PEOPLE'S UNIVERSITY, BHOPAL

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

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

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
EET-18101	Power quality	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 power system and their associated problems.
Course Outcome	1. Knowledge about various remedial measures useful for improving power quality.
	2. Details of measuring instruments and their industrial usage.
	3. Various equipments and their contribution in power quality deterioration.

Unit	Contents (Theory)	Marks Weightage
I	**Introduction to Power Quality:** Terms and definitions of transients, Long Duration Voltage Variations: under Voltage, Under Voltage and Sustained Interruptions; **Short Duration Voltage Variations:** interruption, Sag, Swell; Voltage Imbalance; Notching D C offset,waveform distortion; voltage fluctuation; power frequency variations	**14**
II	**Voltage Sag: Sources of voltage sag:** motor starting, arc furnace, fault clearing etc; estimating voltage sag performance and principle of its protection; solutions at end user level- Isolation Transformer, Voltage Regulator, Static UPS, Rotary UPS, Active Series Compensator.	**14**
III	**Electrical Transients:** Sources of Transient Over voltages- Atmospheric and switching transients- motor starting transients, pf correction capacitor switching transients, ups switching transients, neutral voltage swing etc; devices for over voltage protection	**14**
IV	**Harmonics:** Causes of harmonics; current and voltage harmonics: measurement of harmonics; effects of harmonics on – Transformers, AC Motors, Capacitor Banks, Cables, and Protection Devices, Energy Metering, Communication Lines etc. harmonic mitigation techniques,	**14**
V	**Measurement and Solving of Power Quality Problems:** Power quality measurement devices- Harmonic Analyzer , Transient Disturbance Analyzer, wiring and grounding tester, Flicker Meter, Oscilloscope, multimeter etc. Introduction to Custom Power Devices-Network Reconfiguration devices; Load compensation and voltage regulation using DSTATCOM; protecting sensitive loads using DVR; Unified power Quality Conditioner. (UPQC)	**14**

Text Book/References Books/ Websites

1. Roger C Dugan, McGrahan, Santoso & Beaty; "Electrical Power System Quality"; McGraw Hill
2. Arinthom Ghosh & Gerard Ledwich; "Power Quality Enhancement Using Custom Power Devices"; Kluwer Academic Publishers
3. C. Sankaran; " Power Quality"; CRC Press

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

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
EET-18102	Power Systems Deregulation	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 Power System Operation and It's associated problems.
Course Outcome	1. Knowledge about Power System deregulation, market structure, concepts of costs.
	2. Understanding the electricity structure, various model and it's challenges.
	3. Understanding the Ancillary Services and System Security in Deregulation.

Unit	Contents (Theory)	Marks Weightage
I	Need and conditions for deregulation. Introduction of Market structure, Market Architecture, Spot market, forward markets and settlements. Review of Concepts marginal cost of generation, least-cost operation, incremental cost of generation, Power System Operation: Old vs. New	**14**
II	Electricity sector structures and Ownership /management, the forms of Ownership and management. Different structure model like Monopoly model, Purchasing agency model, wholesale competition model, Retail competition model.	**14**
III	Framework and methods for the analysis of Bilateral and pool markets, LMP based markets, auction models and price formation, price based unit commitment, country practices	**14**
IV	Transmission network and market power. Power wheeling transactions and marginal costing, transmission costing. Congestion management methods- market splitting, counter-trading; Effect of congestion on LMPs- country practices	**14**
V	Ancillary Services and System Security in Deregulation. Classifications and definitions, AS management in various markets- country practices. Technical, economic, & regulatory issues involved in the deregulation of the power industry.	**14**

Text Book/References Books/ Websites

1. P. Venkatesh, B.V. Manikandan ; "Electrical Power Systems: Analysis, Security and Deregulation"; PHI.
2. Mohammad Shahidehpour, Hatim Yamin "Market Operations in Electric Power Systems: Forecasting, Scheduling and Risk Management";Wiley.
3. Lol Lei Lai; "Power System Restructuring and Deregulation"; Wiley.

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

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

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
EET-18103	Advanced Electrical Drive	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 fundamentals of Electrical Machine.
Course Outcome	1. Understanding the Electrical drives and their applications in the Industry.
	2. Understanding the various closed loop Controllers, Sensors and Transducers.
	3. Knowledge of AC, DC and other Special Drives and their applications.

Unit	Contents (Theory)	Marks Weightage
I	Review of electric motors & Solid state converters: Speed control techniques of DC, Induction & synchronous Motor, Converters, inverters, chopper and cyclo converter operation, Effects of power electronic equipments on load side & supply side.	**14**
II	Review of closed loop controllers, sensors & transducers: PI, PID, Variable structure. AC, DC & Pulse tachogenerators.	**14**
III	DC Drives : Converter & chopper fed DC drive, Reversing, Starting, Regenerative breaking , Four quadrant operation, High power application AC Drive: Inverter & cyclo converter fed drive, Vector control, Sensor less operation, Linear electrical motor concept, Synchronous motor drive	**14**
IV	Special Drives: Switched reluctance & permanent magnet brushless DC Operation, Converters, Characteristics & Control, PLC based drives.	**14**
V	Servo drives & stepper motor- AC & DC Servomotor, Stepper motor, Control techniques, Controllers, Microstepping, Sensorless operation.	**14**

Text Book/References Books/ Websites

1. Ned Mohan, T.M. Undeland, W.P. Robbins; "Power Electronics-Converters, Applications and design", John Wiley & Sons.
2. J.M.D. Murphy, F.O. Turnbull;"Power Electronic Control of AC motors";Pergamon Press.
3. P.C. Sen; "D.C. drive"; Pergamon Press.
4. B.K. Bose, Power Electronics & AC drive prentice Hall.
5. G.K Dubey; "Power semi Conductor controller drives"; Prentice Hall.
6. Vedam Subramanyam;"Thyristor Control of Electrical Drives"; McGraw Hill.
7. T.J.E. Miller; "Switched Reluctance & P.M. B.L. DC motor";Pergamon Press.
8. P.V. Rao; "Power semiconductor Drives";BS Publications.

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

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

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External (35)	Internal (15)	Total (50)
EET-1802	EHV AC/DC Transmission Systems	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	Basic knowledge of EHV AC/DC Transmission System.
Course Outcome	1. Need of EHV Transmission system and Corona effects.
	2. Control of active and reactive power flow using load frequency control.
	3. Method of voltage control by static var compensator.

Unit	Contents (Theory)	Marks Weightage
I	**EHV AC Transmission:** Need of EHV transmission lines, power handling capacity and surge impedance loading. Problems of EHV transmission, bundled conductors: geometric mean radius of bundle properties of bundle conductors. Electrostatic fields of EHV lines and their effects, corona effects: Corona loss, audio and radio noise.	**14**
II	**Load Frequency Control:** Introduction to control of active and reactive power flow, turbine speed governing system. Speed governing characteristic of generating unit and load sharing between parallel operating generators. **Method of Load Frequency Control:** Flat frequency, flat tie line and tie line load bias control. Automatic generation control (description of block diagram only).	**14**
III	**Voltage Control:** No load receiving end voltage and reactive power generation. Methods of voltage control. Synchronous phase modifier, shunt capacitors and reactors, saturable reactors Thynstorised static VAR compensators- TCR, FC-TCR and TSC- TCR.	**14**
IV	**FACTS:** Introduction to FACTS controllers, types of FACTS controllers, Brief description of STATCOM, Thyristor controlled series capacitors and unified power flow controller.	**14**
V	**HVDC Transmission:** Types of D.C. links, advantages and disadvantages of HVDC transmission. Basic scheme and equipment of converter station. Ground return. Basic principles of DC link control and basic converter control characteristics. Application of HVDC transmission.	**14**

Text Book/References Books/ Websites

1. S. Rao; "EHV AC & DC Transmission" ;Khanna pub.
2. Kimbark; "HVDC Transmission" ;john willy & sons pub
3. Arrillaga; "HVDC Transmission 2nd Edition" ; IEE londan pub.
4. Padiyar; "HVDC Transmission 1st Edition" ; New age international pub.
5. T.K. Nagsarkar,M.S. Sukhiza; "Power System Analysis" ; Oxford University

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

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

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)			Total (50)
EET-1803	Computer Aided Design of Electrical Machine	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 about Electrical Machine.
Course Outcome	1. Apply theoretical concepts in designing conventional electrical machines.
	2. Select appropriate material for designing electrical machines.
	3. Estimate the machine performance based on the design outcome by data interpretation.

Unit	Contents (Theory)	Marks weightage
I	**Basic Principles of Electrical Machine Design:** Specifications, Factors affecting the design, Limitations, main dimension, loadings, output equation, factor affecting the size and rating, Electrical Engineering Materials: conducting, magnetic and insulating materials. **Magnetic Circuit Calculation:** Ohm's law for magnetic circuit, mmf required for air gap and iron parts, tapered teeth, real and apparent flux density, magnetizing current.	**14**
II	**Heating and Cooling of Electrical Machines:** heat dissipation and heat flow equations, Newton's law of cooling, equations for temperature rise, **Rating of Machines**: Continuous, short and intermittent ratings, mean temperature rise, hydrogen cooling of turbo alternators, quantity of cooling medium.	**14**
III	**Computer Aided Design of Transformers:** Power and Distribution Transformers, core and yoke cross sections, square and stepped core, output equations, main dimensions, types &, design of windings, optimization concepts.	**14**
IV	**Computer Aided Design of Synchronous Machines:** Turbo and Hydro alternators, choice of specific magnetic & electric loading, short circuit ratio and its effects, air gap length, output equation, main dimensions, flow charts for design of synchronous machine, design of stator core & winding.	**14**
V	**Computer Aided Design of Induction Machines:** Output equation, main dimensions, design criteria, flow charts for design of induction motor, air gap length, design of stator core and winding, rotor design.	**14**

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

Text Book/References Books/ Websites

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

Suggested List of Laboratory Experiments :- (Expandable):

1. Develop program for calculating main dimension of DC generator.
2. Develop program for design of commutator and brush.
3. Program from calculating losses in efficiency.
4. Temperature rise of armature.
5. Design of synchronous machine.
6. Design a 30000 KVA, 3000 Rpm, 50 Hz, 3 phase air cooled turbo alternator. The load power is 0.8 lagging.

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

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)			Total (50)
EET-1804	Power System Operation & Control	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 about the basic Power System Operation and Protection.**
Course Outcome	1. Understanding the Admittance and Impendence Model.
	2. Understanding the symmetrical faults and Unsymmetrical faults in the Power System.
	3. Knowledge about the Load Flow Studies and it's importance in the Power System.

Unit	Contents (Theory)	Marks Weightage
I	(i) Percent and per unit quantities. Single line diagram for a balanced 3-phase system. **(ii) Admittance Model:** Branch and node admittances Equivalent admittance network and calculation of Y bus. Modification of an existing Y bus.	**14**
II	**Impendence Model:** Bus admittance and impedance matrices. Thevenin's theorem and Z b Direct determination of Z bus. Modification of an existing bus **(ii) Symmetrical fault Analysis** Transient on a Transmission line, short circuit of a synchronous machine on no load, short circuit of a loaded synchronous machine. Equivalent circuits of synchronous machine under sub transient, transient and steady state conditions. Selection of circuit breakers, Algorithm for short circuit studies. Analysis of 3 phases faults	**14**
III	**Symmetrical Components:** Fortescure theorem, symmetrical component transformation Phase shift in star-delta transformers. Sequence Impedances of transmission lines, Synchronous Machine and Transformers, zero sequence network of transformers and transmission lines. Construction of sequence networks of power system. **Fault Analysis:** Analysis of single line to ground faults using symmetrical components, connection of sequence networks under the fault condition.	**14**
IV	**Unsymmetrical Fault Analysis:** (i) Analysis of line-to-line and double line to ground faults IV using symmetrical components, connection of sequence networks under fault conditions. (ii) Analysis of unsymmetrical shunt faults using bus impedance matrix method.	**14**
V	**Load Flow Analysis:** Load flow problem, development of load flow equations, bus classification. Gauss Seidel, Newton Raphosn, decoupled and fast decoupled methods for load flow analysis. Comparison of load flow methods	**14**

Text Book/References Books/ Websites

1. C.L. Wadhwa; "Electric Power System"; Willey Eastem Ltd.
2. V.K. Mehta and Rohit Mehta; "Principles of Power System"; S.CHAND.
3. Badri Ram and B.N. Vishwakarma; "Power System Protection and Switchgear"; Mcgraw Hill.
4. IJ Nagrath and DP Kothari; "Power System Engineering". Tata MGH.

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Suggested List of Laboratory Experiments :- (Expandable):

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 upto 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 (PSAT, EDSA, MY POWER, ETAP etc).

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

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total			Total (50)
EET-1805	MATLAB	-	-	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	Elementary ordinary differential equations, linear algebra and basic principles of descriptive geometry.
Course Outcome	1. Knowledge of computer methods for solving a wide range of engineering problems.
	2. Methods to utilize computer skills to enhance learning and performance in other engineering and science courses.
	3. Knowledge of computer engineering software to solve and present problem solutions in a technical format.

Unit	Contents (Theory)	Marks Weightage
I	Concepts and importance of MATLAB, Terminologies related MATLAB, Various commands and expressions in MATLAB, Different types of basic Programs in MATLAB etc.	**50**

Text Book/References Books/ Websites

1. Shailendra Jain; "Modeling and Simulation using MATLAB – Simulink"; Wiley.
2. Agam Kumar Tyagi; "MATLAB and Simulink for Engineers"; Oxford Higher Education.
3. Amos Gilat; "MATLAB: An Introduction with Applications"; Wiley.

Suggested List of Laboratory Experiments :- (Expandable):

1. Write MATLAB commands to analyze arithmetic, logical and Boolean operations.
2. Write MATLAB commands to analyze vector operations and magic matrix's.
3. Write a MATLAB program to demonstrate if and else if statement for comparing Two numbers.
4. Analyze the following operations in MATLAB.
   a) Colon operator b) Line Plotting c) 2D plotting
5. Write MATLAB code to observe Regression and Polynomial functions.
6. Generate an array of random numbers between 1 to 100. Arrange them in
   (a) Ascending and descending order
   (b) Pick the numbers divisible by 2 using suitable commands.
7. Write a program to multiply 3X3 matrix and obtain inverse of the resultant matrix.
8. Generate an array of random numbers between 1 to 50 and
   (a) Convert them into binary numbers
   (b) Normalize the numbers between 0 and 1 using suitable formula
9. Write a MATLAB program to generate second order system.
   Write a MATLAB program to obtain smallest and largest values of integers.
10. Write a MATLAB program to obtain smallest and largest of floating point numbers.

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

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total			Total (200)
EET-1806	Major Project	-	-	4	External (Nil)	Internal (Nil)	Nil	External (140)	Internal (60)	Min: 80 (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: 60	Lab work & Sessional – Max Marks: -55	Assignment / Quiz/Attendance Max. Marks:05

Pre-Requisite	
Course Outcome	The student will be able to-Utilize technical resources:
	1. Identify, analyze & define the problem.
	2. Generate alternative solutions to the problem identified.
	3. Compare & select feasible solutions from alternatives generated.
	4. Design, develop, manufacture & operate equipment/program.
	5. Acquire higher-level technical knowledge by studying recent development in Engineering field.
	6. Compare machines/devices/apparatus for performance practices.
	7. 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 that he has selected for his 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 need analysis, market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan wherever applicable. Each group of students is required to prepare a project report based on the above points and present the same at the final examination with a demonstration of the working system. Evaluation will be based on his performance in technical work pertaining to the solution of a small size problem, project report, and presentation of work and defending it in a viva-voce.	**200**

Text Book/References Books/ Websites: Nil

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

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total			Total (50)
BT-1807	Professional Ethics and Proficiency	-	-	1	External (Nil)	Internal (Nil)	Nil	External (35)	Internal (15)	Min: 20 (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: 15	Lab work & Sessional - Max Marks: 10	Assignment/Quiz/Attendance - Max. Marks: 05

Pre-Requisite	**Nil**
Course Outcome	1. To give the knowledge of business ethics, etiquettes in social and office settings, email etiquettes, telephone etiquettes.
	2. To give the knowledge about the career oriental communication covering, resume and bio-data.
	3. To give the knowledge about the communication and personality development.

Unit	Contents (Theory)	Marks Weightage
I	**Ethics**: Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.	**14**
II	Communication and personality development covering, Psychological aspects of communication, Cognition as a part of communication, Emotional Intelligence, Politeness and etiquette in communication, Cultural factors that influence communication, Mannerisms to be avoided in communication, Language and persuasion, Language and conflict resolution.	**14**
III	Career Oriental Communication covering, Resume and biodata, Design & style, Applying for a job, Language and format of job application, Job Interviews, purpose and process.	**14**
IV	Advanced Techniques in Technical Communication covering, Interview through telephone/video-conferencing.	**14**
V	**Power-point presentation**: Structure and format, Using e-mail for business communication, Standard e-mail practices, Language in e-mail, Using internet for collecting information, Referencing while using internet materials for project reports.	**14**

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments:-

Students should prepare a hand written report on Professional Ethics and Proficiency as assigned by faculty.