipments.
8. Study NEMA 4x Enclosure, portable cabinets.
9. Study of Different types of Racks and cabinets for equipment handling.
10. Steps of Multi-layer PCB Design.