National Institute of Technology Srinagar

Open (Institute) Elective codes

The codes have been allotted based on the senate approved numbering scheme. Basket codes B1/B2 have been included to streamline the processing; and ensure that course categorization and registration procedures are more efficient and simpler.

S No	Department	Level	Basket	Subject	Course Code
1	Chemical Engineering	5th	B1	Energy Technology	CET B1 901
			B2	Membrane Science & Engineering	CET B2 902
		6th	B1	Petroleum Refining	CET B1 951
			B2	Waste Management	CET B2 952
2	Civil Engineering	5th	B1	Quantity Surveying & Cost Evaluation	CVT B1 901
			B2	Building Materials & Construction	CVT B2 902
		6th	B1	Environmental Engineering	CVT B1 951
			B2	Civil Engineering Drawing	CVT B2 952
3	Computer Science Engineering	5th	B1	Database Management Systems	CST B1 901
			B2	Python Programming	CST B2 902
		6th	B1	Data Structures	CST B1 951
			B2	Artificial Intelligence	CST B2 952
4	Electrical Engineering	5th	B1	Energy Conversion Technologies	EET B1 901
			B2	Fundamentals of SCADA	EET B2 902
		6th	B1	Modelling & Dynamics	EET B1 951
			B2	Intelligent Computational Techniques	EET B2 952
5	Electronics & Communication Engineering	5th	B1	Integrated Electronics & Applications	ECT B1 901
			B2	Consumer Electronics	ECT B2 902
		6th	B1	Communication Systems for Engineering Applications	ECT B1 951
			B2	Introduction to Computer Networks	ECT B2 952
6	Information Technology	5th	B1	Python Programming	ITT B1 901
			B2	Web Development	ITT B2 902
		6th	B1	Fundamentals of Machine Learning	ITT B1 951
			B2	Big Data	ITT B2 952
7	Mechanical Engineering	5th	B1	Introduction to Mechatronics	MET B1 901
			B2	Introduction to Electric Vehicle	MET B2 902
		6th	B1	Basic Robot Mechanics	MET B1 951
			B2	Sustainable Engineering	MET B2 952
8	Metallurgy & Materials Engineering	5th	B1	Electrical & Electronic Engineering Materials	MMT B1 901
			B2	Introduction to Materials Science & Engineering	MMT B2 902
		6th	B1	Nanomaterials	MMT B1 951
			B2	Energy Materials	MMT B2 952

Energy Technology (CET B1 901)

Subject: Energy Technology (CET B1 901)	**Year & Semester: -Institute Open Elective-I, 3rd year & 5th Semester**		**Total Course Credit: 3**		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (26 Marks)	Internal Assessment (24 Marks)	Final-Term (50 Marks)		

Course Objectives

The aim of this course is to provide the fundamental knowledge regarding the utilization and characteristics of various energy resources available (natural or transformed) which usually pertain to Chemical Engineering field.

Course Outcomes (COs)

CO1.	Develop the fundamental understanding of solid, liquid and gaseous fuels and their properties.	BTL 3
CO2.	Inspect the various conventional energy sources.	BTL 4
CO3.	Analyze the governing stoichiometry, chemistry as well as thermodynamics of the combustion of fuels.	BTL 4
CO4.	Inspect the various non-conventional energy sources.	BTL 4

Details of the Syllabus

Module No.	**Contents**	**Hours**
Module I	Concept of solid, liquid and gaseous fuels, basic understanding of various properties: heating value, ultimate analysis, proximate analysis, heating value, density, specific gravity, viscosity, flash point, ignition temp, pour point, ash composition	12
Module II	Conventional energy sources and their utilization: Coal, petroleum, natural gas, syngas, LPG, refinery gas, producer gas, water gas. Combustion calculations of coal and petroleum fractions.	10
Module III	Non-conventional energy sources and their utilization: Geothermal energy, solar energy, wind energy, hydrogen energy, nuclear energy	10
Module IV	Generation of energy from biomass-based feedstock and wastes: biogas, landfill gas, biodiesel	10

Books Recommended:

Text books	1	Sarkar, S. “Fuel and Combustion” (2000).
	2	Griswold, J. , “Fuels, Combustion and Furnaces”
	3	Larry C White, “Industrial Energy Management & Utilization”
	4	Himus, G.W., “The Elements of Fuel Technology”

Membrane Science and Engineering (CET B2 902)

Subject: Membrane Science and Engineering (CET B2 902)	**Year & Semester: Institute Open Elective-I, 3rd Year & 5th Semester**		**Total Course Credit: 3**		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (26 Marks)	Continuous Assessment (24 Marks)	End-Term (50 Marks)		

Objective: The course will enable students to develop necessary skills to design appropriate membrane-based separation technique as per the need.

Course outcomes (COs): Upon successful completion of the course, students will be able to:

CO1.	Develop expertise in membrane separation mechanisms, transport models, membrane types, modules, and their applications	BTL 6
CO2.	Develop skills in applying transport models for the calculation of membrane permeability, flux, and the extent of separation for various membrane separation systems.	BTL 3
CO3.	Be able to determine the types of experimental data needed for the calculation of membrane permeability parameters.	BTL 4
CO4.	To be able to calculate membrane process performance and analyze membrane separation characteristics.	BTL 4

Details of the Syllabus:

Module No.	**Contents**	**Hours**
Module I	Introduction to membranes, types of membranes, membrane processes, and applications.	12
Module II	General transport theories. Membrane preparation and their characterization.	10
Module III	Principles of various membrane processes such as reverse osmosis, microfiltration, ultrafiltration, dialysis, liquid membrane, pervaporation, etc.	10
Module IV	Applications of various membrane processes in different industries.	10

Books Recommended:

Text books	**1.**	Sun-Tak-Hwang and Karl Kammermeyer, "Membranes in Separations", John Wiley & Sons,
	2.	Coulson J.M. and Richardson J.F., "Chemical Engineering: Particle Technology and Separation Processes", Vol. 2, 4th Edition, Asian Books Pvt. Ltd. New Delhi, 1998.
	3.	Christie J. Geankoplis, "Transport Processes and Unit Operations", 4th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
Reference books	**1.**	Strathmann H., Giorno L. and Drioli E., "An Introduction to Membrane Science and Technology", Institute of Membrane Technology, CNR-ITM, University of Clabria, Italy, 2006.

Petroleum Refining (CET B1 951)

Subject: Petroleum Refining (CET B1 951)	**Year & Semester: Institute Open Elective-II, 3rd year & 6th Semester**		**Total Course Credit: 3**		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (26 Marks)	Internal Assessment (24 Marks)	Final-Term (50 Marks)		

Pre-requisites: None.

Course Outcomes (COs): At the end of the course, the student will be able to:

CO1	Develop a comprehensive understanding of crude oil production, properties, and characterization methods.	BTL 3
CO2	Identify various treatments processes associated with good quality petroleum.	BTL 4
CO3	Classify different fractionation processes and their best utilization.	BTL 4
CO4	Make use of refining processes pertaining to crude oil refinery engineering.	BTL 3

Detailed Syllabus:

Module No.	**Contents**	**Hours**
Module I	**Introduction:** Petroleum Industries: An overview, Crude oil, Properties and composition of Crude oil, Origin and occurrence of petroleum crude, Physical properties of petroleum.	12
Module II	**Crude Oil Distillation Processes:** Pretreatment of crude, atmospheric and vacuum distillation process, effects of crude characteristics and operating variables on Crude oil distillation. Processing of high TAN crude oil.	10
Module III	**Thermal Conversion Process:** Thermal Cracking Reactions, Thermal Cracking, Visbreaking, Coking Process, Delayed coking.	10
Module IV	**Catalytic Conversion Process**: Catalytic Conversion Process: Fluid Catalytic Cracking (FCC), Hydrocracking, Catalytic Reforming, Alkylation, Isomerization and Polymerization.	10

Books Recommended:

Text Books	**1.**	O.P. Gupta, "Elements of Petroleum Refinery Engineering", 2nd Edition, Khanna Publication, (2021).
	2.	Nelson W. L., "Petroleum Refinery Engineering" McGraw Hill. (1987).
	3.	Wauquier J. P., "Petroleum Refining 2 Separation Processes", Vol:1-5, (1998).
Reference Books	**4.**	Bhaskar Rao, B.K. "Modern Petroleum refining processes" Oxford &IBH Publishing Co Pvt. Ltd., (2005).
	5.	Meyers R. A., "Hand book of Petroleum Refining Processes", 3rd Ed., The McGraw-Hill Publication. (2004)

Waste Management (CET B2 952)

Subject: Waste Management (CET B2 952)	**Year & Semester: Institute Open Elective-II, 3rd year & 6th Semester**		**Total Course Credit: 3**		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (26 Marks)	Internal Assessment (24 Marks)	Final-Term (50 Marks)		

Pre-requisites: Nil

Course Outcomes: At the end of the course, the student will be able to:

CO1	Build the management of solid waste towards sustainable development	BTL 3
CO2	Evaluate material and energy calculations in technologies to dispose and process the waste.	BTL 5
CO3	Develop the technologies to convert waste into useful products/energy	BTL 3
CO4	Identify and classify hazardous waste	BTL 4

Detailed Syllabus:

Module No.	**Contents**	**Hours**
Module I	**Introduction to Waste Generation and Management:** Classification of solid wastes (source and type-based), solid waste management (SWM), elements of SWM, ESSWM (environmentally sound solid waste management), and EST (environmentally sound technologies), health and environmental effects (public health and environmental). E-waste generation.	12
Module II	**Material Balances and Energy Balances of Waste Generation/Treatment Processes**: Steady-state and unsteady-state material balances, recycle, bypass, and purge calculations, reactive systems. Thermodynamic concepts, enthalpy changes, heat capacity, heat transfer, adiabatic and non-adiabatic processes.	10
Module III	**Collection, Storage, Transport, and Disposal of Wastes**: Waste Collection, Storage and Transport: Collection components, storage-containers/collection vehicles, collection operation, transfer station, waste collection system design. Waste Disposal: key issues like Plastic pollution.	10
Module IV	**Hazardous Waste Management and Treatment**: Hazardous waste, hazardous waste treatment, prevention, and minimization. E-waste recycling. Advanced oxidation processes in wastewater treatment.	10

Books Recommended:

Text books	**1.**	Tchobaanoglous, G., Theisen, H., and Samuel A Vigil, Integrated Solid Waste Management, McGraw-Hill Publishers.
	2.	Bilitewski B., Hard He G., Marek K., Weissbach A., and Boeddicker H., Waste Management, Springer.
	3.	Basic Principles and Calculations in Chemical Engineering by D.M. Himmelblau and J.B. Riggs, Pearson Education
Reference books	**1.**	Nicholas, P., & Cheremisinoff, P. D., Handbook of solid waste management and waste minimization technologies, Imprint of Elsevier Science. 2005
	2.	Kumar, P & Kumar, B., Global Waste management, Scrivener (Wiley), 2025, 1st Edition