Ref: UPL University/SRICT/BOS/EE/2023-24/04

Proposed Teaching Scheme for Second Year Master of Electrical Engineering

Semester-III (Electrical Engineering) Proposed Structure

Sr. No.	Category	Course Code	Course Name	Hours Per Week			Total Hours	Credits	E	M	I	V	Total
				L	T	P							
1	Program Elective-V	EE3216 / EE 3217	Program Elective-V	3	0	0	3	3	70	30	0	0	100
2	Open Elective-II	EE3218 / EE3219	Open Elective-II	3	0	0	3	3	70	30	0	0	100
3	Open Elective- III	EE3220 / EE 3221	Open Elective- III	3	0	0	3	3	70	30	0	0	100
4	Project / Seminar	MH3201	Seminar	0	0	4	4	2	0	0	20	30	50
5	Dissertation- I / Industrial Project	MH3202	Dissertation- I	0	0	14	14	7	0	0	50	100	150
						Total	**27**	**18**	**210**	**90**	**70**	**130**	**500**

Semester-IV (Electrical Engineering) Proposed Structure

Sr. No.	Category	Course Code	Course Name	Hours Per Week			Total Hours	Credits	E	M	I	V	Total
				L	T	P							
1	Dissertation- II	MH3203	Dissertation- II	0	0	36	36	18	0	0	100	200	300
						Total	**36**	**18**	**0**	**0**	**100**	**200**	**300**

Program Elective-V	
Course Code	**Course Name**
EE3216	Smart Grid
EE3217	Advanced Power Converters

Open Elective-II	
Course Code	**Course Name**
EE3218	Waste to Energy
EE3219	Emerging Technology

Open Elective-III	
Course Code	**Course Name**
EE3220	Energy Storage Devices and its Application
EE3221	Advanced Operation Research

Masters of Engineering
Course Code: EE3216
Course Name: Smart Grid

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Program Elective - 5

Rationale:
This course mainly focuses on basic fundamentals of smart grid for its implementation in the existing power system network. This course provides overview of smart grid and its applications in potential sectors of Modern power systems. It also provides detailed utility level analysis in terms of energy management, network analysis and operation of smart grids. The course also explores issues in management, control, protection and monitoring of grid with renewable energy source integration as well as in micro grids at remote location.

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE(V)	PA (I)	
3	0	0	3	70	30	0	0	100

Course Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Smart Grid:** Basics of Load and Generation, Grid operation, Concepts of Power Flow Analysis, Economic Dispatch and Unit Commitment. Introduction to Smart Grid, Difference between conventional & smart grid, Architecture of Smart Grid, Smart Grid standards, Policies Applications, Smart Grid control layer and elements, Smart Grid Initiative for Power Distribution Utility in India.	**06**
2	**Smart Grid Architecture:** Power Line Communications, Two-way Digital Communications Paradigm, Network Architectures, IP-based Systems, Advanced Metering Infrastructure, Fiber Optical Networks, Wide Area Network WAN based on Fiber Optical Networks, IP based Real Time data Transmission, Substation communication network.	**06**
3	**Distributed Generation Technologies:** Resources, Advantages and disadvantages of DG, Distributed Generation Utilization Barriers, Distributed Generation integration to power grid Smart Grid components control elements, Smart Grid Technologies.	**06**

Masters of Engineering
Course Code: EE3216
Course Name: Smart Grid

SECTION-B		
4	**Micro Grids:** Concept of micro grid, need & applications of micro grid, formation of micro grid, Modelling of AC Smart Grid components, Modelling of DC Smart Grid components, Modelling of storage devices, issues of interconnection, Operation, protection & control of micro grid. Simulation and case study of AC micro grid Islanding, need and benefits, different methods of islanding detection.	**06**
5	**Measuring Techniques in Smart Grid:** Fault Detection and Self-Healing Systems, Applications and Challenges, , wide-area monitoring system (WAMS), Phasor measurement units PMU; Smart sensors/telemetry, advanced metering infrastructure (AMI);smart metering; smart grid system monitoring, Phasor estimation, Dynamic Phasor estimation.	**06**
6	**Demand Side Management:** Demand side management of Smart Grid, Demand response analysis of Smart Grid, Pricing and Energy Consumption Scheduling, Controllable Load Models, Dynamics and Challenges, Electric Vehicles and Vehicle-to-Grid Systems, Demand Side Ancillary Services Energy Management, Practical study of Smart Grid.	**06**

Text Books:

1. EkanayakeJ.,Jenkins N., Liyanage K., Wu, J., Yokoyama A., Smart Grid: Technology and applications, Wiley Publications.
2. Momoh J., Smart Grid: Fundamentals of design and analysis, John Wiley & Sons.

Reference Book:

1. Ali K., M.N. Marwali, Min Dai, “Integration of Green and Renewable Energy in Electric Power Systems”, Wiley.
2. S. Borlase, “Smart Grids, Infrastructure, Technology and Solutions”, CRC Press, 1st Edition, 2013.
3. G. Masters, “Renewable and Efficient Electric Power System”, Wiley–IEEE Press, 2nd Edition, 2013.

Course Outcomes:

Students will be able to:

Sr. No.	CO statement
CO-1	Summaries various aspects of the smart grid Technologies.
CO-2	Study communication infrastructure and justify the feasibility of the same for smart grid applications.
CO-3	Analyze distributed generation as a part of modern hybrid power system.
CO-4	Describe the micro grids and their applications for smart grid.
CO-5	Demonstrate the measuring techniques which are utilized in smart meters.
CO-6	Use of Demand Side Ancillary Services Energy Management in Pricing in smart grid operations.

Masters of Engineering
Course Code: EE3216
Course Name: Smart Grid

List of Open Source Software/learning website:

https://nptel.ac.in

https://vlab.co.in

References used for designing a course:

Nirma University, Gujarat Technological University, AICTE.

Prepared By: Mr. Ankur Gheewala, Assistant Professor, DEE

Moderated By: Dr. Jalpa Thakkar, HOD, DEE

Master of Engineering
Course Code: EE3217
Course Name: Advance Power Converters

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of Course: Program Elective-V

Rationale: The course is aimed to provide detailed knowledge of some advanced power electronic converters that are not covered in the basic course on Power Electronics at undergraduate or postgraduate level.

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

Course Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Resonant Converters:** Introduction, Classification of resonant converters, basic resonant circuit concepts, load resonant converters, resonant switch converters, zero voltage switching, clamped voltage topologies	6
2	**Multi-pulse converters:** Concept of multi-pulse, Need for Phase Shifting Transformer, Phase shifts with Y-Z and Δ-Z transformer configurations, Delta-Polygon and Fork type configurations, Analysis to determine phase shift and current waveforms, Harmonic Current Cancellation Applications of multi-pulse converters.	5
3	**Multi-level converters:** Need for multi-level inverters, Concept of multi-level Cascaded Multi-level Inverter, Operation with equal and unequal DC sources, Carrier based PWM Control Strategy Diode Clamped multi-level inverter configurations, Other Multilevel Inverter Configurations like Flying Capacitor, NPC-Hybrid etc. Features and relative comparison of these configurations and Applications.	7

Master of Engineering
Course Code: EE3217
Course Name: Advance Power Converters

SECTION-B		
4	**Matrix converters:** Fundamentals of matrix converter technology, Conventional Matrix Converter, Bi-directional switch topologies, Modulation techniques for matrix converters, Performance and control of matrix converters, Concept of Direct AC-AC frequency Converter and Indirect AC-AC frequency conversion without DC link energy storage.	**6**
5	**Converters for Solar Photovoltaic Systems:** Basics of PV cell, PV array and Characteristics, Maximum Power Point Tracking (MPPT), Need for Power Electronic Converter for MPPT and Power Processing	**6**
6	**Converters for Wind Energy Generation System (WEGS):** Basics of wind energy, wind turbines and their characteristics, types of generators for WEGS, Power Electronics Converter for WEGS	**6**

Text Books:

1. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.
2. P.S. Bimbhra, “Power Electronics”, Khanna Publishers, New Delhi, 2012

Reference Books:

1. Dr. D. M. Patel, “Power Electronics”, Atul Prakashan, 2021
2. J. S. Katre, “Power Electronics”, Tech Knowledge Publication, 2020.
3. Mohan, Undeland and Robbins, “Power Electronics – Converters, Applications and Design”, John Willey & sons, Inc., 3rd ed., 2003.
4. Bin Wu, “High Power Converters and AC Drives”, John Willey & sons, Inc., 2006.

Course Outcomes:

Students will be able to:

Sr. No.	CO statement
CO-1	**Simulate and design** resonant converters.
CO-2	**Select and design** the appropriate phase shifting converter for a multi-pulse converter.
CO-3	**Evaluate** various multi-level inverter configurations and design control schemes for them.
CO-4	**Analyse** the operation and performance of Matrix Converter.
CO-5	**Recognize** the operation and demands of Solar Converters.
CO-6	**Apply** the knowledge of power electronic converters in the area of Wind Energy Generation systems and other industrial applications.

Master of Engineering
Course Code: EE3217
Course Name: Advance Power Converters

List of Open Source Software/learning website:

1. cw.mit.edu/courses/electrical.../6-334-power-electronics-spring-2007
2. Courses available through NPTEL - website: https://nptel.ac.in

References used for designing a course:

1. AICTE Model Curriculum-Jan 2018
2. GTU

Master of Engineering
Course Code: EE3218
Course Name: Waste to Energy

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Open Elective-II

Rationale:

The objective of the course is to provide insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production. This course is designed to provide an understanding of the various aspects of Waste to Energy. The various sources of waste generation is analyzed with a focus on its potential for energy production. The need for characterization of wastes will be discussed along with the existing norms for waste utilization for alternate energy source. Various Technological options available for the production of energy form waste will delineated along with economics of using alternate sources. Case studies will be discussed to provide a better understanding of the concepts of "Waste to Energy" in the Indian context.

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE(V)	PA (I)	
3	0	0	3	70	30	0	0	100

Course Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction** The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.	4
2	**Waste Sources & Characterization** Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.	6
3	**Technologies for Waste to Energy** Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.	8

Master of Engineering
Course Code: EE3218
Course Name: Waste to Energy

	SECTION-B	
4	**Waste to Energy Options** Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to fuel resources for other useful energy applications.	**8**
5	**Centralized and Decentralized Waste to Energy Plants** Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry.	**6**
6	**Waste To Energy & Environmental Implications** Environmental standards for Waste to Energy Plant operations and gas clean-up. Savings on non-renewable fuel resources	**4**

Text Books:

1. Nicholas P. Cheremisinoff. Handbook of Solid Waste Management and Waste Minimization Technologies. An Imprint of Elsevier, New Delhi (2003).
2. M. Dutta , B. P. Parida, B. K. Guha and T. R. Surkrishnan. Industrial Solid Waste Management and Landfilling practice. Narosa Publishing House, New Delhi (1999).

Reference Books

1. Waste-to-Energy: Technologies and Project Implementation by Marc J Rogoff Dr and Francois Screve.
2. Waste to Energy: Opportunities and Challenges for Developing and Transition Economies (Green Energy and Technology)" by Avraam Karagiannidis.
3. Waste-to-Energy: Advanced Cycles and New Design Concepts for Efficient Power Plants by Lisa Branchini

List of suggested Practical: (Min. 10 Practical should be performed):

NA

Course Outcomes:

Students will be able to:

Sr. No.	CO statement
CO-1	Understand the basic of Waste to Energy conversation.
CO-2	Understand the various Waste Sources & its Characterization.
CO-3	Analyse the various aspects of Waste to Energy Management Systems.
CO-4	Evaluate various waste to Energy options.
CO-5	Apply the knowledge about the operations of Waste to Energy Plants.
CO-6	Analyse the environment aspect of Waste to Energy conversation.

Master of Engineering
Course Code: EE3218
Course Name: Waste to Energy

List of Open Source Software/learning website:

www.envfor.nic.in

www.cpcb.nic.in

www.mnre.gov.in

www.eai.in/ref/ae/wte/typ/clas/india_industrial_wastes.html

www.teriin.org/projects/green/pdf/National-Waste.pdf

References used for designing a course: TERI

Master of Engineering
Course Code: EE3219
Course Name: Emerging Technology

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Open Elective- II

Rationale: -

Teaching and Examination Scheme:

Teaching Scheme				Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Course Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction:** Need of Industry 4.0, Reason for Adopting Industry 4.0, Definition, Goals and Design Principles, Technologies of Industry 4.0, Globalization and emerging issues	6
2	**Smart Energy Sources:** Energy Storage for Mitigating the Variability of Renewable Electricity Sources- Types of electric energy storage, Potential of Sodium-Sulfur Battery Energy Storage to Enable Integration of Wind, Electric Vehicles as Energy Storage: V2G Capacity Estimation, Battery Energy Storage Systems (BESS), Compressed Air Energy Storage (CAES), Superconducting Magnetic Energy Storage (SMES)	6
3	**Machine Learning:** Traditional programming vs Machine Learning, Key elements of machine learning: Representation, Process (Date collection, Data preparation, Model selection, Model training, Evaluation and Prediction), Application of machine learning in different areas of Electrical Engineering	6
	SECTION-B	
4	**Introduction to IoT :** Architecture of IoT, Communication network: Home Area Network (HAN), Neighborhood Area Network (NAN), Field Area Network (FAN), Wide Area Network (WAN)	6
5	**Industrial Internet of Things (IIoT):** Introduction to IIoT, Sensor technology and industrial application, Smart metering, City automation, Automotive applications, Industry standards, Smart card, Plant automation, Real life examples of IIoT in manufacturing sector	6

Master of Engineering
Course Code: EE3219
Course Name: Emerging Technology

6	**Applications and Tools of Industry 4.0** Manufacturing, Healthcare, Education, Aerospace and Defense, Agriculture, Transportation and Logistics, Impact of Industry 4.0 on Society: Impact on Business, Government, People. Tools for Artificial Intelligence,	**6**

Text Books:

1. Jean-Claude André, ―Industry 4.0‖, Wiley- ISTE, July 2019, ISBN: 781786304827,2019.
2. Hossam A. Gabbar, ―Smart Energy Grid Engineering‖, Academic Press, 2017, ISBN 978- 0-12-805343-0.
3. Smart Grid: Technology and Applications by JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama,Wiley

Reference Books:

1. Miller M, ―The internet of things: How smart TVs, smart cars, smart homes, and smart cities are changing the world‖, Pearson Education, 2015, ISBN: 9780134021300.

Course Outcomes:

Students will be able to:

Sr. No.	CO statement
CO-1	Understand the basic concepts of Industry 4.0 and the other related fields.
CO-2	Analyze the different energy storage systems.
CO-3	Understand the features of machine learning to apply on real world problems.
CO-4	Describe applications of IoT in Microgrid..
CO-5	Understand the IIoT to for smart cities using automation.
CO-6	Analyze the impact of industry 4.0 on society.

List of Open Source Software/learning website:

References used for designing a course:

1. AICTE
2. GTU

Master of Engineering
Course Code: EE3220
Course Name: Energy Storage Devices and its Application

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Open Elective- III

Rationale: The emerging energy generation sources such as solar and wind generates energy in variable patterns. Hence, energy storage is becoming of major importance to store and supply energy without any interruption. The energy storage can be in mechanical, electrochemical, or chemical forms.

Teaching and Examination Scheme:

Teaching Scheme				Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Course Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Energy Storage:** Types of Energy Storage, Various forms of Energy Storage, Mechanical- Thermal – Chemical- Electrochemical – Electrical – Other alternative energy storage technologies and their Comparison, comparison of time scale of storages and applications, Energy storage in the power and transportation sectors	6
2	**Needs for electrical energy storage:** Emerging needs for EES, More renewable energy, Less fossil fuel, Smart grid uses, The roles of electrical energy storage technologies, The roles from the viewpoint of a utility, The roles from the viewpoint of consumers, The roles from the viewpoint of generators of renewable energy.	6
3	**Features of energy storage systems:** Classification of EES systems, Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES), Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2), Synthetic natural gas (SNG).	6
	SECTION-B	
4	**Types of Electrical Energy storage systems**: Electrical storage systems, Double-layer capacitors (DLC), Super conducting magnetic energy storage (SMES), Thermal storage systems, Standards for EES, Technical comparison of EES technologies.	5

Master of Engineering

Course Code: EE3220

Course Name: Energy Storage Devices and its Application

5	**Electromagnetic storage systems:** double layer capacitors with electrostatically charge storage, superconducting magnetic energy storage (SMES), concepts, advantages and limitations of electromagnetic energy storage systems, and future prospects of electrochemical storage systems	**6**
6	**Electrochemical storage system:** Batteries-Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods, major battery chemistries and their voltages- Li-ion battery& Metal hydride battery vs lead-acid battery Super capacitors- Working principle of super capacitor, types of super capacitors, cycling and performance characteristics, difference between battery and super capacitors, Introduction to Hybrid electrochemical super capacitors.	**7**

Text Books:

1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011)
2. Ralph Zito, Energy storage: A new approach, Wiley (2010)

Reference Books:

1. Francisco D'az-Gonzalez, Andreas Sumper, Oriol Gomis-Bellmunt," Energy Storage in Power Systems" Wiley Publication, 2016.
2. Ru-Shiliu, Leizhang, Sueliang Sun, "Electrochemical Technologies for Energy Storage and Conversion", Wiley Publications, 2012.

Course Outcomes:

Students will be able to:

Sr. No.	CO statement
CO-1	Discuss the need and identify the suitable energy storage devices for applications.
CO-2	Explain the working of various energy storage devices and their importance.
CO-3	Explain the basic characteristics of batteries for mobile and hybrid systems.
CO-4	Discuss the storage of renewable energies and management systems.
CO-5	Explain the need for other energy devices and their scope for applications
CO-6	Evaluate the potential of electrochemical storage system.

Master of Engineering
Course Code: EE3220
Course Name: Energy Storage Devices and its Application

References used for designing a course:

1. AICTE
2. GTU

Master of Engineering
Course Code: EE 3221
Course Name: Advanced Operation Research

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Open Elective- III

Rationale: Operations Research now a day widely used in the area of decision making for the real life problems. Managers and decision makers get idea for optimizing and approximating industrial problems. They not only strive to devise appropriate measures for problem solving but also apply scientific techniques to monitor the organizations ongoing activities such as production mix, transportation, queuing, assignment, dynamic, Integer, goal and game problem.

Teaching and Examination Scheme:

Teaching Scheme			Credit	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE(V)	PA (I)	
3	0	0	3	70	30	0	0	100

Course Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction:** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research, Convex sets and convex functions and their properties.	04
2	**Non-Linear Programming:** Kuhn-Tucker conditions, Lagrange's theory, Duality theory, Search techniques: one variable and several variables, Pontryagain's maximum principle and its applications.	07
3	**Dynamic Programming And Its Applications:** Introduction, Nature of dynamic programming, Deterministic processes, Non Sequential discrete optimization, Allocation problems, Assortment problems, Sequential discrete optimization, Long-term planning problem, Multi-stage decision process, Application of Dynamic Programming in production scheduling and routing problems.	07
	SECTION-B	
4	**Queuing Theory:** Basic Structures of queuing models, Poisson queues- M/M/1, M/M/C for finite and infinite queue length, Non-Poisson queue-M/G/1, Machine Maintenance (steady state).	07
5	**Inventory Models:** Inventory control- Deterministic including price breaks and Multi-item with	04

Master of Engineering
Course Code: EE 3221
Course Name: Advanced Operation Research

	constraints, Probabilistic (with and without lead time).	
6	**Goal Programming:** Introduction, Difference between LP and GP approach, Concept of Goal Programming, Graphical solution- method of Goal Programming, Modified simplex method of Goal Programming.	**07**

Text Books:

1. Beale, E.M.L. and Mackley, L.: Introduction to Optimization John Wiley, 1988.

2. Hiller, F.S. and Lieberman: Introduction to Operation Research 6th Ed., McGraw-Hill International Edition, Industrial Engineering Series, 1995.

3. Rao, S.S.: Optimization Theory and Applications, 2nd Ed., Wiley Eastern Ltd., New Delhi, 1985.

Reference Books:

1. Operations Research – Theory and Applications b J. K. Sharma, Trinity Press, Laxmi Publications.

2. Operations Research by P. Rama Murthy, New Age International Publishers

3. Operations Research: An Introduction by Hamdy Taha, Pearson Education Inc

4. Operations Research: Principles and Practice by Pradeep Prabhakar Pai, Oxford Higher Education, Oxford University press.

List of suggested Practical: (Min. 10 Practical should be performed): Nil
Course Outcomes: Students will be able to:

Sr. No.	CO statement
CO-1	To describe the characteristic, scope, and application of Operation Research in real life.
CO-2	To formulate the real-life problems into a mathematical form and use NLPP techniques for optimization of production mix problem in industry.
CO-3	To formulate the real-life problems into a mathematical form and use DPP techniques for optimization of production mix problem in industry.
CO-4	Apply quantitative techniques in machine replacement and inventory control.
CO-5	Solve simple problems of Queuing theory.
CO-6	Demonstrate selection of critical path and reduction of project time in different problems related to network

List of Open Source Software/learning website: https://nptel.ac.in/

References used for designing a course: SVNIT, Surat