

SDM College of Engineering and Technology, Dharwad
Department of Chemical Engineering

List of Courses having focus on Employability/Entrepreneurship/Skill development during last five years

Name of the Course	Course Code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
Year of introduction 2021-22		
MEPIP	18UHUC500	Management, entrepreneurship and IPR
Petroleum and Petrochemicals	18UCHE508	Crude refining, hydrocarbon cracking etc.
Novel Separation Techniques	18UCHE705	Newer separations in biochemical, petroleum, gas, metallurgical
Sugar Technology	18UCHE803	Distillery and cogeneration
Solid waste Management	18UCHO806	Integrated solid waste management
Year of introduction 2020-21		
Energy Tech and Management	18UCHE507	Energy systems, supply and environmental concern
MEPIP	18UCHC600	Management, entrepreneurship and IPR
Petroleum and Petrochemicals	18UCHE606	Crude refining, hydrocarbon cracking etc.
Novel Separation Techniques	18UCHE709	Newer separations in biochemical, petroleum, gas, metallurgical
Solid waste Management	18UCHE803	Integrated solid waste management
Sugar Technology	18UCHE805	Distillery and cogeneration
Year of introduction 2019-20		
Energy Tech and Management	15UCHE507	Energy systems, supply and environmental concern
Petroleum and Petrochemicals	15UCHE606	Crude refining, hydrocarbon cracking etc.
MEPIP	15UCHC600	Management, entrepreneurship and IPR
Novel Separation Techniques	15UCHE709	Newer separations in biochemical, petroleum, gas, metallurgical
Solid waste Management	15UCHE803	Integrated solid waste management

Sugar Technology	15UCHE805	Distillery and cogeneration
Year of introduction 2018-19		
Process Instrumentation	15UCHE506	Control of chemical processes, calibration and analysis
Energy Tech and Management	15UCHE507	Energy systems, supply and environmental concern
MEPIP	15UCHC600	Management, entrepreneurship and IPR
Petroleum and Petrochemicals	15UCHE606	Crude refining, hydrocarbon cracking etc.
Solid waste Management	15UCHE803	Integrated solid waste management
Sugar Technology	15UCHE805	Distillery and cogeneration
Novel Separation Techniques	15UCHE709	Newer separations in biochemical, petroleum, gas, metallurgical
Year of introduction 2017-18		
Process Instrumentation	15UCHE506	Control of chemical processes, calibration and analysis
Energy Tech and Management	15UCHE507	Energy systems, supply and environmental concern
Petroleum and Petrochemicals	15UCHE606	Crude refining, hydrocarbon cracking etc.
Polymer Science and Technology	15UCHE609	Polymer processing and chemistry
MEPIP	15UCHC600	Management, entrepreneurship and IPR
Novel Separation Techniques	11UCHE709	Newer separations in biochemical, petroleum, gas, metallurgical
Solid waste Management	11UCHE803	Integrated solid waste management

Syllabus of Courses having focus on Employability/Entrepreneurship/Skill development during last five years

18UCHE508

Petroleum and Petrochemicals

(3-0-0) 3

Contact Hours: 39

Course Learning Objective (CLO):

1. Studying this subject, the students will learn about the extraction and production of oil and gas to meet energy needs, as well as refining of crude oil for a wide spectrum of useful products such as petrochemicals, Chemicals, Plastics.

Course Outcomes:

Description of the course outcome: At the end of the course student will be able to		Mapping to POs (1-12)/ PSOs (13-15)													
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)											
CO-1	Outline the Indian petroleum industry and world scenario, and characterize the crude.	6	2	1											
CO-2	Identify and characterize the different products of hydrocarbon.	2	14	3											
CO-3	Apply the basic procedure and role of all fundamental system used in petroleum industry.	1,2	3	13											
CO-4	Analyze the measuring parameters to be measured according to the operational conditions	13	1	4											
CO-5	Describe basic principle, operation and analyze the key issues and optimization of petrochemical production system.	1	2, 13	3											
POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	2.25	2.5	1.3	1.0	-	3.0	-	-	-	-	-	-	2.0	2.0	-

Course Content:

Unit-I

Indian Petroleum Industry: prospects & future, major companies, world production, markets, offshore and onshore, oil well technology.

Petroleum Crude Characterization: Composition and classification, UOP K factor, TBP analysis, EFV Analysis, Average Boiling points, ASTM Curves, Thermal properties, Pour Point. **07 Hrs.**

Unit-II

Product Properties and Test Methods: Characterization -Flash point, Fire point, Reid vapor pressure Analysis, Octane Numbers, Cetane Index, smoke point, Burning quality, Carbon Residue, Viscosity Index, Softening point, Penetration Index, Oxidation Stability, Volatility, Aniline point, Pour point . Various Petroleum products & Additives for Naphtha, Gasoline, Gas, ATF, LPG, Kerosene, Diesel, Lubricating oils, Bitumen. **09 Hrs.**

Unit-III

Crude Pretreatment: Crude receiving, Storing, Pumping, dehydration, comparison, petroleum furnaces and comparison, Refining of petroleum – Atmospheric and vacuum distillation. **07 Hrs.**

Unit-IV

Treatment Techniques: Removal of sulphur compounds, storage and stability, product treatment using solvent, dewaxing, clay treatment and hydro refining.

Thermal Cracking: Visbreaking, Coking, Catalytic cracking (FCC), Hydro cracking, Air blowing of bitumen. Catalytic reforming, Extraction of Aromatics. **08 Hrs.**

Unit-V

Petrochemicals: Definition, importance and growth potential of the field, raw materials for petrochemical industries, sources, economics and advantages. Production of petrochemicals like dimethyl terephthalate (DMT), ethylene glycol, synthetic glycerin, LAB, acrylonitrile, methyl methacrylate (MMA), phthalic anhydride, maleic anhydride, phenol acetone, formaldehyde, production of carbon black. **08 Hrs.**

Reference Books:

- 1) B.K. Bhaskar Rao, "Modern Petroleum Processes", 3/e, Oxford IBH publisher.
- 2) Ram Prasad, "Petroleum Refining Technology", Khanna Publishers, 2000.

Course content:

Unit I

Introduction to Solid Wastes: Definition, Characteristics, Types of solid waste, Physical, Chemical and Biological properties of Municipal Solid Waste, Overview of materials flow in society and 4R concept of solid waste management. Evolution of SWM, Effect on health and environment. Legislation and government agencies. **08 Hrs.**

Unit II

Engineered Systems for Solid Waste Management: Generation of solid waste, Quantities of solid Waste, Methods to measure solid waste quantities, Solid waste generation and collection, Factors affecting solid waste generation rate, Onsite handling, Storage and Processing, Transfer and transport, Collection system and devices. **08 Hrs.**

Unit III

Processing Techniques and Recovery of Energy: Objectives of waste processing, component separation and volume reduction, various processing technologies — biological and chemical conversion methods, Composting, Factors affecting composting, Aerobic composting and anaerobic Digestion, Details of energy recovery system, heat recovery, gasification, pyrolysis and refuse derived fuels (RDFs). Municipal incinerators, Grates, Furnances of solid waste. Recovery, Material and Energy recovery operations. **08 Hrs.**

Unit IV

Disposal of Solid Wastes: Various disposal methods, landfills — site selection, site infrastructure, essential components of landfill; types of landfilling methods, landfill planning –leachate management and gas control; Environmental monitoring systems for landfill sites, closure and post-closure plans for landfills, landfill site rehabilitation, reclamation and remediation. **08 Hrs.**

Unit V

Hazardous Wastes: Definition, identification and classification of hazardous solid waste, Origin and reduction at source, Collection and handling, Management issues and planning methods, Environmental Act, E-waste handling and disposal, Biomedical waste.

Industrial Solid Waste Management: Major industries and management methods used in typical industries – Coal fired power stations, textile industry, oil refinery, distillery, sugar industry, and radioactive waste generation units.

07 Hrs.

Reference Books:

- 1) George Tchobanoglous, “Integrated Solid waste Management-Engineering Principles and Management issues”, McGraw Hill, 1993.
- 2) Howard Peavy, “Environmental Engineering”, McGraw Hill, 1986.
- 3) Dutta, “Industrial Solid waste Management and landfilling practice”, Narose Publication, 1999.

18UCHE705	Novel Separation Techniques	(3-0-0) 3
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Contact Hours: 39

Course Learning Objectives (CLOs):

1. To provide an understanding of novel/newer separations using mass transfer and thermodynamic considerations.
2. To provide an understanding of their applications at different levels in industry, viz. refineries, biochemical processing, pharmaceuticals, gaseous separations, metallurgical etc.

Course Outcomes (COs):

Description of the course outcome: At the end of the course student will be able to		Mapping to POs (1,12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Comprehend the use of separation factors and understand continuous adsorption processes with advanced chromatographic techniques.	4, 14	-	-
CO-2	Classify membrane based separations and explain their mass transfer and thermodynamic considerations with applications.	-	4,12	-
CO-3	Interpret the surfactant based micellar and foam separations with applications.	14	4, 12	-

CO-4	Comprehend Super Critical Fluid Extraction process with applications.	-	4, 12	14											
CO-5	Outline the processes of gaseous diffusion, thermal diffusion, and electrophoresis.	4	-	14											
POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	-	-	-	2.4	-	-	-	-	-	-	-	2.0	-	2.0	-

Course content:

Unit-I

Introduction to separations: Importance, principles and separation factors, economic significance etc.

Adsorptive Separations: Thermal swing adsorption, gradient chromatography, Ligand chromatography and unsteady state fixed bed adsorption etc. **08 Hrs.**

Unit-II

Membrane Separation Processes: Classification, structure and characteristics of membranes, membrane modules, concentration polarization and fouling of membranes, R.O., U.F, Pervaporation, and gaseous separations. **08Hrs.**

Unit-III

Surfactant Based Separations: Fundamentals of surfactants at surfaces and in solutions. Liquid membrane permeation, foam separations, micellar separations. **08 Hrs.**

Unit-IV

Super Critical Fluid Extraction: Physicochemical principles, thermodynamics, process description. Applications and case study. **08 Hrs.**

Unit-V

Miscellaneous Separations: Gaseous diffusion, Thermal diffusion, electrophoresis and types. **07 Hrs.**

Reference Books:

- 1) P.C. Wankat, "Large scale adsorption chromatography" CRC Press, 1986.
- 2) R.W. Rousseu, "Handbook of separation process technology", John Wiley and sons 1987.

milling process. Composition of cane and juice, properties of sucrose and reducing sugars. Various analytical methods used in sugar industry. **08 Hrs.**

Unit- II

Purification: clarifying and bleaching agents, defecation process. Classification of sulphitation and carbonation methods. Advantages of carbonation over sulphitation. Methods for the clarification of the syrup. Filtration of scums. **08 Hrs.**

Unit- III

Unit Operations: Evaporation, multiple effect evaporation, various features of evaporators design, causes of entrainment, incrustation formation and removal, crystallization, boiling syrup massecuites, requirements of good pan boiling, rate of crystallization, factors affecting the crystal growth, various types of crystallizers, boiling schemes, condensers, centrifugal operation, dryers, grading of sugar. **08 Hrs.**

Unit- IV

Distillery: Molasses, storage, utilization, various distillation types, advantages. Production of ethanol by fermentation process, factors influencing the production of alcohol, design considerations for distillation column, distillery wastes, treatment, disposal. **08Hrs.**

Unit- V

Co-generation: Types of co-generation systems, quality of bagasse and boilers used, efficiency, production of steam, quality of steam, pollution control measures for water, air, solid wastes and noise in sugar industries. **07 Hrs.**

Reference Books:

- 1) Honing P (Ed), "Principles of Sugar Technology", Vol I to III, Elsevier publishing company, 1953.
- 2) Jenkins. G.H., "Introduction to cane sugar Technology", Elsevier, 1966.
- 3) Mathur.R.B.L, "Handbook of cane Sugar Technology", 2/e, Oxford and I.B.H. Publishing Co., 1997.
- 4) R.K. Rajput, "A text book on Power Plant Engineering", 2/e, Laxmi publications (p) Ltd., New Delhi, 2001.

Contact Hours: 52

Course Learning Objective (CLO):

1. To understand the importance, development and different functions of management.
2. To provide basic concepts of entrepreneurship, intellectual property rights and legal issues.

Course Outcomes (COs):

Description of the course: At the end of course, the student will able to		Mapping to POs (1-12)/ PSOs (13-15)													
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)											
CO-1	Explain historical development and levels of management along with importance of planning and organizing	7,8	9,10	6											
CO-2	Explain staffing, directing and controlling in modern organization structures.	7,8	9, 10	6											
CO-3	Summarize the role of entrepreneurs in economic development and asses impact of liberalization and globalization on SSI.	7,8	9, 10	-											
CO-4	Identify Institutional support to small scale industries and prepare project report and its feasibility studies.	8,11	9, 10, 14	-											
CO-5	Describe forms of intellectual property rights and procedure for registration, infringements and penalties.	10,12	6,7,8	-											
POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	-	-	-	-	-	1.3	2.75	2.8	2.0	2.2	3.0	3.0	-	2.0	-

Course Content:**Unit-I**

Management: Meaning, nature and characteristics of management. Levels of management, development of management thoughts, modern management approaches.

Planning and Organizing: Nature, importance, purpose and objectives of planning. Types of plans, decision making and hierarchy of plans. Types of organization, departmentation, committees, organization levels and span of control. **12 Hrs.**

Unit-II

Staffing and Directing: Nature, importance, selection and recruitment. Leadership styles, motivation, communication and coordination.

Controlling: definition, steps in controlling, essentials of a sound control system and methods of establishing controlling. **11 Hrs.**

Unit-III

Entrepreneurship: Evolution, meaning and characteristics of entrepreneur. Functions and types of entrepreneurs, role of entrepreneurship in economic development and barriers of entrepreneurship.

Small Scale Industry: Role of SSI in economic development, advantages SSI, steps to start a SSI. Impact of liberalization, privatization and globalization. Ancillary and tiny industries. **10 Hrs.**

Unit-IV

Institutional Support: Introduction, Institutions to assist SSI. Objectives and functions of SSIDC, SSIB, DICs, TCOs, ICICI, NSIC, SIDO, IDBI and SIDBI etc.

Preparation of Project Report: Project identification, selection, contents, feasibility studies and network analysis. **10 Hrs.**

Unit-V

Intellectual Property Rights: meaning and forms of IPR, international conventions, world court. Copy right, patents, Industrial designs and trademarks. Procedure for registration, infringements and remedies. Offenses and penalties. **09 Hrs.**

Reference Books:

- 1) Thomas W. Zimmerer, "Essentials of Entrepreneurship", PHI, 2005.
- 2) Veerabhadrapa Havinal, "Management and Entrepreneurship", 1/e, ISBN (13): 978-81-224-2659-5, New Age International, 2009.
- 3) Peter Drucker, "The Practice of Management", ISBN-10: 0060878975

- Harper Business Reissue edition, 2006
- 4) N.K. Acharya, "Text book on Intellectual Property Rights", 4/e, Asia Law House.

15UCHE506 Process Instrumentation (4-0-0)4: 52 Hrs.

Course Learning Objectives:

- To make students understand the Identification, classification construction, working principle and application of various transducers used for Displacement, Temperature, Level, flow and Miscellaneous measurement.

Course Outcomes:

COs	Description: At the end of the course student will be able to	Mapping to POs and PSOs													
		Introductory 1	Moderate 2	Substantial 3											
CO1	Comprehend the fundamentals of instrumentation to control chemical processes.	3	1,13												
CO2	Explain process control instrumentation with principles and theory	3,13	1												
CO3	Apply correct practice to installation, calibration of instrument and analyze limitations of each measuring instruments.	1,13	3												
CO4	Troubleshoot, isolate and fix electronic instrumentation problems.		1,3,13												
CO5	Design a simple instrumentation system.	13	1	3											
POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
Mapping Level	1.8	1.8											1.4		

Prerequisites: Nil

Course content:

- Introduction:** classification, characteristics of instruments- static and dynamic. Sensor and Transducer: Definition, classification (active,

- passive, primary, secondary, mechanical, electrical, analog, digital). Transducer specifications. Transmitters, Converters, Control panel, Recorders and monitors. Error: definition, classification. **5 Hrs.**
- 2. Flow Measurement:** Head Type: orifice, venturi, nozzle, pitot tube. Variable Area Type: Rotameter type. Other flow meters: Turbine, electromagnetic, ultrasonic, positive displacement, anemometers, solid flow measurements. **7 Hrs.**
- 3. Pressure Measurement:** Pressure scales, units and relations, classification, U-tube types, well type, inclined type manometer, micro manometer, bellows, diaphragm, bourdon tube,. Vacuum Measurement Units and relations, McLeod gauge, Pirani gauge, thermocouple gauge, hot cathode ionization gauge, Knudsen gauge. **5 Hrs.**
- 4. Level Measurement:** Need for Level Measurement, Classification of Level Measurement Techniques. Construction and working of Dipstick, displacer, float system, bubbler, capacitive devices for level measurement, ultrasonic level gauge, DP cell, vibrating type, radar, radioactive type level gauges, LASER type transducers, fiber optic level sensors. **6 Hrs.**
- 5. Temperature Measurement:** Temperature scales, classification of Temperature Sensors, a) Thermometers: Classification, Construction and working of glass thermometers, liquid expansion thermometer, gas thermometer (filled system thermometer), bimetallic thermometer, Specifications. b) Resistance temperature detector (RTD): Principle, types, Configurations, construction and working of RTD, Material for RTD, Lead wire Compensation in RTD, Specifications, advantages, disadvantages and applications of RTD. c) Thermistors: Principle, types (NTC and PTC), characteristics, Construction and working, materials, specifications of Thermistor, applications. **10 Hrs.**
- 6. Thermocouples:** Principle, thermoelectric effect, Seebeck effect, Peltier effect, laws of thermocouple, types of thermocouple with characteristic curve, thermocouple table, Sensitivity, constructional features of Thermocouples, Thermocouple specifications, cold junction Compensation method, thermopile, thermocouple emf measurement method, Thermo well. Pyrometers: Principle, Construction and working of Radiation and optical pyrometers and its Applications. **6 Hrs.**

7. Displacement Measurement: a) Resistance potentiometer: piezo-resistive effect, ultrasonic transducer. LVDT, RVDT. Selection and properties of materials for LVDT, and general electromagnetic sensors. b) Capacitance type transducers: with applications, materials for capacitive, ultrasonic and elastic transducers. c) Digital transducer: translational and rotary encoders, Optical and magnetic pickups. d) Pneumatic transducer: flapper- nozzle transducer. **6 Hrs.**

8. Miscellaneous Transducers: Transducers for Position, speed, acceleration, humidity, and moisture measurement. Electronic measuring instruments, Electronic voltmeters, Principle of A/D and D/A converters. **7 Hrs.**

Reference Books:

1. Donald Eckman, "Automatic Process Control", Wiley Eastern Limited
2. John P. Bentley, "Principles of Measurement Systems", 3/e, Addison Wesley Longman Ltd., UK, 2000.
3. Doebelin E.O, "Measurement Systems - Application and Design", 4/e, McGraw-Hill International Edition, New York, 1992.
4. Stephanopoulos George, "Chemical Process Control".

18UCHC404	Energy Technology and Management	(3-0-0) 3
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Contact Hours: 39

Course Learning Objectives (CLOs):

1. Understand the utilization of conventional and non – conventional energy sources and the principle of working of related equipments.
2. Recognize the effects of current energy systems on the environment and society.
3. Study energy costs/waste minimization without affecting production and quality.

Course Outcomes (COs):

Description of the course outcome: At the end of the course student will be able to		Mapping to POs (1-12)/ PSOs(13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Identify and comprehend the effects of current energy systems based on solid and gaseous fuels.	2	13	1

CO-2	Analyze the principles and concepts and explain basic principles involved in solar and wind energy conversion system.	1	, 13	3, 14											
CO-3	Describe the challenges and problems associated with Bio-energy and fuel cell technology, and explain its basic principles and operations.	2	1	3, 14											
CO-4	Summarize the basic principle and production process of ocean and tidal energy sources with regards to future energy supply and environmental concern.	3	1,13	2,14											
CO-5	Discuss the principles and need of energy audit and management programs.	14	2,13	1											
POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	1.8	2.25	1.66	-	-	-	-	-	-	-	-	-	2.0	1.5	-

Course Content:

Unit-I

Introduction to Energy Sources: World energy futures, Indian energy scenario, Conventional and non-conventional energy sources. **Fuels:** Classification, properties and tests and analysis of solid, liquid and gaseous fuels.

08 Hrs.

Unit-II

Solar Energy: Solar constant, Solar radiation at earth's surface, Solar radiation geometry, Solar radiation measurement. Solar water heating, space cooling, Solar distillation, pumping and Solar cooking- Basic principles, methods, applications, advantages and limitations. **Wind Energy:** Introduction, Basic components of WECS (wind energy conversion system). Classification of WEC Systems. Types of wind energy machines- (wind energy collectors) horizontal axis, vertical axis machines.

09 Hrs.

Unit-III

Bio-Energy: Introduction, Biomass conversion technology, Wet and Dry process, Factors affecting Bio digestion or Generation of gases, Classification of Bio gas plants, Floating Drum, Fixed Dome plants -Basic principles, Construction and Working principles, Advantages and disadvantages. **Fuel Cells:** Design and Principle of operation, Classification, Types, Advantages and

disadvantages, Conversion efficiency, Types of electrodes, Work output and EMF of Fuel Cells, Applications of Fuel Cells. **08 Hrs.**

Unit-IV

Geothermal and Ocean Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India. **Ocean Energy:** Principle of working, performance and limitations of Wave Tidal Energy. Ocean Thermal Energy-Availability, theory and working principle, performance and limitations. **07 Hrs.**

Unit-V

Energy Management: Principles and needs initiating and managing an energy management programs. **Energy Audit:** Elements and concepts, Types of Energy Audits, Energy Audit of any one chemical industries. **07 Hrs.**

Reference Books:

- 1) G.D. Rai, "Non-Conventional Energy Sources", 4/e Second Reprint, Khanna Publications", 1997.
- 2) P.C. Jain and M. Jain, "Engineering Chemistry", 10/e, 3rd Reprint, DhanpatRai and Sons, 1995.
- 3) S.P. Sukhatme, "Solar Energy", 2/e, 3rd Reprint, Tata McGraw Hill, New Delhi, 1998.
- 4) G.D. Rai, "Solar Energy Utilization", 4/e, Khanna Publications.
- 5) G.N.Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles and Applications", Narosa Publishing House, 2004.



H.O.D.

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