AC
Item No.

UNIVERSITY OF MUMBAI

Revised syllabus (Rev- 2016) from Academic Year 2016 -17

Under

FACULTY OF TECHNOLOGY

Electrical Engineering

Third Year with Effect from **AY 2018-19**

As per **Choice Based Credit and Grading System** with effect from the AY 2016–17

Program Structure for
BE Electrical Engineering
University of Mumbai
(With Effect from 2019-20)

Scheme for Semester VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EEC801	Design, Management and Auditing of Electrical Systems	4	-	1	4	-	1	5
EEC802	Flexible AC Transmission System	4	-	-	4	-	-	4
EEDLO804X	Department Level Optional Course-IV	3	-	1	3	-	1	4
ILO802X	Institute Level Optional Course-II	3	-	-	3	-	-	3
EEL801	Simulation Lab - IV	-	2	-	-	1	-	1
EEL802	Electrical System Design Lab		2	-	-	1	-	1
EEL803	Project-II	-	12	-	-	6	-	6
Total		**14**	**16**	**2**	**14**	**8**	**2**	**24**

Examination Scheme for Semester VIII

Course Code	Course Name	Examination Scheme												Total Marks
		Theory				Term Work		Practical		Oral		Pract./Oral		
		External (UA)		Internal (CA)										
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
EEC801	Design, Management and Auditing of Electrical Systems	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC802	Flexible AC Transmission System	80	32	20	8	-	-	-	-	-	-	-	-	100
EEDLO 804X	Department Level Optional Course-IV	80	32	20	8	25	10	-	-	-	-	-	-	125
ILO802 X	Institute Level Optional Course-II	80	32	20	8	-	-	-	-	-	-	-	-	100
EEL801	Simulation Lab - IV	-	-	-	-	25	10	-	-	25	10	-	-	50
EEL802	Electrical System Design Lab					25	10	-	-	25	10	-	-	50
EEL803	Project-II	-	-	-	-	50	20	-	-	50	20	-	-	100
Total		**320**	**-**	**80**	**-**	**150**	**-**	**-**	**-**	**100**	**-**	**-**	**-**	**650**

List of Department Level Optional Courses

Course Code	Department Level Optional Course - III
EEDLO7031	High Voltage Engineering
EEDLO7032	Electric Vehicle Technology
EEDLO7033	Industrial Controller
EEDLO7034	Power Quality

Course Code	Department Level Optional Course - IV
EEDLO8041	Illumination Engineering
EEDLO8042	Smart Grid
EEDLO8043	Power System Modeling and Control
EEDLO8044	Power System Planning and Reliability

List of Institute Level Optional Courses

Course Code	Institute Level Optional Course - I
ILO7011	Product Lifecycle Management
ILO7012	Reliability Engineering
ILO7013	Management Information System
ILO7014	Design of Experiments
ILO7015	Operation Research
ILO7016	Cyber Security and Laws
ILO7017	Disaster Management and Mitigation Measures
ILO7018	Energy Audit and Management
ILO7019	Development Engineering

Course Code	Institute Level Optional Course - II
ILO8021	Project Management
ILO8022	Finance Management
ILO8023	Entrepreneurship Development and Management
ILO8024	Human Resource Management
ILO8025	Professional Ethics and Corporate Social Responsibility (CSR)
ILO8026	Research Methodology
ILO8027	IPR and Patenting
ILO8028	Digital Business Management
ILO8029	Environmental Management

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC801	**Design, Management and Auditing of Electrical System (abbreviated as DMAES)**	**4**	**1**	**4**	**1**	**5**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEC801	Design, Management and Auditing of Electrical System	20	20	20	80	03	25	125

Course Objectives	• To give the students basic knowledge of designing electrical distribution network • To give the students basic knowledge of electrical energy audit in the distribution system
Course Outcomes	Students will be able • To do sizing, selecting transformer, switchgear and cable as required for distribution system • To illustrate Engineering knowledge in energy audit and energy efficient technologies to improve energy efficiency

Module	Contents	Hours
1	**Introduction** Types of electrical Projects, Types of electrical system, review of components of electrical system, different plans/ drawings in electrical system design, single line diagram in detail, Tendering, Estimation	5
2	**Design of Power Distribution System** Different types of distribution systems and selection criteria, Electrical Earthing, Electrical load size, L.F, D.F, future estimates, substation equipment options, design considerations in transformer selection, sizing and specifications, IS standards applicable in above design	7
3	**Design of Switchgear Protection and Auxiliary system** Selection of HT/LT switchgears, metering, switchboards and MCC, protection systems, coordination and discrimination. Cables selection and sizing, cable installation and management systems, bus bars design; Basics of selection of emergency/backup supplies, UPS, DG Set, Batteries; Preliminary design of interior lighting system. IS standards applicable in above designs	10
4	**Energy Monitoring and Targeting:** Defining monitoring and targeting. Elements of monitoring and	7

	Targeting. Analysis techniques for energy optimization, Cumulative Sum of Differences (CUSUM), Electricity billing. **Energy Management of Electrical Systems:** Electrical load management and maximum demand control, Power factor improvement and its benefit, selection and location of capacitors, distribution and transformer losses.	
5	**Energy Audit:** Introduction to Energy Conservation Act 2001 . Energy Audit: Definition,-need, Types of energy audit, Energy Management (audit) approach understanding energy costs, Bench marking, Maximizing system efficiencies, optimizing input energy requirement, fuel and energy substitution. Energy Audit instruments. **Electrical Energy Performance Assessment**: Motors And Variable Speed Drives, Lighting Systems. Basics of HVAC system assessment for electrical energy usage.	10
6	**Energy Efficient Technologies**: Energy efficient BLDC Fans, Smart lighting system for indoor and outdoor applications, Maximum Demand controllers, Automatic Power Factor Controllers, Energy Efficient Motors, Soft starters, Variable Speed Drives, Energy Efficient Transformer. Energy saving potential of each technology. Use of Energy Management system (EMS) and Building Management System (BMS).	9

Books Recommended:

Text Books:

1. “Handbook of Electrical Installation Practice” Fourth Edition, by Geofry Stokes, Blackwell Science
2. “Energy-Efficient Electric Motor”, Third Edition, By Ali Emadi, New Marcel Dekker, Inc., 2005.
3. “Electrical Energy Efficiency: Technologies And Applications” by Andreas Sumper and Angelo Baggini, John Wiley & Sons, Ltd., 2012
4. “Electrical Calculations and Guidelines for Generating Stations and Industrial Plants” by Thomas E. Baker, CRC Publications, 2012
5. “Electrical Installations Handbook” , Third Edition, by Gunter Seip, MCD Verilag, 2000
6. “Electrical Installation Designs”, Fourth Edition by Bill Atkinson, Roger Lovegrove and Gary Gundry, John Wiley & Sons, Ltd, 2013.
7. “Handbook of International Electrical Safety Practices”, by Princeton Energy Resources International, Scrivener Publishing, 2010.
8. “Designing with Light: Lighting Handbook”, by Anil Valia, Lighting System
9. “Energy Management Handbook”, by W.C. Turner, John Wiley and sons
10. “Handbook on Energy Audits and Management”, by Amit Kumar Tyagi, TERI
11. “Introduction to Efficient Electrical System Design” , by Stephen Ayraud and Albert Thumann, The Fairmount Press

Reference Books:

“Energy Auditing Made Simple”, by P. Balasubramanian, Seperation Engineers (P) Ltd

2. “Electrical Installation Calculations: for Compliance with BS 7671:200”, Fourth Edition, by Mark Coates, Brian Jenkins, John Wiley & Sons, Ltd, 2010
3. “Energy Management Principles”, by C.B.Smith, Peragamon Press
4. “Energy Conservation Guidebook”, by Dale R.Patrick, Stephon Fadro, E. Richardson, Fairmont Press
5. “Handbook of Energy Audits”, by Albert Thumann, William J. Younger, Terry Niehus, CRC Press

Websites:

www.energymanagertraining.com
www.bee-india.nic.in

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Term work:

Term work shall consist of minimum eight tutorials and assignments (minimum 2). The distribution of marks for term work shall be as follows:

Tutorials	:15 marks
Assignments	:05 marks
Attendance (Theory and Tutorial)	:05 marks

The final certification and acceptance of term work ensures minimum passing in the term work

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC802	**Flexible AC Transmission System (abbreviated as FACTS)**	**4**	**-**	**4**	**-**	**4**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEC802	Flexible AC Transmission System	20	20	20	80	03	-	100

Course Objectives	• To understand the concept of Flexible AC Transmission System • To introduce the operation of various FACTS controllers.
Course Outcomes	Student will be able to • Illustrate the aspects of flexible ac transmission system over conventional ac transmission system • Analyze the concept of load compensation. • Categorize the static shunt and series compensation for transmission line. • Outline the concept of voltage and phase angle regulators. • Understand unified power flow controllers using circuit diagram and phasors.

Module	Contents	Hours
1	**FACTS Concepts and General System Considerations**: Transmission Interconnections, Flow of Power in AC system, What Limits the Loading Capability, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of controllable Parameters, Basic Types of FACTS Controllers, Brief Description and Definitions, Benefits from FACTS Technology	08
2	**Load Compensation**: Objectives in load compensation, ideal compensator, Practical considerations, Power factor correction and Voltage Regulation in single phase systems, Approximate reactive power characteristics with example, Load compensator as a voltage regulator, Phase balancing and power factor correction of unsymmetrical loads	12
3	**Static shunt compensators:** Objectives of shunt compensation, Methods of controllable VAR generation, Variable impedance type static Var generator (TCR,TSR,TSC,FC-TCR), Switching converter type Var generators, basic operating principle	10
4	**Static series compensation**: Objectives of series compensation-Variable impedance type series compensation (only GCSC, TSSC and TCSC), Switching converter type series compensation (only SSSC)	08

5	**Static voltage and phase angle regulators-** Objectives of voltage and phase angle regulators- TCVR and TCPAR, Switching converter based voltage and phase angle regulators	06
6	**Unified Power Flow Controller (UPFC):** Basic operating principle, Conventional transmission control capabilities	04

Books Recommended:

Text Books:

1. 'Hingorani N.G.. & Gyugi L., "Understanding FACTS : Concepts and Technology of Flexible AC Transmission Systems," Wiley-1EEE Press

2. Timothy J. E. Miller "Reactive power control in Electric Systems," Wiley India Edition.

Reference Books:

1. Yong Hua Song "Flexible AC transmission system" Institution of Electrical Engineers, London

2. Arindam Ghosh and Gerard Ledwich, " Power Quality Enhancement Using Custom Power Devices," Kluwer Academic Publishers

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEDLO 8041	**Illumination Engineering (abbreviated as IE)**	**3**	**1**	**3**	**1**	**4**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEDLO 8041	Illumination Engineering	20	20	20	80	03	25	125

Course Objectives	• To introduce various laws of illumination, lighting parameters, light sources, luminaries and their characteristics to be used for lighting design. • To introduce lighting design considerations for interior and exterior applications. • To adapt to the LED based solid state lighting with different lighting control technologies and standards.
Course Outcomes	Student will be able to • Identify and describe the various laws of illumination, lighting parameters, light sources, luminaries and their Photometric characteristics. • Identify and describe various LED lighting components / subsystems, thermal management and lifetime studies. • Formulate and design an Interior Lighting system through standards, design considerations and calculation for different application areas. • Formulate and design an Exterior Lighting system through standards, design considerations and calculation for different application areas. • Identify and describe different Lighting Control schemes. • Identify and describe Solid-State Lighting technology, it's applications in Lighting for health and safety and solar powered schemes.

Module	Contents	Hours
1	**Introduction:** Review of Light, Color and Photometry: Laws of illumination, illumination entities. Radiometric and photometric standards, Photometric measurement procedure- assessment of lamp efficacy, Color temperature, Colorimetry- Measurement of CRI, Glare	03
2	**Lamps and Luminaries:** Lamp: Review of development, construction and characteristics: Incandescent lamp, Discharge lamps, induction lamp, and LED lamp; LED Lighting Components and Subsystems, OLEDs, light-emitting polymers (LEPs) Thermal Management and Lifetime Studies; Luminaire: optical control, Control gear: ballast, standard and electronic, Luminaries photometry, Luminaire testing procedures	8

3	**Interior Lighting Design & Calculation:** Objectives, quality and quantity of lighting. Lamp /Luminaire selection and placement, design considerations and calculation. Glare Consideration and control. Indoor lighting design by lumen method, by point by point method. Applications: residential, educational institute, industries, sports centers, commercial premises: retail stores, offices etc. Applicable standards.	06
4	**Exterior Lighting Design & Calculation:** Exterior lighting system- Road lighting system, Utility area lighting, Sports lighting, Decorative flood lighting. Applicable standards	04
5	**Lighting Control:** Introduction to Lighting Control, Controls, Selection of Lighting Controls, Design of Lighting Control Scheme, Lighting and LEED, Day-lighting control, Controlling LED Lighting Systems, Smart Lighting Fixtures, Digital Lighting Networks, DMX control. BACnet: Building Automation Standard Protocol.	03
6	**Solid-State Lighting:** Drivers for LED lamps, standards and regulations, LED luminaries, LED Light Distributions, Indoor Lighting Applications Smart Street Lighting with Remote Monitoring and Control System, Solar Powered LED Lighting, Tunable White Lighting and RGB LED based Colored Lighting. Lighting for health and safety, Circadian Rhythm and Human Centric Lighting.	12

Books Recommended:

Text Books:

1. Anil Valia, "Designing With Light – A Lighting Handbook" International Lighting Academy
2. M. Nisa Khan "Understanding LED Illumination," CRC Press 2013
3. Anil Valia, "LED LIGHTING SYSTEMS All you need to know," International Lighting Academy
4. National Lighting Code- 2011
5. Kao Chen , "Energy Management in Illumination Systems," CRC Press.
6. John L. Fetters , "The Hand Book of Lighting Surveys and Audits ," CRC Press.

Reference Books:

1. Illuminating Engineering Society, "The IES Lighting Handbook", 10th Edition
2. J. L. Lindsey and S. C. Dunning, "Applied Illumination Engineering," ThirdEdition, Fairmont Press, 2016
3. Lamps and Lighting – Edited by J.R.Coaton and A.M.Marsden, 4th Edition
4. Lighting for health and safety – N.A.Smith, Butterworth-Heimann.
5. Human Factors in Lighting – Peter R. Boyce, Taylor & Francis.

Website Reference:

1. http://nptel.iitm.ac.in: 'Illumination Engineering' web-course

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Term work:

Term work shall consist of minimum eight tutorials and assignments (minimum 2).
The distribution of marks for term work shall be as follows:

Tutorials	:15 marks
Assignments	:05 marks
Attendance (Theory and Tutorial)	:05 marks

The final certification and acceptance of term work ensures minimum passing in the term work

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEDLO 8042	**Smart Grid (abbreviated as SG)**	**3**	**1**	**3**	**1**	**4**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEDLO 8042	Smart Grid	20	20	20	80	03	25	125

Course Objectives	• To impart knowledge of futuristic power grid technology and the path on which development is taking place. • To elaborate the fundamentals of various technologies and tools which will play vital role in formation of the Smart grids in near future.
Course Outcomes	Students will be able • To identify and describe the history and evolvement Smart Grid, its features /functions and Barriers • To classify and describe the principles of various Smart Grid enabling Technologies. • To evaluate and compare applications of Smart Measurement and Monitoring Technologies. • To identify and describe the role Microgrids and Distributed Energy Resources in evolvement of Smartgrid • To Identify and describe the importance of various communication technology used for Smart Grid. • To assess the Power Quality issues and its Management in Smart Grid..

Module	Contents	Hours
1	**Introduction to Smart Grid:** Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional grid & smart grid, Concept of Resilient & Self Healing Grid. Present development & International policies in Smart Grid. Case studies of Smart Grid. CDM opportunities in Smart Grid.	05
2	**Smart Grid enabling Technologies:** Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicle (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation.	08
3	**Smart Measurement and Monitoring Technologies:** Smart Substations, Substation Automation, Feeder Automation. Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Wide Area	05

	Measurement System(WAMS), Phase Measurement Unit(PMU).	
4	**Microgrids and Distributed Energy Resources:** Concept of microgrid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Review of fundamentals and Integration of renewable energy sources. Storage like Battery, Pumped Hydro. Microgrid and Smart grid comparison.	08
5	**Power Quality Management in Smart Grid:** Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring.	05
6	**Communication Technology for Smart Grid:** Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN). ZigBee, GPS; Wireless Mesh Network, Basics of CLOUD Computing & Cyber Security for Smart Grid.	05

Books Recommended:

Text Books:

1. James Momoh, "Smart Grid:Fundamentals of Design and Analysis," IEEE Press and Wiley Publications, 2015
2. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley
3. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response" CRC Press
4. J. C. Sabonnadière, N. Hadjsaïd, "Smart Grids", Wiley Blackwell
5. L.T.Berger and K. Iniewski, "Smart Grid Applications, Communications and Security," Wiley Publications , 2015

Reference Books:

1. K. Liyanage, Jianzhong Wu, A. Yokoyama, Nick Jenkins J.Ekanayake, " Smart Grid: Technology and Applications," Wiley Publications , 2015
2. Stuart Borlase, "Smart Grids: Infrastructure, Technology, and Solutions," CRC Press, 2012
3. Yang Xiao, "Communication and Networking in Smart Grids," CRC Press, 2012
4. H. T. Mouftah, and M. Erol-Kantarci, "Smart Grid: Networking, Data Management, and Business Models," CRC Press, 2016

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Term work:

Term work shall consist of minimum eight tutorials and assignments (minimum 2).
The distribution of marks for term work shall be as follows:
Tutorials :15 marks

Assignments :05 marks
Attendance (Theory and Tutorial) :05 marks
The final certification and acceptance of term work ensures minimum passing in the term work

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEDLO 8043	**Power System Modeling and Control (abbreviated as PSMC)**	**3**	**1**	**3**	**1**	**4**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEDLO 8043	Power System Modeling and Control	20	20	20	80	03	25	125

Course Objectives	• To impart knowledge power system stability and control. • To elaborate the fundamentals of electrical machines and do the modeling of various components of power system.
Course Outcomes	Students will be able • To understand the basic concept of stability and its types • To evaluate the models of synchronous machine, induction machine, excitation system and load. • To analyse the dynamic stability of power system.

Module	Contents	Hours
1	**Introduction** **Basic Concepts and Definitions:**-Rotor angle stability, voltage Stability and voltage collapse, Mid term and long term stability, Classification of stability, Historical review of stability problem in India and world.	04
2	**Synchronous Machine Modeling and Representation** Basic equations of synchronous machine, dqo transformation, Per unit-voltage- flux- torque- power equations and reactance, Equivalent circuit d-q axis, Voltage current flux linkage relation- phasor representation-rotor angle-steady state equivalent circuit. Three phase short circuit, Magnetic saturation and representation Simplifications for large scale studies, Constant flux linkage model.	10
3	**Modeling Of Other Components** Basic load modeling concept, Modeling of induction motor, Acquisition of load model parameters	8
4	**Excitation System Modeling and Control** Excitation system requirement, Elements of excitation system, Types of excitation system, Dynamic performance measures, Control and protective functions, Basic elements of different types of excitation system.	10
5	**Small Signal Stability (SSS) and Control** Fundamental concept of stability of dynamic system, Eigen properties of state matrix, SSS of single machine infinite bus system, Effect of AVR	10

	on synchronizing and damping torque, Power system stabilizer, SSS of multi- machine system, Special techniques to analyze large system, Characteristics.	
6	**Voltage Stability and Control** Basic concepts, Voltage collapse, Voltage stability analysis, Prevention of voltage collapse. Counter measure for Sub Synchronous Resonance	06

Books Recommended:

Text Books:

1. Prabha Kundur , Power System Stability and Control , TMH Publication,2008
2. Padiyar K R, Power System Dynamics- Stability and Control, BSP Publication.

Reference Books:

1. Kimbark E W, Power System Stability, Volume I, III, Wiley publication.
2. Jr W.D. Stevenson., G. J. Grainger. Elements of Power System. Mc-Graw-Hill Publication.

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Term work:

Term work shall consist of minimum eight tutorials and assignments (minimum 2).
The distribution of marks for term work shall be as follows:

Tutorials :15 marks
Assignments :05 marks
Attendance (Theory and Tutorial) :05 marks

The final certification and acceptance of term work ensures minimum passing in the term work

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEDLO 8044	**Power System Planning and Reliability (abbreviated as PSPR)**	**3**	**1**	**3**	**1**	**4**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEDLO 8044	Power System Planning and Reliability	20	20	20	80	03	25	125

Course Objectives	• To understand the different power system planning and forecasting, techniques and reliability evaluation in terms of basic reliability indices.
Course Outcomes	Students will be able • To make a Generation System Model for the Power system in terms of frequency and duration of failure. • To calculate reliability indices of the power system based on system model and the load curve. • To plan a small Generation and Transmission system, predict its behavior, and do the required change in order to achieve reliability.

Module	Contents	Hours
1	**Load Forecasting:** Introduction, Classification of Load, Load Growth Characteristics, Peak Load Forecasting, Extrapolation and Co-Relation methods of load Forecasting, Reactive Load Forecasting, Impact of weather on load forecasting.	06
2	**System Planning:** Introduction to System Planning, Short, Medium and Long Term strategic planning, Reactive Power Planning**.** Introduction to Generation and Network Planning.	06
3	**Reliability of Systems:** Concepts, Terms and Definitions, Reliability models, Markov process, Reliability function, Hazard rate function, Bathtub Curve. Serial Configuration, Parallel Configuration, Mixed Configuration of systems, Minimal Cuts and Minimal Paths, Methods to find Minimal Cut Sets, System reliability using conditional probability method, cut set method and tie set method.	08
4	**Generating Capacity:** Basic Probability Methods introduction, Generation system model, capacity outage probability table, recursive algorithm, Evaluation of: loss of load indices, Loss of load expectation, Loss of energy. Frequency and Duration Method basic concepts, Numerical based on Frequency and Duration method.	08

5	**Operating Reserve:** General concept, PJM method, Modified PJM method.	04
6	**Composite generation and transmission system:** Data requirement, Outages, system and load point indices, Application to simple system	04

Books Recommended:

Text Books:

1. Power System Planning - R.L. Sullivan, Tata McGraw Hill Publishing Company
2. Electrical Power System Planning – A.S Pabla, Macmillan India Ltd.
3. Reliability Evaluation of Power System - Roy Billinton and Ronald N Allan, Springer Publishers

Reference Books:

1. Reliability Assessment of Large Electric Power Systems - Roy Billinton and Ronald N Allan, Kluwer academic publishers, 1988
2. Reliability Evaluation of Engineering System- Roy Billinton and Ronald N Allan, Springer Publishers
3. Electrical Power System Planning: Issues, Algorithms and Solutions – Hossein Seifi and M.S Sepasian, Springer Publishers
4. Modern Power System Planning – X. Wang and J.R. McDonald, McGraw Hill

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Term work:

Term work shall consist of minimum eight tutorials and assignments (minimum 2)..
The distribution of marks for term work shall be as follows:
Tutorials :15 marks
Assignments :05 marks
Attendance (Theory and Tutorial) :05 marks
The final certification and acceptance of term work ensures minimum passing in the term work

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8021	**Project Management (abbreviated as PM)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8021	Project Management	20	20	20	80	03	-	100

Course Objectives	• To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques. • To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.
Course Outcomes	Student will be able to… • Apply selection criteria and select an appropriate project from different options. • Write work break down structure for a project and develop a schedule based on it. • Identify opportunities and threats to the project and decide an approach to deal with them strategically. • Use Earned value technique and determine & predict status of the project. • Capture lessons learned during project phases and document them for future reference

Module	Contents	Hours
1	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager. Negotiations and resolving conflicts. Project management in various organization structures. PM knowledge areas as per Project Management Institute (PMI).	5
2	**Initiating Projects:** How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	6
3	**Project Planning and Scheduling:** Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and	8

	bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart. Introduction to Project Management Information System (PMIS).	
4	**Planning Projects:** Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan. Risk Management in projects: Risk management planning, Risk identification and risk register. Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	6
5	**Executing Projects:** Planning monitoring and controlling cycle. Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings. **Monitoring and Controlling Projects:** Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. **Project Contracting** Project procurement management, contracting and outsourcing,	8
6	**Project Leadership and Ethics:** Introduction to project leadership, ethics in projects. Multicultural and virtual projects. **Closing the Project:** Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6

Books Recommended:

Reference Books:

1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7thEd.
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA
3. Gido Clements, Project Management, Cengage Learning.
4. Gopalan, Project Management, , Wiley India
5. Dennis Lock, Project Management, Gower Publishing England, 9 th Ed.

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8022	**Finance Management (abbreviated as FM)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8022	Finance Management	20	20	20	80	03	-	100

Course Objectives	• Overview of Indian financial system, instruments and market • Basic concepts of value of money, returns and risks, corporate finance, working capital and its management • Knowledge about sources of finance, capital structure, dividend policy
Course Outcomes	Student will be able to… • Understand Indian finance system and corporate finance • Take investment, finance as well as dividend decisions

Module	Contents	Hours
1	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. **Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market. **Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	6
2	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	6
3	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market	9

	Ratios; Limitations of Ratio Analysis.	
4	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	10

Books Recommended:

Reference Books:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8023	**Entrepreneurship Development and Management (abbreviated as EDM)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8023	Entrepreneurship Development and Management	20	20	20	80	03	-	100

Course Objectives	• To acquaint with entrepreneurship and management of business • Understand Indian environment for entrepreneurship • Idea of EDP, MSME
Course Outcomes	Student will be able to… • Understand the concept of business plan and ownerships • Interpret key regulations and legal aspects of entrepreneurship in India • Understand government policies for entrepreneurs

Module	Contents	Hours
1	**Overview Of Entrepreneurship:** Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	4
2	**Business Plans And Importance Of Capital To Entrepreneurship:** Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur **Entrepreneurship And Business Development:** Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations	9
3	Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	5
4	**Indian Environment for Entrepreneurship:** key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies	8

	of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc	
5	**Effective Management of Business:** Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing	8
6	**Achieving Success In The Small Business:** Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	5

Books Recommended:

Reference Books:

1. Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHill Company
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIM Ahmedabad
8. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann Publication Ltd.
9. Kurakto, Entrepreneurship- Principles and Practices, Thomson Publication
10. Laghu Udyog Samachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8024	**Human Resource Management (abbreviated as HRM)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8024	Human Resource Management	20	20	20	80	03	-	100

Course Objectives	• To introduce the students with basic concepts, techniques and practices of the human resource management. • To provide opportunity of learning Human resource Management (HRM) processes, related with the functions, and challenges in the emerging perspective. • To familiarize the students about the latest developments, trends & different aspects of HRM. • To acquaint the student with the importance of behavioral skills, Inter-personal, inter- group in an organizational setting. • To prepare the students as future organizational change facilitators, stable leaders and managers, using the knowledge and techniques of human resource management.
Course Outcomes	Learner will be able to… • Gain knowledge and understand the concepts about the different aspects of the human resource management. • Understand and tackle the changes and challenges in today's diverse, dynamic organizational setting and culture. • Utilize the behavioral skill sets learnt, in working with different people, teams & groups within the national and global environment. • Apply the acquired techniques, knowledge and integrate it within the engineering/ non engineering working environment emerging as future engineers and managers.

Module	Contents	Hours
1	**Introduction to HR:** Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing,	05

	Empowerment, TQM, Managing ethical issues.	
2	**Organizational Behavior (OB) :** Introduction to OB Origin, Nature and Scope of Organizational Behavior, Relevance to Organizational Effectiveness and Contemporary issues, Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness, Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behavior. Motivation: Theories of Motivation and their Applications for Behavioral Change (Maslow, Herzberg, McGregor); Group Behavior and Group Dynamics: Work groups formal and informal groups and stages of group development. Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. Case study	07
3	**Organizational Structure & Design:** Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.	06
4	**Human resource Planning:** Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale. Performance Appraisal Systems: Traditional & modern methods, Performance Counseling, Career Planning. Training & Development: Identification of Training Needs, Training Methods	05
5	**Emerging Trends in HR :** Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development , managing processes & transformation in HR. Organizational Change, Culture, Environment, Cross Cultural Leadership and Decision Making**:** Cross Cultural Communication and diversity at work**,** Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.	06
6	**HR & MIS:** Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries **Strategic HRM** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals **Labor Laws & Industrial Relations** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and	10

	Establishments Act	

Books Recommended:

Reference Books:

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015
5. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
6. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8025	**Professional Ethics and Corporate Social Responsibility (abbreviated as PECSR)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8025	Professional Ethics and Corporate Social Responsibility	20	20	20	80	03	-	100

Course Objectives	• To understand professional ethics in business • To recognized corporate social responsibility
Course Outcomes	Student will be able to… • Understand rights and duties of business • Distinguish different aspects of corporate social responsibility • Demonstrate professional ethics • Understand legal aspects of corporate social responsibility

Module	Contents	Hours
1	**Professional Ethics and Business:** The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	04
2	**Professional Ethics in the Marketplace:** Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy **Professional Ethics and the Environment:** Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources	08
3	**Professional Ethics of Consumer Protection:** Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy **Professional Ethics of Job Discrimination:** Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	06
4	**Introduction to Corporate Social Responsibility:** Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business;	05

	Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	
5	**Corporate Social Responsibility:** Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India	08
6	**Corporate Social Responsibility in Globalizing India:** Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.	08

Books Recommended:

Reference Books:

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.
3. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Publisher: Pearson, New Delhi.
4. Corporate Social Responsibility in India (2015) by Bidyut Chakrabarty, Routledge, New Delhi.

Assessment:
Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8026	**Research Methodology (abbreviated as RM)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8026	Research Methodology	20	20	20	80	03	-	100

Course Objectives	• To understand Research and Research Process • To acquaint students with identifying problems for research and develop research strategies • To familiarize students with the techniques of data collection, analysis of data and interpretation
Course Outcomes	Student will be able to… • Prepare a preliminary research design for projects in their subject matter areas • Accurately collect, analyze and report data • Present complex data or situations clearly • Review and analyze research findings

Module	Contents	Hours
1	**Introduction and Basic Research Concepts:** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology, Need of Research in Business and Social Sciences , Objectives of Research, **Issues** and Problems in Research, Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	10
2	**Types of Research:** Basic Research, Applied Research, Descriptive Research, Analytical Research, Empirical Research, Qualitative and Quantitative Approaches	08
3	**Research Design and Sample Design :** Research Design – Meaning, Types and Significance, Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	08
4	**Research Methodology :** Meaning of Research Methodology, Stages in Scientific Research Process **a.** Identification and Selection of Research Problem **b.** Formulation of Research Problem **c.** Review of Literature **d.** Formulation of Hypothesis	08

	e. Formulation of research Design **f**. Sample Design **g.** Data Collection **h.** Data Analysis **i.** Hypothesis testing and Interpretation of Data **j.** Preparation of Research Report	
5	**Formulating Research Problem:** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	04
6	**Outcome of Research:** Preparation of the report on conclusion reached, Validity Testing & Ethical Issues, Suggestions and Recommendation	04

Books Recommended:

Reference Books:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R., 1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2^{nd}ed), Singapore, Pearson Education

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8027	**IPR and Patenting (abbreviated as IPRP)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8027	IPR and Patenting	20	20	20	80	03	-	100

Course Objectives	• To understand intellectual property rights protection system • To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures • To get acquaintance with Patent search and patent filing procedure and • applications
Course Outcomes	Student will be able to… • understand Intellectual Property assets • assist individuals and organizations in capacity building • work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting

Module	Contents	Hours
1	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc. **Importance of IPR in Modern Global Economic Environment:** Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development	05
2	**Enforcement of Intellectual Property Rights:** Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) activein IPR enforcement **Indian Scenario of IPR:** Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.	07
3	**Emerging Issues in IPR:** Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	06
4	**Basics of Patents:** Definition of Patents, Conditions of patentability,	07

	Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	
5	**Patent Rules:** Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	08
6	**Procedure for Filing a Patent (National and International):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publicationetc, Time frame and cost, Patent Licensing, Patent Infringement **Patent databases:** Important websites, Searching international databases	07

Books Recommended:

Reference Books:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4. Tzen Wong and Graham Dutfield,2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5. Cornish, William Rodolph&Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell
6. LousHarns, 2012, The enforcement of Intellactual Property Rights: A Case Book, 3rd Edition, WIPO
7. PrabhuddhaGanguli, 2012, Intellectual Property Rights, 1st Edition, TMH
8. R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books
9. M Ashok Kumar andmohdIqbal Ali, 2-11, Intellectual Property Rights, 2nd Edition, Serial Publications
10. KompalBansal and PraishitBansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BS Publications
11. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights,
12. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company
13. N S Rathore, S M Mathur, PritiMathur, AnshulRathi**,** IPR: Drafting,Interpretation of Patent Specifications and Claims**,** New India Publishing Agency

14. Vivien Irish, 2005,Intellectual Property Rights for Engineers,IET
15. Howard B Rockman, 2004, Intellectual Property Law for Engineers and scientists, Wiley-IEEE Press

Assessment:
Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8028	**Digital Business Management (abbreviated as DBM)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8028	Digital Business Management	20	20	20	80	03	-	100

Course Objectives	• To familiarize with digital business concept • To acquaint with E-commerce • To give insights into E-business and its strategies
Course Outcomes	Student will be able to ….. • Identify drivers of digital business • Illustrate various approaches and techniques for E-business and management • Prepare E-business plan

Module	Contents	Hours
1	**Introduction to Digital Business:** Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business**- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) Opportunities and Challenges in Digital Business,	09
2	**Overview of E-Commerce: E-Commerce-** Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC	06
3	**Digital Business Support services**: ERP as e –business backbone, knowledge Tope Apps, Information and referral system, **Application**	06

	Development: Building Digital business Applications and Infrastructure	
4	**Managing E-Business**-Managing Knowledge, Management skills for e-business, Managing Risks in e –business, Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption, ryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications	06
5	**E-Business Strategy**-E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	04
6	**M Materializing e-business: From Idea to Realization**-Business plan preparation **Case Studies and presentations**	08

Books Recommended:

Reference Books:

1. A textbook on E-commerce**,** Er Arunrajan Mishra, Dr W K Sarwade,Neha Publishers & Distributors, 2011
2. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
3. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
4. Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
5. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
6. Trend and Challenges in Digital Business Innovation, Vinocenzo Morabito, Springer
7. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan
8. E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of Electronic Governance
9. Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5
10. Measuring Digital Economy-A new perspective -DOI:10.1787/9789264221796-en OECD Publishing

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
ILO8029	**Environmental Management (abbreviated as EVM)**	**3**	**-**	**3**	**-**	**3**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
ILO8029	Environmental Management	20	20	20	80	03	-	100

Course Objectives	• Understand and identify environmental issues relevant to India and global concerns • Learn concepts of ecology • Familiarise environment related legislations
Course Outcomes	Student will be able to… • Understand the concept of environmental management • Understand ecosystem and interdependence, food chain etc. • Understand and interpret environment related legislations

Module	Contents	Hours
1	Introduction and Definition of Environment: Significance of Environment Management for contemporary managers, Career opportunities. Environmental issues relevant to India, Sustainable Development, The Energy scenario.	10
2	Global Environmental concerns : Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc.	06
3	Concepts of Ecology: Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.	05
4	Scope of Environment Management, Role & functions of Government as a planning and regulating agency. Environment Quality Management and Corporate Environmental Responsibility	10
5	Total Quality Environmental Management, ISO-14000, EMS certification.	05
6	General overview of major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	03

Books Recommended:

Reference Books:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
3. Environmental Management, **T V Ramachandra and Vijay Kulkarni, TERI Press**
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Maclillan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL801	**Simulation Lab- IV (abbreviated as Sim Lab-IV)**	**-**	**2**	**-**	**1**	**1**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg.					
EEL801	Simulation Lab- IV	-	-	-	-	25	-	25	50

Course Objectives	• To design the transmission systems with various FACTS controllers • To design various electrical system
Course Outcomes	Student will be able to • Analyze the transmission line performance with and without FACTS controllers using simulations. • Analyze the operation of various electrical systems using simulation.

Syllabus: Same as that of Courses of Sem-VIII

Suggested List of Laboratory Experiment:
Software Based Design and Implementation /Simulation

1. PCB Design and Implementation for any of the electrical application using suitable CAD software
2. Simulation of any of the electrical circuits using circuit simulator software
3. PCB design for implementation of Basic electrical network theorem based experiments
4. Software based design of Solar PV power generating plant
5. Software Based Lighting system design for Indoor or Outdoor application
6. Virtual Instrumentation Software based circuit implementation
7. Load Compensation
8. FACTS Controllers
9. Simulations based on Department/Institute Level Optional Courses

Any other experiment based on syllabus which will help students to understand topic/concept.

Term work:

Term work shall consist of minimum eight experiments. The distribution of marks shall be as follows:
Experiments Performance :10 marks

Journal :10 marks
Attendance (Theory and Practical) :05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Oral Examination:
Oral examination will be based on entire syllabus.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL802	**Electrical System Design Lab (abbreviated as ESD Lab)**	**-**	**2**	**-**	**1**	**1**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg.					
EEL802	Electrical System Design Lab	-	-	-	-	25	-	25	50

Course Objectives	• To impart hardware knowledge related to electrical system in the students
Course Outcomes	Student will be able to • Design electrical system for different applications.

Syllabus: Same as that of Courses of Sem-VIII

Suggested List of Laboratory Experiment:

Design and Implementation of Hardware Circuits

1. Design of basic electrical network theorem based experiments
2. Design and Implementation of Single /Multi output Power supply
3. Design and Implementation of Multi output Switched Mode Power supply
4. Design and Implementation of DOL/Star delta starter for Electrical Machines
5. Design and Implementation of Electro-magnetic relays based on/off control of Electrical loads
6. Design and Implementation of Auxiliary Circuits for Power Electronics Applications: (a) Gate drive circuits (b) Snubber circuits
7. Design and Implementation of High frequency magnetics
8. Design and Implementation of Buck/Boost/ Buck-boost dc-dc Converter.
9. Design and Implementation of Voltage and Current sensing circuits in DC and AC circuits
10. Design and Implementation Signal Processing amplifier system for sensor outputs
11. Design and Implementation of a closed loop controlled converter/Inverter circuit
12. Solar Photovoltaic fed Battery charge controller
13. IoT based Home automation System
14. Design and Implementation of small scale Solar PV (upto 2 kW) power generating plant.

Any other experiment based on syllabus which will help students to understand topic/concept.

Term work:

Term work shall consist of minimum three experiments. The distribution of marks shall be as follows:

Experiments Performance	:15 marks
Journal	:05 marks
Attendance (Theory and Practical)	:05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Oral Examination:

Oral examination will be based on entire syllabus.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL703/EEL803	**Project-I/II**	**-**	**6/12**	**-**	**3/6**	**3/6**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg.					
EEL703/EEL803	Project-I/II	-	-	-	-	25/50	-	25/50	50/100

Course Objectives	• To acquaint with the process of undertaking literature survey/industrial visit and identifying the problem • To familiarize the process of problem solving in a group • To acquaint with the process of applying basic engineering fundamental in the domain of practical applications • To inculcate the process of research
Course Outcomes	Student will be able to… • Do literature survey/industrial visit and identify the problem • Apply basic engineering fundamental in the domain of practical applications • Cultivate the habit of working in a team • Attempt a problem solution in a right approach • Correlate the theoretical and experimental/simulations results and draw the proper inferences • Prepare report as per the standard guidelines.

Guidelines for Project

Students should do literature survey/visit industry/analyse current trends and identify the problem for Project and finalize in consultation with Guide/Supervisor.

Students should use multiple literatures and understand the problem.

Students should attempt solution to the problem by experimental/simulation methods. The solution to be validated with proper justification and report to be compiled in standard format.

Guidelines for Assessment of Project I

Project I should be assessed based on following points

1. Quality of problem selected

2. Clarity of Problem definition and Feasibility of problem solution

3. Relevance to the specialization

4. Clarity of objective and scope

5. Breadth and depth of literature survey

Project Report has to be prepared strictly as per University of Mumbai report writing guidelines. Project I should be assessed through a presentation by the student project group to a panel of Internal and External Examiner approved by the University of Mumbai

Guidelines for Assessment of Project II

Project II should be assessed based on following points

1. Quality of problem selected

2. Clarity of Problem definition and Feasibility of problem solution

3. Relevance to the specialization / Industrial trends

4. Clarity of objective and scope

5. Quality of work attempted

6. Validation of results

7. Quality of Written and Oral Presentation

Project Report has to be prepared strictly as per University of Mumbai report writing guidelines. Project II should be assessed through a presentation by the student project group to a panel of Internal and External Examiner approved by the University of Mumbai Students should be motivated to publish a paper in Conferences/students competitions based on the work.

Faculty Load

In semester VII - 1 (one) period of 1/2 hour per week per project group

In semester VIII - 2 (Two) period of 1 hour each per week per project group