PEOPLE'S UNIVERSITY, BHOPAL

(Applicable for Admitted from Academic Session 2019-20 onwards)

Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
EET-17101	Computer Application to Power System	3	1	-			Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks:-20	Assignment/Quiz/Attendance- Max. Marks:-10
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks:-Nil	Assignment / Quiz/Attendance - Max. Marks:- Nil

Pre-Requisite	Knowledge of electrical power system operation.
Course Outcome	1. Requirements for advanced functions for automation and control of power systems.
	2. Implement functions for power system control using predefined components and standardized interfaces.
	3. Apply the knowledge of matrix Inverse for solving system of linear equations.

Unit	Contents (Theory)	Marks Weightage
I	Models of power system components, network model using graph theory, formation of Z bus, transmission line models, regulating transformer, line load ability, capability curves of alternator.	14
II	Control of load bus voltage using reactive power control variable, SVC & SVS, regulated shunt compensation, series and shunt compensation, Uniform series and shunt compensation and effect of load ability of transmission lines.	14
III	General sensitivity relations, generation shift distribution factors, line outage distribution factors, compensated shift factors, sensitivity associated with voltage-VAR, sensitivities relating load bus voltage changes in terms of PV bus voltage changes, sensitivity relating changes in reactive power generation for changes in PV Bus Voltage.	14
IV	Security functions, Security level, contingency analysis, security control, economic dispatch using LP formulation, pre-contingency and post- contingency, corrective rescheduling.	14
V	Difference between voltage and angle stability, PV Curve for voltage stability assessment, proximity and mechanism, modal analysis using reduced Jacobian, participation factor, effect of series and shunt compensation on voltage stability effect of load models.	14

Text Book/References Books/ Websites

1. Dr. M. Ramamoorthy ; "Computer- Aided Design of Electrical Equipment"; East-West press Pvt. Ltd. New Delhi.
2. A.K. Sawhney; "Electrical Machine Design"; Dhanpat Rai & Sons.
3. S.K. Sen; "Principles of Electrical Machine Design with Computer Programmes"; Oxford & IBH Publishing Co.
4. M.G. Say; "Performance and Design of A.C. Machines"; Affiliated East West Press Pvt. Ltd. New Delhi.

Suggested List of Laboratory Experiments :- (Expandable): Nil

PEOPLE'S UNIVERSITY, BHOPAL

(Applicable for Admitted from Academic Session 2019-20 onwards)

Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External	Internal	Total
EET-17102	Generalized Theory of Electrical Machine	3	1	-	External (70)	Internal (30)	Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks:-20	Assignment/Quiz/Attendance- Max. Marks:-10
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks:-Nil	Assignment / Quiz/Attendance - Max. Marks:- Nil

Pre-Requisite	Knowledge of the Electrical Machines and their principal of operation.
Course Outcome	1. Mathematical analysis of Electrical machines.
	2. Knowledge about the basic design parameters of electrical machines.
	3. Analyse the performance of the various electrical machines.

Unit	Contents (Theory)	Marks Weightage
I	**Review:** Primitive machine, Voltage and torque equation. Concept of transformation changes of variables & m/c variables and transform variables. Application to D.C. machine for steady state and transient analysis, and Equation of cross field commutator machine.	14
II	**Induction Machine:** Voltage, torque equation for steady state operation, Equivalent circuit, Dynamic performance during sudden changes in load torque and three phase fault at the machine terminals. Voltage & torque equation for steady state operation of 1- induction motor & scharge motor.	14
III	**Synchronous Machine:** Transformation equations for rotating three phase windings, Voltage and power equation for salient and non salient alternator, their phasor diagrams, Simplified equations of a synchronous machine with two damper coils.	14
IV	**Operational Impedances and Time Constants of Synchronous Machines:** Park's equations in operational form, operational impedances and G(P) for a synchronous machine with four Rotor Windings, Standard synchronous machine Reactances, time constants, Derived synchronous machine time constants, parameters from short circuit Characteristics.	14
V	**Approximate Methods for Generator & System Analysis:** The problem of power system analysis, Equivalent circuit & vector diagrams for approximate calculations, Analysis of line to line short circuit, Application of approximate method to power system analysis.	14

Text Book/References Books/ Websites

1. P.S. Bimbhra; "Generalized Theory of Electric Machines" Khanna Publishers.
2. P.C. Kraus; "Analysis of Electric Machine"; McGraw Hill.
3. D.P. Kothari, I.J. Nagrath ; " Generalized Theory of Electrical Machines ; Mcgraw-hill.

Suggested List of Laboratory Experiments :- (Expandable): Nil

PEOPLE'S UNIVERSITY, BHOPAL

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Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External	Internal	Total
EET-17103	Electrical Safety & Protection	3	1	-	External (70)	Internal (30)	Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks:-20	Assignment/Quiz/Attendance- Max. Marks:-10
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks:-Nil	Assignment / Quiz/Attendance - Max. Marks:- Nil

Pre-Requisite	Knowledge about electrical equipments.
Course Outcome	1. Describe electrical hazards and safety equipment.
	2. Analyze and apply various grounding and bonding techniques.
	3. Knowledge about proper maintenance of electrical equipment by understanding various
	4. standards.

Unit	Contents (Theory)	Marks Weightage
I	Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags, locking devices- voltage measuring instruments-proximity and contact testers-safety electrical one line diagram- electrician's safety kit.	14
II	General requirements for grounding and bonding- definitions- grounding of electrical equipment bonding of electrically conducting materials and other equipment-connection of grounding and bonding equipment- system grounding- purpose of system grounding- grounding electrode system grounding conductor connection to electrodes-use of grounded circuit conductor for grounding equipment- grounding of low voltage and high voltage systems.	14
III	The six step safety methods- pre job briefings - hot-work decision tree-safe switching of power system- lockout-tag out- flash hazard calculation and approach distances- calculating the required level of arc protection-safety equipment.	14
IV	Procedure for low, medium and high voltage systems- the one minute safety audit Electrical safety programme structure, development- company safety teamsafety policy programme implementation- employee electrical safety teams- safety meetings- safety audit accident prevention- first aid- rescue techniques-accident investigation.	14
V	Safety related case for electrical equipments, Various Standards : IEEE, IEC, IS, regulatory bodiesnational electrical safety code- standard for electrical safety in work place- occupational safety and health administration standards, Indian Electricity Acts related to Electrical Safety.	14

Text Book/References Books/ Websites

1. John Cadick, Mary Capelli-Schellpfeffer, Dennis Neitzel, Al Winfield ; "Electrical Safety Handbook" ;McGraw-Hill Education.
2. Sunil S. Rao, Prof. H.L. Saluja; "Electrical safety, fire safety Engineering and safety management"; Khanna Publishers.
3. Maxwell Adams.J; "Electrical Safety- a guide to the causes and prevention of electric Hazards";The Institution of Electric Engineers.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External (35)	Internal (15)	Total (50)
EET-1702	Non Conventional Energy Source	3	1	-			Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks:-20	Assignment/Quiz/Attendance- Max. Marks:-10
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks:-Nil	Assignment / Quiz/Attendance - Max. Marks:-Nil

Pre-Requisite	Knowledge about basic of electrical machine and generation.
Course Outcome	1. Knowledge about advantages of non-conventional sources for power generation.
	2. Present day advancement in terms of renewable energy sources.
	3. Sustainable development keeping in mind future aspects of energy.

Unit	Contents (Theory)	Marks Weightage
I	**Introduction:** World energy situation, conventional and non-conventional energy sources, Indian energy scene. Tidal Energy: Introduction to tidal power. Components of tidal power plants, double basin arrangement. Power generation. Advantages and limitations of tidal power generation. Prospects of tidal energy in India.	**14**
II	**Solar Energy:** Solar radiation, solar radiation geometry, solar radiation on tilted surface. Solar energy collector. Flat- plate collector, concentrating collector – parabolidal and heliostat. Solar pond. Basic solar power plant. Solar cell, solar cell array, basic photo-voltaic power generating system.	**14**
III	**Wind Energy:** Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, towers, generators, control and monitoring components. Basic electric generation turbines, towers, generators, control and monitoring components. Basic electric generation schemes- constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes. Applications of wind energy. **Geothermal Energy:** Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy. Applications of geothermal energy. Geothermal energy in India.	**14**
IV	**Nuclear Fusion Energy:** Introduction, nuclear fission and nuclear fusion. Requirements for nuclear fusion. Plasma confinement - magnetic confinement and inertial confinement. Basic Tokamak reactor, laser fusion reactor. Advantages of nuclear fusion. Fusion hybrid and cold fusion.	**14**
V	**Biomass Energy:** Introduction, biomass categories, bio-fuels. Introduction to biomass conversion technologies. Biogas generation, basic biogas plants-fixed dome type, floating gasholder type, Deen Bandhu biogas plant, Pragati design biogas plant. Utilization of bio gas. Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production.	**14**

Text Book/References Books/ Websites

1. J. B. Gupta; "A Course In Electrical Power"; Dhanpat Rai Publications.
2. G. D. Rai;" Non Conventional energy sources"; Khanna Publications.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)			Total (50)
EET-1703	Electrical Drives	3	1	1	External (70)	Internal (30)	Min: 40 (D Grade)	External (35)	Internal (15)	Min: 20 (D Grade)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks:-20	Assignment/Quiz/Attendance- Max. Marks:-10
Practical Internal Max Marks: 15	Lab work & Sessional – Max Marks:-10	Assignment / Quiz/Attendance - Max. Marks:-05

Pre-Requisite	Knowledge of the basic electrical machines.
Course Outcome	1. Review of conventioinal methods & convertor control methods used in speed control.
	2. Various power recovery schemes in AC drives to improve the effeciency of the drives in industry.
	3. Invertor and cycloconvertor fed speed control technologies and their benefits.

Unit	Contents (Theory)	Marks Weightage
I	**Dynamics of Electric Drives:** Fundamental torque equations, speed-torque conventions and multiquardant operation, equivalent values of drive parameters, nature and classification of load torques, steady state stability, load equalization, close loop configurations of drives.	**14**
II	**DC Drives:** Speed torque curves, torque and power limitation in armature voltage and field control, Starting, **Braking**-Regenerative Braking, dynamic braking and plugging. **Speed Control**-Controlled Rectifier fed DC drives, Chopper Controlled DC drives.	**14**
III	**Induction Motor Drives-I:** Starting, **Braking**-Regenerative braking, plugging and dynamic braking. **Speed Control**-Stator voltage control, variable frequency control from voltage source, Voltage Source Inverter (VSI) Control.	**14**
IV	**Induction Motor Drives-II:** Variable frequency control from current source, Current Source Inverter (CSI) Control, Cycloconverter Control, Static rotor resistance control, Slip Power Recovery- Stator Scherbius drive, Static Kramer drive.	**14**
V	**Synchronous Motor Drive**: Control of Synchronous Motor-Separately Controlled and VSI fed Self-Controlled Synchronous Motor Drives. Dynamic and Regenerative Braking of Synchronous Motor with VSI. Control of Synchronous Motor Using Current Source Inverter(CSI).	**14**

Text Book/References Books/ Websites

1. S. K Pillai; "A first course on Electrical Drives"; Second edition, Wiley Eastern.
2. G. K. Dubey; "Power Semiconductor Controlled Drives"; Prentice-Hall, Englewood Cliffs.
3. G. K Dubey; "Fundamentals of Electrical Drives"; Narosa Publishing House.
4. B. K Bose; "Power Electronics and AC Drives"; Prentice-Hall.
5. P.V. Rao; "Power semiconductor Drives"; BS Publications.

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Programme: **Bachelor of Technology** **Semester –VII**

Suggested List of Laboratory Experiments :- (Expandable):

1. Study the starting and running characteristics of converter fed DC traction motor.
2. To study the energy recovery systems and braking of a DC drive.
3. To study the braking Methods of a three-phase induction motor.
4. To study the performance of VSI fed three-phase induction motor using PWM technique.
5. To control the speed of a three phase slip ring Induction motor using rotor impedance control.
6. To study the performance of Vector Controlled three phase Induction motor drive.
7. To Study frequency Controlled Synchronous motor drive.
8. To study the control & performance Characteristics of switched Reluctance motor.
9. To study the performance & control of a Stepper motor.
10. To Study the Performance of a permanent magnet Brushless dc motor.

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Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)			Total (50)
EET-1704	Protection of Power Systems	3	1	1	External (70)	Internal (30)	Min: 40 (D Grade)	External (35)	Internal (15)	Min: 20 (D Grade)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks:-20	Assignment/Quiz/Attendance Max. Marks:-10
Practical Internal Max Marks: 15	Lab work & Sessional – Max Marks:-10	Assignment / Quiz/Attendance - Max. Marks:-05

Pre-Requisite	Knowledge of switching electrical elements.
Course Outcome	1. Understand fault clearing phenomena under abnormal conditions in different type of circuit breakers.
	2. Identify the main components and features of a protection scheme.
	3. Acquire to knowledge & understand the types of fault.

Unit	Contents (Theory)	Marks Weightage
I	**Causes and consequences of dangerous currents:** Faults, overloads and switching over currents. Introduction to protection, trip circuit of a circuit breaker. Functional characteristics of a relay, zone of protection, primary and backup protection. CTs & PTs: Current transformer construction, measurement and protective CTs. Type of potential transformers. Steady state ratio and phase angle errors in CTs and PTs. Transient errors in CT and CVT (Capacitive Voltage Transformer).	**14**
II	**Overcurrent Protection:** HRC fuse and thermal relay. Over current (OC) relays– instantaneous, definite time, inverse time and inverse definite minimum time over current relays, time and current grading. Induction disc type relay. Directional over current relay, 30◦, 60◦ and 90◦ connections. Earth fault relay. Brief description of over current protective schemes for a feeder, parallel feeders and ring mains.	**14**
III	**Generator Protection:** Stator protection– differential and percentage differential protection, protection against stator inter-turn faults, stator overheating protection. Rotor protection, protection against excitation and prime mover failure, field earth fault and unbalanced stator currents (negative sequence current protection).	**14**
IV	**Transformer Protection:** Percentage differential protection, magnetizing inrush current, percentage differential relay with harmonic restraint. Buchholz relay. Differential protection of generator transfer unit. Busbar Protection: Differential protection of busbars, high impedance relay scheme, frames leakage protection.	**14**
V	**Transmission Line Protection:** Introduction to distance protection. Construction, operating principle and characteristics of an electromagnetic impedance relay. Effect of arc resistance. Induction cup type reactance and mho relays. Comparison between impedance, reactance and mho relays. Three stepped distance protection of transmission line. Induction Motor Protection: Introduction to various faults and abnormal operating conditions, unbalance supply voltage and single phasing. Introduction to protection of induction motors- HRC fuse.	**14**

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Programme: **Bachelor of Technology** **Semester –VII**

Text Book/References Books/ Websites

1. C.R.Mason;"The Art And Science Of Protective Relayin"; John Wiley.
2. A.R.Van. C. Warrington;"Protective Relays – Their theory And Practice"; John Willey.
3. S.P.Patra, S.K.Basu & S.Choudhuri;"Power System Protection"; Oxfort & IBH.
4. B.Ravindranath & M.Chander;" Power System Protection & Switchgear"; Willey Eastern.
5. S. Rao;" Switchgear & Protection"; Khanna Publishers.

Suggested List of Laboratory Experiments :- (Expandable):

1. To study the operation of definite time over current relay.
2. To plot the characteristics of single pole over current or earth fault using static IDMT Relays.
3. To study the operation of static over voltage relay.
4. To plot the characteristics of electromagnetic IDMT relay .
5. To study directional over current relay.

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Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total			Total (50)
EET-1705	Electrical Machine Design CAD based	-	-	1	External (Nil)	Internal (Nil)	Nil	External (Nil)	Internal (50)	Min: 20 (D Grade)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: Nil	Best of Two Mid Semester Test – Max Marks:- Nil	Assignment/Quiz/Attendance- Max. Marks:- Nil
Practical Internal Max Marks: 50	Lab work & Sessional – Max Marks:-Nil	Assignment / Quiz/Attendance - Max. Marks:-50

Pre-Requisite	Knowledge about software.
Course Outcome	1. Develop skills in computer aided drafting of electrical machines.
	2. Develop lay-out of various electrical installations.
	3. Knowledge about software and designing.

Unit	Contents (Theory)	Marks Weightage
I	Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.	14

Text Book/References Books/ Websites

1. Auto CAD reference manual (Release 2008 or later)
2. A text book computer aided machine drawing: S. Trymbaka Murthy
3. CAD/ CAM principle, practice and manufacturing management: Chris McMahon, Jimmie Browne

Suggested List of Laboratory Experiments :- (Expandable):

1. Study of script, DXE & IGES Files.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B spline or cubic spline.
4. Creations of Shafts, rounds, Chamfers and slots
5. Representation of dimensioning and tolerances scanning and plotting.
6. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing of front view and top view and side view of objects for the given pictorial views (eg. V-block, Simple stool, Objects with hole and curves).
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

PEOPLE'S UNIVERSITY, BHOPAL

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Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total			Total (150)
EET-1706	Minor Project	-	-	3	External (Nil)	Internal (Nil)	Nil	External (105)	Internal (45)	Min: 60 (D Grade)

Duration of Theory (Externals): Nil

Theory Internal- Max Marks: -Nil	Best of Two Mid Semester Test – Max Marks: -Nil	Assignment/Quiz/Attendance Max. Marks: -Nil
Practical Internal Max Marks: 45	Lab work & Sessional – Max Marks: 40	Assignment / Quiz/ Attendance Max. Marks: 05

Pre-Requisite	Fundamental Engineering concepts of concern discipline.
Course Outcome	Student should able to:
	1. Identify, analyze & define the problem.
	2. Generate alternative solutions to the problem identified.
	3. Compare & select feasible solutions from alternatives generated.
	4. Work effectively in a team.

Unit	Contents (Theory)	Marks Weightage
I	Students shall be encouraged to form groups (Maximum 5) to do a Minor Project on technical topic of concern branch. The student should prepare a working system or some design or understanding of a complex system (on minor level) that he has selected for his/her minor project work using system analysis tools and submit the same in the form of a write-up i.e. detail project report. The student should maintain proper documentation of different stages of project such as concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan wherever applicable. Each student is required to prepare a project report based on the above points and present the same at the final examination with a demonstration of their project.	**150**

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: **Bachelor of Technology** **Semester –VII**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total			Total (100)
EET-1707	Industrial Training-II	-	-	2	External (Nil	Internal (Nil)	Nil	External (70)	Internal (30)	Min: 40 (D Grade)

Duration of Theory (Externals): Nil

Theory Internal- Max Marks: -Nil	Best of Two Mid Semester Test – Max Marks: -Nil	Assignment/Quiz/Attendance Max. Marks: -Nil
Practical Internal Max Marks: 30	Lab work & Sessional – Max Marks: 25	Assignment / Quiz/ Attendance Max. Marks: 5

Pre-Requisite	Fundamental Engineering concepts of concern discipline.
Course Outcome	1. Enrich their practical learning and they will be better equipped to integrate the practical experiences with the classroom learning process. 2. Interact with real World of Work and should try to learn as much as possible from real life experiences by involving with industry staff.

Unit	Contents (Theory)	Marks Weightage
-	The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. Industrial training of the students is essential to bridge the wide gap between the classroom and industrial environment. As a part of B. Tech. curriculum, EET1707, Industrial Training -II is a Practical course, which the students should undergo in reputed Private / Public Sector / Government organization / companies as industrial training of minimum two weeks to be undergone by the student in the semester break after VI semester theory examinations. **Training period**: Minimum of Four weeks or 30 (Thirty) Days. **Evaluation:** Seventh semester. **Companies / Areas covered**: Any field related to concern branch / discipline of Engineering. **Grading**: As per Scheme. **Note:** Presentation will take place the following week after completion your training. The presentation is evaluated by your class in charge. Report must be submitted during power point presentation. A Viva voce comprising comprehensive questions based on your presentation and training undergone. **Etiquettes:** Dress properly, Behave well, Portray good image as a university student, Be punctual, Observe work ethics, Concern for safety, Be professional.	**100**

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments :- (Expandable): Nil