Fergusson College (Autonomous)

Pune

Learning Outcomes-Based Curriculum

for

F. Y. B. Sc.

(Electronic Equipment Maintenance)

With effect from June 2019

Program Outcomes (POs)

PO1	Gains in-depth knowledge of technological aspects of electronics
PO2	Acquires knowledge of maintenance and troubleshooting
PO3	Gets hands-on-training related to instruments and tools used for maintenance and troubleshooting
PO4	Learns the basic and advanced tools for making PCBs and assembly of circuits
PO5	Understands installation and fabrication process of solar-LED lighting systems
PO6	Enriches the knowledge through industrial visits, On-the-Job training, market survey, hobby projects etc.
PO7	Acquires the maintenance and troubleshooting skills in the areas of solar-LED lighting products, instrumentation, PC hardware, computer networking and consumer products.
PO8	Learns to use and understand the servicing manuals of consumer products.

Mapping Program Outcomes with Course Outcomes

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
Course-1	×	×						
Course-2	×	×	×					
Course-3	×		×					×
Course-4	×			×				
Course-5	×				×			
Course-6	×		×					×

F. Y. B. Sc. (Electronic Equipment Maintenance): EEM

Particulars	Course	Paper code	Title of Paper	No. of Credits
F.Y. B.Sc. Semester- I	Course- 1	EEM1101	Components, devices and circuit drawings	2
	Course- 2	EEM1102	Maintenance and troubleshooting - tools and instruments	2
	Course- 3	EEM1103	EEM Practical - I	2
F.Y. B.Sc. Semester- II	Course- 4	EEM1201	PCB design and assembly	2
	Course- 5	EEM1202	Solar thermal and LED lighting system	2
	Course- 6	EEM1203	EEM Practical - II	2

S.Y. B.Sc. (Electronic Equipment Maintenance): EEM

Particulars	Name of Paper	Paper code	Title of Paper	No. of Credits
S.Y. B.Sc. Semester- III	Paper - 1	EEM2301	Maintenance and troubleshooting of Instruments	3
	Paper - 2	EEM2302	Computer Maintenance and troubleshooting	3
	Paper - 3	EEM2303	EEM Practical - III	2
S.Y. B.Sc. Semester- IV	Paper - 1	EEM2401	Consumer products - maintenance and Troubleshooting	3
	Paper - 2	EEM2402	Computer network - Maintenance and troubleshooting	3
	Paper - 3	EEM2403	EEM Practical - IV	2

EEM1101: Components, devices and circuit drawings [Credits -2]

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Explores different components and devices in electronic systems 2. Acquires skill of reading circuit drawings and diagrams 3. Gets acquainted with functionality and symbols of electronic components and devices 4. Knows the important technical specifications of components and devices 5. Decodes the data sheets for the components and devices	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams to discuss different electronic systems, components and circuits. 3. Discuss technical specifications and datasheets of the components

Unit -I	**Exploring electronic systems and equipments** Electronic system and equipments, electronic circuits, types of printed circuit boards, identification of components, devices and enclosures, reading drawings and diagrams- block diagrams, circuit diagrams, wiring diagrams, front and rear panels Case studies - (a) Consumer Products – Mobile phones, still camera, video Camera, Car audio/video system, Home audio/video system; (b) Test and measuring instruments – power supply, meters, multimeters, signal generators and CRO	10
Unit -II	**Revealing technical specifications of passive components** Functionality, Visual identification, technical specifications and testing: colour codes, device marking schemes and interpretation of information printed on the body of devices and use of data sheets- Resistor, capacitor, inductors, transformers, switches, relays, solenoids, Fuses, connectors, cables, Batteries; Motors (DC), contactor, circuit breakers, MCB, ELCB	18
Unit -III	**Decoding data sheets of semiconductor devices** Semiconductor device numbering, data sheets, absolute maximum rating, reading of data sheets, packages and lead information of Diodes, BJT, JFET, MOSFET, DIAC, TRAIAC, UJT, LEDs, LCDs, 7-segment, dot matrix, bar graph, LEDs for lighting, Linear and digital ICs, SMDs	8

References

1.	Troubleshooting Electronic Equipment, R. S. Khandpur, Tata Mc Graw Hill Publishing Ltd. (2007)
2.	Electronic Instruments and systems: Principles, maintenance and troubleshooting, R. G. Gupta, Tata Mc Graw Hill Publishing Ltd. (2004)

EEM1102: Maintenance and troubleshooting - Tools and Instruments

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Summarises the importance of maintenance and troubleshooting. 2. Defines terminologies related with maintenance and troubleshooting. 3. Lists variety of tools and instruments for maintenance and troubleshooting 4. Identifies and selects tools and instruments for maintenance and troubleshooting	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams to discuss the concepts and troubleshooting steps. 3. Demonstrate instruments for troubleshooting.

Unit -I	**Maintenance and troubleshooting concepts** Maintenance and troubleshooting – 5 Ws and 1H (Why, What, Where, Which, Who and How); 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, Fail Safe Design, Maintenance policy, Stages of Maintenance	**8**
Unit -II	**Tools for maintenance and troubleshooting** Functionality, types and use - Screwdrivers, cutter, pliers, wire strippers, crimp tools, hex drivers, clamps, drills, drill machines, grinders, hacksaw, Files, punch, tweezers, soldering gun and soldering stations, solder and flux, IC holders, magnifier and microscopes for SMDs, Fasteners and adhesives – screws, self tapping screws and bolts, washers, rivets, Soft tools - adhesives and bonding, glues, epoxies and solvents, lubricants, freeze spray	**16**
Unit -III	**Instruments for maintenance and troubleshooting** – Idea of test and measuring instruments, Functionality (Principle and understanding front panel), types and use of voltmeters, ammeters, ohm-meters, AMMs, Meggers, DMMs, DFMs, power supplies, signal/function generator, CROs and DSOs	**12**

References

1.	Electronic Instruments and systems: Principles, maintenance and troubleshooting, R. G. Gupta, Tata Mc Graw Hill Publishing Ltd (2004)
2.	Practical Electronics: Components and techniques, J. M. Hughes, O'Reilly Media Inc (2015)
3.	Troubleshooting Electronic Equipment, R. S. Khandpur, Tata Mc Graw Hill Publishing Ltd (2007)
4.	Electronic Instrumentation, H. S. Kalasi, Tata Mc Graw Hill Publishing Ltd (2004)
5.	www.howstuffworks.com

EEM1103: EEM Practical - I

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Acquires skills of identifying various components and tools 2. Demonstrates skill of proper use of tools and instruments 3. Learns skills of referencing from data-books, operating instruction manuals and other referencing material. 4. Prepares circuit drawings and block diagrams for a given instrument / equipment 5. Acquires ability to prepare technical report writing skills for laboratory exercises.	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Use diagrams of tools to discuss the concepts and its uses. 3. Demonstrate handling of tools and instruments. 4. Demonstration of component testing and fault findings

List of Experiments

	Group-A: Tools
1.	Identification of various tools for maintenance and troubleshooting
2.	Identification and knowing technical specifications of various passive components
3.	Identification and knowing technical specifications of various semiconductor devices
	Group-B: Test and measuring instruments
4.	Study of analog meters and AMMs
5.	Study of DMM
6.	Study of signal generators and CRO
	Group-C: Terminal identification and functional checking using multimeter (use of Operating instructions manual / component datasheet is mandatory)
7.	Rheostat, Potentiometer And Switches, EM Relay, Transformer, Auto- Transformer (Dimmerstat),Fuses
8.	Diode, Zener, Transistor (At least 3 different packages each) and LEDs(different wattages and colours), LED strips, Neon indicator lamp
9.	DC Sources: Battery (5 Different types), Solar PV cell, Battery Eliminator, CVCC Power Supply.
10.	Preparation of circuit drawings / diagrams (for any two electronic systems)

Any 10 experiments: 8 compulsory + 1 Activity (Equivalent to Two Practicals)

EEM1201: PCB design and assembly

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Acquires knowledge of PCB technology. 2. Designs layout for electronic circuits. 3. Generates layout using traditional methods and CAD methods 4. Transfers artwork or layout to laminates 5. Demonstrates several mechanical operations for generating PCB	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Demonstrate use of PCB software for PCB making 3. Group discussion on various soft ware's for PCB making

Unit -I	**Basics of PCBs** Need, Classification, Electronics components (discrete, ICs, SMDs) – symbols, dimensions, packages, Connectors and cables.	4
Unit -II	**Circuit layout and artwork** Layout planning and design - Drawings and diagrams, General PCB design considerations, Mechanical design considerations, Electrical considerations, Components placement rules, Layout design Artwork generation and automation - Manual artwork, guidelines for artwork preparations, film master preparations, CAD / CAM tools, design automation	14
Unit -III	**Preparing PCBs** Laminates and types; Image transfer techniques - Cleaning, screen printing, pattern transfer techniques, photo printing; Etching techniques - etching solutions and etching techniques; Mechanical operations - cutting methods, punching, drilling, assembly, soldering	14
Unit-IV	**PCB technology trends**: Multilayer and flexible PCBs	4

References

1.	Printed circuits boards, R. S. Khandpur, Tata Mc Graw Hill Publication (2005)
2.	Printed circuits handbooks, Clyde F. Coombs and Happy T. Holden, Mc Graw Hill (2016)
3.	Printed circuit board: design and technology, Walter Bosshart, Tata McGraw Hill (2008)
4.	Printed Circuit boards: Designer's reference: Christopher Robertson, Prentice Hall (2004)

EEM1202: Solar thermal and LED lighting system

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Knows the importance of solar powered systems 2. Gets acquainted with power requirements of various electronic systems 3. Characterizes solar PV cells and modules and compares with data sheets 4. Builds various LED lighting systems 5. Demonstrates installation and use of solar-LED systems	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Demonstrate use of LED lightning systems 3. Educational excursion, if possible to learn solar, thermal power stations

Unit -I	**Solar energy and photovoltaic** The sun, Solar radiations, variations and types, solar geometry, solar radiation measurements, solar energy technologies, Energy requirement of variety of consumer products, Solar cell -Structure, characteristics, Isc, Voc, Pmax, FF, Types, commercially available solar cell technologies Solar panel – Size, orientation, IV characteristics, irradiance data	10
Unit -II	**Solar - LED lighting** LED -Photometry, principles, IV characteristics, Driving LEDs, Driving LEDs with an AC voltage, Power LEDs, LD lamps, Basic LED circuits, Solar LED street lights Solar Lantern and charging station – need, major components, Solar home lighting system - solar panels, Batteries, Controller, inverter, electrical devices, ON grid, OFF grid, Hybrid systems, connecting everything together and installation Commercial Solar LED lighting systems	16
Unit -III	**Solar Thermal –** Principle of solar thermal equipment, solar water heater – technology, components, flat plate collector and evacuated tube collector, Solar cooker technology and components	10

References

1.	Pico-solar electric systems, John Keane, Routledge, Taylor & Fransis Group,(2014)
2.	Solar thermal and photovoltaic field engineers training course, The energy and resource institute, New Delhi (www.terin.org,) 2011
3.	Fundamentals of Solid state lighting: LEDs, OLEDS, and their applications in illumination and Display, Vinod Kumar Khanna, CRC press (2014)
4.	Solar lighting, Ramchndra Pode, Boucar Diouf, Springer (2011)
5.	Photovoltaic Design and Installation for dummies, Ryan Mayfield, Wiley Publishing Inc. (2010)

EEM1203: EEM Practical - II

Course Outcome:	**Suggested Pedagogies**
The learner should be able to 1. Acquires skills of preparing layout manually 2. Generates circuit layout using CAD package 3. Prepares complete PCB using pattern transfer process and etching 4. Characterises Solar cells and modules 5. Builds and tests solar-LED lighting system	1. Use appropriate ICT tool, wherever necessary, for effective teaching. 2. Demonstrate use of PCB software for PCB making 3. Demonstrate the manual PCB making process. 4. Design and demonstrate LED and Solar cell based lightning system.

List of experiments

	Group - A
1.	Lay out preparation process on graph paper (Art work)
2.	Artwork preparation (Art work) - use of open source PCB making software expected
3.	Process of Transferring layout on copper clad laminate, PCB Etching and Drilling
4.	Soldering and De soldering of Components from given PCB
5.	Hobby Circuit building on bread board, tag board and general purpose board
	Group-B
6.	Characteristics of solar cell and panel
7.	LED lighting systems assembly and testing
8.	Emergency lights / solar lantern assembly and testing
9.	Solar cooker/heater system
10.	Solar power plant - study

Any 10 experiments: 8 compulsory + 1 Activity (Equivalent to Two Practical's)