

EEC- 601 – Power Systems Analysis

Unit-I Mechanical Features of Overhead Lines: Conductor material and types of conductor, conductor arrangements and spacing, calculation of sag and tension, supports at different levels, effect of wind and ice loading, stringing chart and sag template, conductor vibrations and vibration dampers.

Unit-II Parameters of Transmission Lines: Resistance, inductance and capacitance of overhead lines, effect of earth, line transposition, GMD and distance, inductance and capacitance of line with symmetrical and unsymmetrical spacing, inductance and capacitance of double circuit lines, skin and proximity effects, equivalent circuits & performance of short, medium and long transmission lines.

Unit-III Insulators: Pin, shackle, suspension and strain insulators, voltage distribution across insulator string, grading and methods of improving string efficiency.

Unit-IV Underground Cables: Conductor, sheathing and armoring materials, types of cables, insulator resistance and capacitance calculation, electrostatic stresses and reduction of maximum stresses, causes of breakdown, thermal rating of cable, introduction to oil filled and gas filled cables.

Unit-V Economic Scheduling of Power Stations: Economic operation of power system, criteria of loading of power plants with and without transmission loss, load dispatching in power system, calculation of cost of generation, fixed charges, interest and depreciations methods of depreciation, power factor improvement.

References:

1. B. R. Gupta: Power System Analysis & Design, S. Chand Publishers. 2008
2. Soni, Gupta and Bhatnagar: A Course in Electrical Power, Dhanpat Rai. 1987
3. C. L. Wadhwa Electrical Power Systems, New Age. 2009
4. Nagrath Kothari: Modern Power System Analysis, MGH. 2011
5. J. J. Grainger & W. D. Stevenson: Power System Analysis, MGH. 2003
6. Kamaraju: Electrical Power Distribution Systems, MGH.

List of Experiment (Extendable):

1. Electrical design of transmission line.
2. Mechanical design of transmission line.
3. Drawing of tower structure.
4. Drawing of insulators.
5. Drawing of cables.
6. Determination of transmission line parameters using MATLAB
7. Layout of substation and various power plants.

EEC- 602 Electrical Drives

Unit I- Basics of Electrical Drives: Elements of drive systems, requirement of electric drives, rating & selection of drives, groups and individual drives, constant power and constant torque drives. Review of characteristics of AC & DC motors, load torque, load-drive, speed torque characteristics, quadrant speed torque characteristics, load equalization, stability of electric drives, moment of inertia and torque of motor load combination.

Unit II-DC Drives: Starting, braking, transient & steady state analysis phase controlled and chopper controlled drives, speed control, energy recovery systems, dual converter.

Unit III- Induction Motor Drives: Starting braking and speed control, PWM, voltage source inverter and current sources fed im drives, cyclo converter fed drive, vector control drives, slip power recovery, conventional control methods, rotor impedance control, converter controlled-Static Scherbius & Static Krammers drives.

Unit IV- Synchronous Motors Drives: Starting, braking, transient analysis, synchronous motors variable speed drives, V/F control, cyclo converter fed synchronous motor drive.

Unit V- Special Motor Drives: Fundamentals of switched reluctance motors, stepper motors, permanent magnet motor, vector control, digital control of drives.

Traction: Electric traction, machine tool drive, electric cars, steel & cements plants, textile & paper mills.

References:

1. G.K. Dubey "Fundamentals of Electrical Drives"-. Narosa Publications
2. 2. Gopal K. Dubey "Power semiconductor Controlled Drives"- PHI
3. S.K. Pillai, "A first course of Electrical Drive" New age International.
4. Ned Mohan Electrical Drive Wiley India
5. V. Subramanyam "Thyristor control of Electric Drive" Tata Mc Graw Hill Pub.
6. S.Shiva Nagaraju power semiconductor drive PHI learning

List of Experiments (Extendable):

1. To 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.

EEC- 603 Power Systems and Control

Unit-I Introduction to Power System Stability Problem: Rotor angle stability, voltage stability and voltage collapse, mid term and long-term stability, classification of stability, states of operation, system security, system dynamic problems, problems associated with modern interconnected power systems, deregulation, power systems restructuring, distributed generation, congestion, pricing.

Unit-II Power System Stability - Steady state, dynamic and transients stability, swing equation, equal area criterion, solution of swing equation using step by step method modified Eulers method and Rnge-Kutta method, methods of improving transient stability.

Unit-III Power Flow Atudies - Formulation of static power flow equations and solutions using Gauss- Seidel, Newton Raphson and FDLF methods, comparison of these methods, Economic operation of power system - Economic dispatch, Emission dispatch, line loss, ITL, economic dispatch using lagrangian multiplier method.

Unit-IV MW Frequency Control- Coherency, control area, modeling of speed control mechanism, load damping, block diagrammatic representation of single and two area interconnected system, static and dynamic response, .optimum parameter adjustment.

Unit-V MVAR Voltage Control - Difference in control strategy over MW – f control, characteristics of an excitation system, DC AC and static excitation system, General block diagram representation of voltage regulators.

References:

1. K.R. Padiyar, Power system dynamics, stability and control, BS Pub. Hydbid
2. P Kunder, Power system stability and control, TMH.
3. P. W. Sauer & M A Pai: Power system dynamics and stability: Pearson.

List of experiments (Extendable):

1. To develop a program in Matlab for information of Y-bus matrix for N bus system.
2. Load flow solution for 3-bus system using Gauss- Seidel, Newton Raphson and FDLF methods up to 3 iteration.
3. Load flow solution for IEEE 6-bus and 30-bus system in Matlab using Newton Raphson method.
4. Assessment of transient stability of a single machine system.
5. Effect of compensation on voltage profile of IEEE 6-bus system.
6. Study of any software tools (PSCAD,EDSA, Mi POWER, ETAP etc)

EEC-604(A) Digital System Design

Unit-I Principles of Combinational Logic: Boolean algebra, combinational forms, canonical forms, generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, incompletely specified functions (don't care terms), simplifying max – term equations, Quine – McClusky minimization technique, Quine – McClusky using don't care terms, reduced prime implicant tables, map entered variable.

Unit-II Analysis and Design of Combinational Logic: Decoders, encoders, digital multiplexers-using multiplexers as boolean function generators, adders, subtractors, cascading full adders, look ahead carry, binary comparators, design methods of building blocks of combinational logics.

Unit-III Sequential Circuits: Basic bistable element, latches, SR latch, application of SR latch, A Switch debouncer, gated SR latch, gated D Latch, master-slave flip-flops, master-slave SR&JK flip-flops, edge triggered flip-flop, positive & negative edge-triggered D flip-flop, characteristic equations, registers, counters-binary ripple counter, synchronous binary counters, counters based on shift registers, design of a synchronous counters, design of a synchronous mod-N counters using clocked JK flip flops.

Unit-IV Sequential Design: Mealy and Moore models, state machine notation, synchronous sequential circuit analysis and design, construction of state diagrams, counters design.

Unit-V HDL: History of HDL, structure of HDL module, operators, data types, types of descriptions, simulation and synthesis, brief comparison of VHDL and Verilog, data-flow descriptions and structure, data type-vectors.

References:

1. Digital Logic Applications and Design John M Yarbrough Cengage Learning 2011
2. Digital Principles and Design Donald D Givone McGraw Hill Education 1 st Edition, 2002
3. Logic and computer design Fundamentals M. Morries Mano and Charles Kime Pearson Learning 4 th Edition, 2014
4. Edition, 2014
5. Fundamentals of logic design Charles H Roth, JR and Larry L. Kinney Cengage Learning 6th Edition, 2013
6. Fundamentals of Digital Circuits A. Anand Kumar PHI 3rd Edition, 2014
7. Digital Logic Design and VHDL A.A.Phadke S.M.Deokar Wiley India 1st Edition, 2009

EEC-604(B) EHVAC & DC

Unit- I Introduction: EHV A.C. and D.C. links, Kind of D.C. links, limitations and advantages of A.C. and D.C. transmission, principal application of A.C. and D.C. transmission, trends in EHV A.C. and D.C. transmission, power handling capacity, firing angle control, overlapping.

Unit- II FACTS Devices: Basic types of controller, series controller, static synchronous series compensator(SSSC), thyristor-controlled series capacitor(TCSC), thyristor controlled series reactor(TCSR), shunt controller (STATCOM), static VAR compensator(SVC), series series controller, combined series-shunt controller, unified power flow controller (UPFC), thyristor controlled phase shifting transformer(TCPST).

Unit- III Converters in EHV D.C: Components of EHV D.C. system, converter circuits, rectifier and inverter valves, reactive power requirements, harmonics generation, adverse effects, classification, remedial measures to suppress, filters, ground return, converter faults & protection ,commutation failure, multi terminal D.C. lines.

Unit- IV Controlling: Control of EHV D.C. system, control characteristics, constant current control, constant extinction angle control, ignition angle control, parallel operation of HVAC & DC system, problems & advantages.

Unit- V Transmission Systems: Travelling waves on transmission systems, attenuation, distortion, effect of junction and termination on propagation of traveling waves, over voltages in transmission system, lightning, switching and temporary over voltages, control of lighting and switching over voltages.

References:

1. S. Rao,- "EHV AC & DC Transmission" Khanna pub.
2. Kimbark,-" HVDC Transmission" john willy & sons pub.
3. Arrillaga,- "HVDC Transmission"2nd Edition ,IEE london pub.
4. Padiyar, -"HVDC Transmission" 1st Edition ,New age international pub.
5. T.K. Nagsarkar,M.S. Sukhiza, -"Power System Analysis", Oxford University
6. Narain.G. Hingorani, I. Gyugyi-"Undustanding of FACTS concept and technology", john willy & sons pub.
7. P.Kundur- "H.V.D.C. Transmission" McGraw Hill

EEEC-604(C) Evolutionary Techniques

Unit –I: Introduction: Approaches to intelligent control, architecture for intelligent control, symbolic reasoning system, rule-based systems, the AI approach, knowledge representation - expert systems.

Unit –II: Artificial Neural Networks: Basic concept mathematical model, mcculloch-pitts neuron model, simple perceptron, Adaline and Madaline, feed-forward multilayer perceptron, learning and training the neural network, data processing, scaling, fourier transformation, principal-component analysis, wavelet transformations, hopfield network, self-organizing network and recurrent network, neural network based controller.

Unit –III: Fuzzy Logic System: Crisp sets, fuzzy sets, basic fuzzy set operation and approximate reasoning, fuzzy logic modeling and control, fuzzification, inferencing and defuzzification, fuzzy knowledge and rule bases, fuzzy modeling and control schemes for nonlinear systems, self organizing fuzzy logic control.

Unit –IV: Genetic Algorithm: Basic concept of genetic algorithm and detail algorithmic steps, adjustment of free parameters, solution of typical control problems using genetic algorithm, concept on some other search techniques like Tabu search and Ant-colony search techniques for solving optimization problems.

Unit –V: Applications: GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using MATLAB-neural network toolbox, stability analysis of neural-network interconnection systems, implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, stability analysis of fuzzy control systems.

References:

1. Introduction to Artificial Neural Systems - Jacek.M.Zurada, Jaico Publishing House, 1999.
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.
3. Fuzzy Sets, Uncertainty and Information - Klir G.J. & Folger T.A., Prentice-Hall of India Pvt. Ltd., 1993.
4. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers, 1994.. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
5. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
6. Elements of Artificial Neural Networks - Kishan Mehrotra, Chelkuri K. Mohan, Sanjay Ranka, Penram International.
7. Artificial Neural Network –Simon Haykin, 2nd Ed., Pearson Education.
8. Introduction Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N. Deepa, 1/e, TMH, New Delhi.

EEC-605(A) Global Positioning System

Unit-I - Geodesy: Basics of geodesy, earth, geoid and ellipsoid of rotation, reference surface, geodetic systems, Indian geodetic system, coordinate systems and transformation.

Unit -II GPS: History, Transit, Timation, NAVSTAR GPS, GLONASS, GALILEO, GPS design objectives and details of segments space, control and user, blocks of GPS- Block I, II/IIA, IIR satellites, IIF, advantages and current limitations of GPS, status of GPS surveying, applications.

Unit -III GPS Signal structure: Carriers, GPS codes: C/A, P, navigational message, GPS receiver, types and structure of receivers, principles of GPS position fixing: pseudo ranging.

Unit -IV: GPS Orbits: Determination of GPS satellite coordinates, types of ephemerides, GPS data formats, RINEX, SP3, satellite geometry based measures: geometry dependent (dilution of precision: DOP), user equivalent range error UERE.

Unit -V Errors and Accuracy: Satellite dependent, ephemeris errors and orbit perturbations, forces on GPS satellites, effects of orbital bias, types of satellite ephemerides, satellite clock bias, selective availability, receiver dependent: receiver clock bias.

References:

1. P. R. Wolf, and C. D. Ghilani, 1997. Adjustment Computations: Statistics and Least Squares in Surveying and GIS, Publisher: John Wiley & Sons, New York (USA), pages 564.
2. J. V. Sickle, 2001. GPS for Land Surveyors Publisher: Ann Arbor Press, Michigan(USA), pages 284.
3. B. Hofmann-Wellenhof, H. Lichtenegger and J. Collins, 1994. Global Positioning System: Theory and Practice, Publisher: Springer, Berlin (Germany), pages 355.
4. Gunter Seeber, 2003. Satellite Geodesy, Publisher: Walter de Gruyter, Berlin (Germany), pages 612.
5. A. Leick, 2004. GPS Satellite Survey (2nd ed.), Publisher: John Wiley & Sons, New York (USA), pages 429.

EEC-605(B) Prime Movers

Unit-I Fluid Mechanics: Newtonian and non-newtonian fluids, viscosity, types of fluid flows, continuity, momentum & energy equations, Bernoulli's equation and its applications, laminar and turbulent flows, flow through pipes, friction losses in pipes, Darcy equation, Reynolds number and its significance.

Unit-II Hydraulic Turbines: Classification and working principles of turbines, Pelton, Francis, and Kaplan turbine, velocity diagrams for impulse and reaction turbine, calculation of blade angles, work-done, power output and efficiencies, specific speed of turbines, function of draft tube and type of draft tubes, unit quantities, performance and characteristic curves.

Unit-III Generation of steam: Dryness fraction and properties of steam function of boilers, working principle of Lancashire boiler, Cornish boiler, Cochran boiler, Locomotive boiler, Babcock and Wilcox boiler, boiler mounting and accessories, Rankine and Modified Rankine cycle for steam engines, evaluation of mean effective pressure, power and cylinder dimension for single acting and double acting steam engines.

Unit-IV Steam turbines: Classification of steam turbines, velocity diagrams for simple impulse and reaction turbines, compounding of steam turbines, pressure compounding, velocity compounding, and pressure-velocity compounding, problems on work done, blade angles, power and thermal efficiency of the turbine. Gas turbine, classification of gas turbine-constant pressure combustion cycle, closed cycle and constant volume combustion gas turbine plants, calculation of various efficiencies and parameters.

Unit-V Pumps: Reciprocating pumps, working of single and double acting types, effect of acceleration head and friction, use of air vessels, work done and power required without and with air vessels centrifugal pumps: classification and working of centrifugal pumps, need for priming, work done and efficiencies, specific speed of pumps, cavitation and its effect on performance.

References:

1. R.K.Rajput, Thermal Engineering, Laxmi Publications, 2004
2. R.Yadav, Steam and Gas turbines, Central Publishing House Ltd 2004 .
3. S.Ramamrutham, Hydraulic Machines, Dhanpat Rai and Sons.2004.

EEC-605(C) Electrical Engineering Graphics

Unit-I Armature: Simplex lap/ wave dc armature windings, simplex lap/ wave, integral/ fractional slot, double layer three phase ac armature windings, single layer three phase ac armature windings.

Unit-II Transformers: Sectional plan and elevation of a transformer limb with windings, sectional plan and elevation of the core assembly of a power transformer, sectional plan and elevation of a distribution transformer tank with its accessories, sketches of capacitor and oil filled type transformer bushings.

Unit-III DC Machines: Sectional front and side elevation of armature with commutator, sectional front and side elevation of yoke and pole assembly with field winding, sectional front and side elevation of assembled machine.

Unit-IV Alternators: Sectional front and side elevation of water wheel rotor assembly with winding, sectional front and side elevation of salient pole alternator, sectional front and side elevation of turbo alternator, sketches of the methods of pole fixing and slot details of turbo and water wheel alternators.

Induction Motors: Sectional front and side elevation of slip ring induction motor, sectional front and side elevation of squirrel cage induction motor.

Unit-V Substations: Layouts and single line diagrams of outdoor and indoor substations, layout of a 220kv substation, layout of a captive power substation, single line diagram of a distribution center, experiments using electrical CAD.

References:

1. Bhattacharya S.K, Electrical Engineering Drawing, Wiley Eastern, Edition 2.
2. Clayton & Hancock, Performance and Design of DC Machines, ELBS, 1992.
3. Narang K.L., A Text Book of Electrical Engineering Drawing, Tech India Publications.
4. A.K. Sawhney, Electrical Machine Design, Dhanpath Rai, New Delhi, 1991.
5. Say M.G, Performance and Design of AC machines, Pitman, ELBS, 1991.

EEC-606(A) TCP-IP

Unit-I Network Managements: Network management framework, network based managements, evolution of network management: SGMP, CMIP, SNMP, network implementation and management strategies, network management categories: performance management, fault management, configuration management, security managements, accounting managements, network management configuration: centralized configuration, distributed configuration, selected management strategy.

Unit-II Management Information Base: Structure of management information, nms presentation of the SMI, NMS meter-ware network view, remote monitoring (RMON), RMON group, desktop management, desktop management interface(DMI), DMI architecture, DMI Browser, DMI/SNMP mapping, desktop SNMP extension agents, setting up LAN access, SNMP configuration.

Unit-III Layering: OSI Layering, TCP/IP layering, protocols & standards, internet standards, internet administration, internet addresses, internet protocol: introduction, IP header, IP routing, subnet addressing, subnet mask, special case of IP addresses, comparative study of IPV4 & IPV6, port numbers address resolution protocol, ARP packet format, proxy ARP, ARP command, ARP example, reverse address resolution protocol (RARP): RARP packet format, RARP examples, RARP server design

Unit-IV Routing: Delivery and Routing of IP Packets, routing methods, static versus dynamic routing, routing table, routing module, classless addressing, CIDR, internet protocol (IP), datagram, fragmentation, IP package, interior and exterior routing, routing information protocol (RIP), open shortest path first protocol (OSPF), BGP, GGP, private networks, virtual private network (VPN), network address translation (NAT).

Unit –V Internet Control Message Protocols: Types of message, message format, error reporting, query, checksum, ICMP package, IGMP, IGMP message and its operation, IGMP package, transmission control protocol, process-to-process communication, TCP Services Flow control, TCP timers. TCP operation, TCP package, application layers protocol, telnet protocol, file transfer protocol (FTP), simple mail transfer protocol (SMTP), X-window system protocol, remote procedure call, and network file system.

References:

1. Forouzan, TCP/IP Protocol Suite 4th edition, TMH
2. J.Richard Burkey, Network Management Concept and Practice, PHI
3. Stevens, TCP/IP Illustrated Volume-I, Pearson
4. Tittel: TCP/IP, Cenage Learning
5. Uyless Black, TCP/IP and related protocols, McGraw Hill.
6. Doughals E. Comer, Internetworking with TCP/IP Vol. I, Principles, Protocols, and Architecture, Prentice Hall, India.

EEC-606(B) Network Synthesis

Unit-I Laplace Transformation: Laplace transformation, laplace transform of a derivative $df(t)/dt$, laplace transform of an integral, laplace transform of common forcing function, initial and final value theorem, convolution, application of laplace transformation technique in electric circuit analysis, partial fraction expansion method, step response of RL, RC circuits, impulse response of series RC, RL network, response of RL circuit with pulse input, pulse response of series RC circuit, step response of RLC series circuit.

Unit- II Two Port Network Analysis: z parameters, y- parameters, hybrid parameter, ABCD parameters, condition of reciprocity and symmetry in two port parameter presentation, interrelationship between parameters of two port networks. expression of input and output impedance in terms of two port parameter, ladder network, equivalent T and pi section representation in parametric form.

Unit – III Network function: Driving point impedance and admittance transfer function, voltage and current transfer ratio, thevenin's theorem, norton theorem, milliman theorem, reciprocity theorem, maximum power transfer theorem, supeposition theorem, substitution theorem.

Unit – IV Network Graph Theory: Concept of network graph, terminology used in network graph, properties of tree in a graph, formation of incidence matrix, properties of incidence matrix, number of tree in a graph, cut set matrix, tie set matrix, fundamental tie set matrix, fundamental cut set matrix.

Unit –V Synthesis of Passive Networks: Concept of stability of a system from pole zero concept, necessary condition of stability of a network function, hurwitz polynomial, properties of hurwitz polynomials, positive real function, concept of network synthesis, reactive network, driving point immitance of LC Network, LC network synthesis, foster and caurr form, rc and RL network synthesis by foster and caurr form.

References:

1. Network Analysis by M.E. Van Valkenbarg, PHI/Pearson Education
2. Circuit Theory Analysis & Synthesis by A Chakraborty (Dhanpat Rai & Co. Pvt. Ltd, New Delhi)
3. Network Theory: Analysis & Synthesis – Smarjit Ghosh, PHI
4. Network Synthesis – T. Lapatra, TMH.

EEC-606(C) Project Management

Unit 1 Concepts of Project Management:: Meaning, definition and characteristics of a project, technical and socio-cultural dimensions, project life cycle phases, project planning, graphic presentation, work breakdown structure, manageable tasks, size of network, blow down NW, identity and logic dummy activity, Fulkerson rule for numbering NW, time-scaled NW

Unit-2 NW analysis: PERT network, mean time and variances, probability to complete PERT project in specified time, CPM network, Event Occurrence Time (EOT), activity start/ finish times, forward and reverse path calculations, concept and calculation of floats, resource allocation and critical-chain.

Unit-3 Project Duration And Control: Importance and options to accelerate project completion, timecost tradeoff, fixed variable and total costs, use of floats and cost optimization, project performance measures, project monitoring info and reports, project control process, Gant chart and control chart, cost-schedule S-graph, planned cost of work schedule (PV), budgeted/ earned cost of work completed (EV) and actual cost of work completed (AC), schedule and cost variances (SV, CV) forecasting final project costs.

Unit-4 Project Organization, Culture And Leadership: Projects within functional organization, dedicated project/ task-force teams, staff, matrix and network organization, choosing appropriate project organization, Organization culture, ten characteristics, cultural dimensions supportive to projects, social network and management by wandering around (MBWA), different traits of a manager and leader, managing project teams, five stage team development model, shared vision, conflicts, rewards, rejuvenating project teams, project stakeholders, concept of project partnering.

Unit-5 Strategic Planning and Project Appraisal: Capital allocation key criteria, Porters competitive strategy model, BCG matrix, Strategic Position Action Evaluation (SPACE), time value of money, cash flows, payback period, IRR, cost of capital, NPV, social cost benefit analysis, UNIDO approach, project risks and financing.

References:

1. Prasana Chandra: Projects: planning Implementation control, TMH.
2. Gray Clifford F And Larson EW, Project The managerial Process, TMH
3. Panneerselven and Serthil kumar, Project management, PHI
4. Burke , Project Management-Planning and control technics, Wiley India
5. Kamaraju R, Essentials of Project Management, PHI Learning
6. Jack R. Meredith, Project Management: a managerial approach, Wiley.
7. Choudhary ,Project Management, TMH
8. Srinath LS, PERT And CPM Principles and Appl, East West Press
9. Richman L, Project Management: Step By Step, PHI Learning

EEC- 607- Industrial Training Project – I

The Industrial Training Project – I should be the outcome of the training done/performed during 5th semester .It should be submitted in hardware form (proto type)or simulation form along with proper data and certificates issued during project training. It should cover the electrical engineering aspects learned during training. A Power point presentation should also be submitted at the time of submission.