Ref: UPL University /SRICT/BOS/CH/2021-22/01
Date: 23-03-2022

Proposed Teaching Scheme for Second Year Master of Chemical Engineering

Master of Engineering

Semester-III (Chemical Engineering) Proposed Structure

Sr. No	Category of Course	Code No.	Course Title	Hours per week			Total contact hrs/ week	Credits	E	M	I	V	Total
				L	T	P							
1	Program Elective V	CH3216/ 17	Program Elective V	3	0	0	3	3	70	30	0	0	100
2	Open Elective-II	CH3218/ 19	Open Elective-II	3	0	0	3	3	70	30	0	0	100
3	Open Elective-III	CH3220/ 21	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	Project	0	0	14	14	7	0	0	50	100	150
Total Credits							**27**	**18**	**Total**				**500**

Semester-IV (Chemical Engineering) Proposed Structure

Sr. No.	Category Of Course	Code No.	Course Title	Hours per week			Total contact hrs/Week	Credits	E	M	I	V	Total
				L	T	P							
1	Dissertation II	MH3203	Project	0	0	36	36	18	0	0	100	200	300
Total Credits							**36**	**18**	**Total**				**300**

A. Course code and definition:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
E	Theory External Examination Marks
M	Theory Internal Examination Marks
I	Practical Internal Examination Marks
V	Practical External Examination Marks

B. List of Professional and Open Electives

CH3103/04	Program Elective-I	Advanced Computer Aided Design/Process Modeling and Simulation
CH3105/06	Program Elective-II	Nano-Technology/Advanced Separation Process
CH3110/11	Program Elective-III	Energy Management/Cleaner Production
CH3112/13	Program Elective-IV	Chemical Reactor Design/Catalysts and Adsorbents
CH3216/17	Program Elective-V	Scale-Up/Hydrogen and Fuel Cell
CH3218/19	Open Elective-II	Waste to energy/CO_2 Capture & Utilization
CH3220/21	Open Elective-III	Safety Management/ Principles of economicsand management

(Established under Gujarat Private Universities Act, 2009)

Master of Engineering

Subject Code: CH3216

Subject Name: Scale-up

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Program Elective-V

Prerequisite: Knowledge of courses like fluid flow operations, heat transfer, mass transfer operations along with chemical reaction engineering.

Rationale: This course deals with the different scale-up methods used in chemical process and plant design. It mainly involves scale-up of major equipment used for mixing, heat and mass transfer and conduction of reaction.

Teaching and Examination Scheme:

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

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Scale-up:** Description and Evolution of a Process System, Introduction to Scale-up Methods used in Chemical Engineering, Similitude, Pilot Plants and Models, Dimensional Analysis.	6
2	**Mixing and Heat Transfer:** Mixing Processes, Flow Patterns, Power Calculations, Continuous Stages Gas-Liquid Slurry Processes, Liquid-Liquid Emulsions.	6
3	**Mass Transfer:** Scale-up of Distillation Columns and Packed Towers for Continuous and Batch Processes, Absorption, Stripping, Extraction Units.	6
	SECTION-B	
4	**Noncatalyzed Chemical Reactors:** Kinetics, Scale-up Considerations for Tubular Reactor, Fluidized Reactor.	6

5	**Solid Catalysed Chemical Reactors:** Scale-up Techniques for Chemical Reactors, Pseudo-homogeneous, Heterogeneous Models. Two-dimensional Models.	**6**
6	**Major Scale-up Issues:** Prediction of Performance in Large Equipment, Practical Commercial Experience, and Problem Areas.	**6**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	40	20	10	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Textbooks:

1. Johnstone, R. E., Thring, M. W., "Pilot Plants Models and Scale-up Methods in Chemical Engineering", McGraw-Hill, 1957.
2. Euzon, J. P., Trambouze, P., Wauquier, J. P., "Scale-up Methodology for Chemical Processes", Technip, 1993.
3. Geankoplis, C. J., Hersel, A., Lepek, D. H., "Transport Processes and Separation Process Principles", 5th Ed., Pearson, 2018.

Reference Books:

1. Zlokarnik, M., "Scale-up in Chemical Engineering", Wiley-VCH, 2006.
2. Bisio, A., Kabel, R. L., "Scale-up of Chemical Processes", John Wiley, 1985.
3. Coker, A. K., "Modeling of Chemical Kinetics and Reactor Design", Gulf Publishing Company, 2001.

List of Practicals/Tutorials: NA

Course Outcomes:

Students should be able to

Sr. No.	CO statement
CO-1	Describe various scale up methods
CO-2	Apply the principle of similarities and dimensionless analysis for scale up.
CO-3	Select criteria for scale up of process.
CO-4	Evaluate various scale up factors.

CO-5	Estimate various design parameters for process equipment.
CO-6	Identify and assess major scale-up issues.

List of Open-Source Software/learning website:

1. https://nptel.ac.in

(Established under Gujarat Private Universities Act, 2009)

Master of Engineering

Subject Code: CH3217

Subject Name: Hydrogen and Fuel Cell

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Program Elective-V

Prerequisite: Fluid Mechanics, Reaction Engineering, Chemical Engineering Thermodynamics.

Rationale: Hydrogen and Fuel Cell gives the post graduate students a brief overview of the importance of hydrogen production and utilization in the energy sector. Additionally, the challenges it poses with the storage and production. It also provides the necessary platform for advanced research in this area and help us building the hydrogen economy in the future.

Teaching and Examination Scheme:

Teaching Scheme			Credits	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

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Hydrogen and Fuel Cell**: Concept and Vision, Role of hydrogen to curb pollution, the global oil picture, Support for hydrogen economy, Hydrogen's early history, exploiting hydrogen properties.	4
2	**Overview of Production of Hydrogen**: Steam reforming, Partial oxidation, auto thermal and dry reforming, water electrolysis (reverse fuel cell operation), Gasification and woody biomass conversion, Biological hydrogen production, Photodissociation, Issues related to scale of production.	7
3	**Hydrogen Storage Options:** Compressed gas storage, liquid hydrogen storage, hydride storages, Cryo-adsorbed gas storage in carbon materials, other chemical storage options, comparison, hydrogen transmission: container and pipeline.	5
	SECTION-B	

Master of Engineering

Subject Code: CH3217

Subject Name: Hydrogen and Fuel Cell

4	**Introduction to Basic Concepts of Fuel cells**: Electrochemistry and thermodynamics of fuel cell, Electrochemical device definitions, Quantum chemistry approaches, Application of water splitting or fuel cell performance at a metal surface, Flow and diffusion modelling, Overview of: Molten carbonate cells, Solid Oxide cells, Acid alkaline cells.	**9**
5	**Proton Exchange Membrane (PEM) Cells**: Current collectors and gas delivery systems, Gas diffusion layers, Membrane layer, Catalyst action, overall performance, high temperature and reverse operation, degradation and lifetime, Direct methanol and other non-hydrogen cells, Biofuel cells.	**6**
6	**Implementation Scenarios**: Based on Fossil fuels, nuclear energy, and renewable energy, Social implications: cost expectations, **The way forward**: hydrogen storage in renewable energy systems, Fuel cell vehicles, fuel cell in centralised power production, Efficiency consideration.	**5**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	25	25	15	10	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Textbooks:

1. Sorensen, B., "Hydrogen and Fuel Cells: Emerging Technologies and Applications", Academic Press, 2nd Ed., 2012.

Reference Books:

1. Rebecca, L. B., "Hydrogen and Fuel Cells: A Comprehensive Guide", PennWell Corporation, 1st Ed., 2005.
2. Lipman, T. E., Weber, A. Z., "Fuel Cell and Hydrogen Production: Encyclopaedia of Sustainability Science and Technology Series", Springer, USA, 2nd Ed., 2019.
3. Hirscher, M., Hirose, K., "Handbook of Hydrogen Storage: New Materials for Future Energy Storage", Wiley-VCH, Germany, 2010.
4. Barbir, F., "PEM Fuel Cells: Theory and Practice", Academic Press, 2nd Ed., 2015.

Master of Engineering

Subject Code: CH3217

Subject Name: Hydrogen and Fuel Cell

List of Practical/Tutorials: NA

Course Outcomes:

Students should be able to

Sr. No.	CO statement
CO-1	Describe the importance of hydrogen and fuel cell in future energy sector
CO-2	Explain the different methodologies for hydrogen production
CO-3	Outline the concept of hydrogen storage
CO-4	Examine the basics of Fuel cell
CO-5	Inspect the importance of PEM cell for hydrogen production
CO-6	Examine the implementation scenarios worldwide

List of Open-Source Software/learning website:

NPTEL video lectures

(Established under Gujarat Private Universities Act, 2009)

Master of Engineering

Subject Code: CH3218

Subject Name: Waste to Energy

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Open Elective-II

Prerequisite: Basics of Unit Operation and Processes.

Rationale: The course deals with the production of energy from different types of wastes through thermo-chemical and biochemical conversion processes. The major objective of this course is to provide basic knowledge with recent advancements in the technology for the utilization of various types of wastes to produce energy/fuels.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Energy from Waste:** Characterisation and Classification of Waste as Fuel, Agro-based, Forest Residues, Industrial Waste, Municipal Solid Waste (MSW), Plastic Waste, E-Waste etc. Alternate Fuel Resource (AFR) - Energy Production from Algae, Transesterificationetc. Waste to Energy Options- Thermochemical and BiochemicalConversion. Feedstocks Testing and Interpretation of Proximate Analysis, Ultimate Analysis, Heating Values, Biochemical Analysis, Thermal Analysis - TGA/DSC.	6
2	**Biomass Combustion:** Biomass Stove Types and Designs, Fixed Bed Combustors, Inclined Grate Combustors, Fluidized Bed Combustors, Pre-Processing and Treatment of MSW, Technologies for The Combustion of MSW- Mass Burn Facilities, Modular Systems and Refuse Derived Fuel (RDF) Systems	6
3	**Liquefaction And Pyrolysis:** Hydrothermal Liquefaction Of Biomass. Pyrolysis of Biomass and Plastics, Slow, Fast and Flash Pyrolysis, Affecting Parameters, Pyrolysis Reactors, Manufacture of Charcoal,	6

Master of Engineering

Subject Code: CH3218

Subject Name: Waste to Energy

	Characterization and Applications of The Pyrolysis and Liquefaction Products. Comparison of Product Properties with Conventional Fuels**.**	
Section-B		
4	**Gasification**: Gasification of Biomass and RDF, Gasification Reactions, Types of Gasifier, Design of Gasifiers. Characterization and Applications of Gasification Products. Comparison of Products Properties with Conventional Fuels.	**6**
5	**Bio-Chemical Conversion:** Anaerobic Digestion of Biomass for Production of Biogas. Effects of Operating Parameters, Cleaning, and Upgradation of Biogas. Fermentation of Biomass to Produce Ethanol, Roadmap for Ethanol Blending in India. Characterization, Applications, and Comparison of Product Properties with Conventional Fuels.	**6**
6	**Assessment and Impact of Waste Conversion:** Analysis of energy flows (for energy conservation) and Environmental Impacts of Waste to Energy Conversion Plants, Life Cycle Assessment and its Application to Sustainable Waste Management, Biomass Energy Programme in India. Case Studies on Sustainable Biomass Conversion.	**6**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	30	15	30	10	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Textbooks:

1. Klinghoffer, N., Castaldi, M., "Waste to Energy Conversion Technology", Woodhead Publishing, 1st Ed., 2013.

Reference Books:

1. Young, G. C., "Municipal Solid Waste to Energy Conversion Processes- Economic, Technical and Renewable Comparisons", Wiley, 1st Ed., 2010.

List of Practical/Tutorials: NA

Course Outcomes:

Master of Engineering

Subject Code: CH3218

Subject Name: Waste to Energy

Students should be able to

Sr. No.	CO statement
CO-1	Perform preliminary analysis of feedstocks
CO-2	Report the techno-economic feasibility of waste feedstocks for energy generation.
CO-3	Describe various thermo-chemical conversion processes
CO-4	Design the process for production of synthesis gas, charcoal, and bio-oil for specific feedstocks
CO-5	Design the process for production of bio-methane and ethanol for specific feedstocks
CO-6	Conduct life cycle assessment of different feedstocks.

List of Open-Source Software/learning website:

1. https://nptel.ac.in/courses/103/107/103107125/

Master of Engineering

Subject Code: CH3219

Subject Name: CO_2 Capture and Utilization

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Open Elective- II

Prerequisite: Basic elements of environmental studies and thermodynamics

Rationale: The course is prepared to provide detailed understanding of reducing CO_2 from the environment by utilization several green technologies and its contribution in energy conservation and management.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to CO_2 capture** Sources of CO_2, Characterization of CO_2 emission sources, Carbon footprint, carbon credit, CO_2 and global warming.	**06**
2	**CO_2 Capture Technologies** CO_2 capture systems, Types of CO_2 capture technologies, Industrial process capture system, Emerging technologies, Cost of CO_2 capture, Factors affecting CO_2 capture cost, Measures of CO_2 capture cost.	**06**
3	**CO_2 Capture by Absorption** Alkanolamine as a Solvents for CO_2 capture, Solubility of CO_2, Mechanism of CO_2 capture, Kinetics of CO_2 capture, Vapour-liquid equilibrium in reactive absorption.	**06**
	SECTION-B	
4	**CO_2 Capture by Adsorption**	**06**

Master of Engineering

Subject Code: CH3219

Subject Name: CO_2 Capture and Utilization

	Adsorbents for CO_2 capture, Factors affecting the adsorption, Temperature swing adsorption, Pressure swing adsorption, Vacuum swing adsorption (VSA), electric-swing adsorption (ESA).	
5	**CO_2 Capture by Other Methods** CO_2 Capture by membrane Technology, CO_2 Capture by condensation, CO_2 Capture by cryogenic distillation, Carbon Storage.	**06**
6	**CO_2 Utilization** CO_2-based chemical products including polymers, CO_2-based fuels.	**06**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	30	20	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Textbook: NA

Reference Books:

1. Danckwerts, P. V., "Gas Liquid Reactions", McGraw-Hill, New York, 1970.
2. Doraiswamy, L. K., Sharma, M. M., "Heterogeneous Reactions: Analysis, Examples and Reactor Design", vol. 1 & 2, John Wiley and Sons, New York, 1984.
3. Kohl, A. L., Nielsen, R. B., "Gas Purification", 5th Ed., Gulf Publishing Company, Houston, 1997.
4. Wilcox, J., "Carbon Capture", Springer, New York, NY, 2011 (https://doi.org/10.1007/978-1-4614-2215-0).

Master of Engineering

Subject Code: CH3219

Subject Name: CO_2 Capture and Utilization

List of Practical/Tutorials: NA

Course Outcomes:

Students should be able to

Sr. No.	CO statement
CO-1	Understand the concept carbon capture
CO-2	Analyze the different methods of carbon capture
CO-3	Understand the carbon capture by absorption
CO-4	Understand the carbon capture by adsorption
CO-5	Select the carbon capture technology
CO-6	Understand the utilization of CO_2

List of Open-Source Software/learning website:

NPTEL lectures are helpful

Master of Engineering

Subject Code: CH3220

Subject Name: Safety Management

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Open Elective-III

Prerequisite: Basic science and Engineering

Rationale: Study the nature and functions of chemicals, chemical processes, receiving, storage and handling of chemicals and understand the occupational health, safety and environment systems to be implemented for sustainable development.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Safety Concepts:** Introduction to Safety Management, Safety Policy, Responsibility of management with respect to safety, safety officers' duties and responsibilities, safety standards and safety practices and performance.	06
2	**Process Safety Management (PSM):** Purpose of PSM, its elements and Risk-Based Process Safety Management (RBPSM): Process safety culture, Compliance with standards, Process safety competency, Workforce involvement, Stakeholder outreach, Process knowledge management, Operating procedures, Safe work practices, Asset integrity and reliability, Contractor Management, Training and Performance Assurance, Management Of Change (MOC), Operational readiness, Conduct of operations, Emergency management, Incident investigation	06
3	**Safety in Chemical Industry:** Criteria for siting and layout of chemical plants, Hazardous Area Classification (HAC), Layers of Protection	06

Master of Engineering

Subject Code: CH3220

Subject Name: Safety Management

	Analysis (LOPA), Instrumentation for safe and efficient operation of plants Safety Integrity Level (SIL)	
	SECTION-B	
4	**Risk Assessment & Hazard Identification:** Checklist procedure, Preliminary hazard analysis, What if analysis, Failure mode effect analysis, Hazard and operability (HAZOP) studies, Hazard analysis techniques: Fault tree analysis, Event tree analysis, General outline of DOW index, Risk estimation and management, Major hazard control, On-site and Off-site emergency preparedness. Identification of hazard, Categorization methods for elimination of hazard. Case studies on HAZOP, What-if, Fault Tree and Event Tree analysis.	**06**
5	**Safe Handling of Chemicals** Safety in receiving, storage and handling of chemicals, Nitrogen blanketing of flammable liquid storage tanks, Use of Material Safety Data Sheets (MSDS) and understanding the terminology used in MSDS, Chemical compatibility considerations, Transportation of hazardous materials, Safety Precautions for transporting hazardous/ toxic/ flammable/explosive/ radioactive substances by all modes. Case studies on various MSDS formats.	**06**
6	**Fire and Explosion:** Industrial fires, Dispersion modelling, Chemistry of fire Classification of fires, Deflagration and detonation, Unconfined Vapour Cloud Explosion (UVCE), Runaway reaction and control methods, Boiling Liquid Expanding Vapour Explosion (BLEVE), Common causes of industrial fires, Dust explosion, factors of pentagon, causes of dust explosions and controls Fire protection, Case studies on past accidents	**06**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	40	40	-	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Master of Engineering

Subject Code: CH3220

Subject Name: Safety Management

Textbooks: NA

Reference Books:

1. Slote, L. "Handbook of Occupational Safety and Health", John Willey and Sons, NewYork, 2019.
2. Lees, F. P., "Loss of prevention in Process Industries", Vol. 1 and 2, Butterworth- Heinemann Ltd., London, 1991.
3. Koren, H., Bisesi, M., "Handbook of Environmental Health and Safety", Jaico Publishing House, Delhi,1999.
4. Crowl, D.A., Louvar J. F., "Chemical Process Safety: Fundamentals with Applications", 4th Ed., 1990.

List of Practical/Tutorials: NA

Course Outcomes:

Students should be able to

Sr. No.	CO statement
CO-1	Understand the concept of safety
CO-2	Analyze the significance of standards
CO-3	Categorize the hazardous area
CO-4	Perform hazard analysis techniques
CO-5	Know the handling of chemicals and its compatibility
CO-6	Analyze the type of fire and its mitigation

List of Open-Source Software/learning website:

Master of Engineering

Subject Code: CH3221

Subject Name: Principles of Economics and Management

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Open Elective - III

Prerequisite: Basic of Mathematics

Rationale: Engineers are designing and fabricating chemical plants on the basis of demand and supply of products in market. Economics plays an important role starting of new plant.

Teaching and Examination Scheme:

Teaching Scheme			Credits	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

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Economics:** Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics, Theory of Demand & Supply; law of demand, law of supply, equilibrium between demand & supply, Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity	6
2	**Theory of Production:** production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale, Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical	6
3	**Markets:** meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly) National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income.	6
	SECTION-B	

4	**Basic Economic Problems:** Poverty-meaning, absolute & relativepoverty, causes, measures to reduce. Unemployment: meaning, types, causes, remedies, Inflation; meaning, types, causes, measures to control	**5**
5	**Money:** meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools. Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.	**5**
6	**Introduction to Management:** Definitions, Nature, Management Difference between Management & administration, skill, types and roles of managers Management Principles; Scientific principles, Administrative principles, Maslow's Hierarchy of needs theory. Functions of Management; Planning, Organizing, Staffing, Directing, Controlling. Corporate Social Responsibility; meaning, importance, Business Ethics.	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
00	10	25	40	25	00

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Textbooks:

1. Paneerselvam, R., "Engineering Economics", PHI publication, 2012.
2. Robbins, S. P., Decenzo, D. A., "Fundamentals of Management: Essential Concepts and Applications", Pearson Education, 2013.

Reference Books:

1. Mankiw, N. G., "Economics: Principles of Economics", Cengage Learning, 9th Ed., 2021.
2. Prasad, L. M., "Principles and Practices of Management", Sultan Chand & Sons, 2020.
3. Tripathy and Reddy, "Principles of Management", McGraw-Hill, 3rd Ed., 2006.
4. Dewett, K. K. Navalur, M. H., "Modern Economic Theory", S. Chand Publications, 1986.

List of Practical/Tutorials: NA

Master of Engineering

Subject Code: CH3221

Subject Name: Principles of Economics and Management

Course Outcomes:

Students should be able to

Sr. No.	CO statement
CO-1	Analyze how elasticity affects revenue.
CO-2	Relate production function and cost function.
CO-3	Understand basic economic problems.
CO-4	Analyze the optimal quantity and pricing decisions of firms in different market structures (perfect competition, monopoly, monopolistic competition) to achieve profit maximization.
CO-5	Describe the basic principles of management: planning, organizing, controlling, and directing.
CO-6	Analyze ethical dilemmas faced by business and managers.

List of Open-Source Software/learning website:

NPTEL, World Wide Web, etc.