

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

Diploma in Chemical Engineering

SEMESTER-VI

S No.	Board of study	Subject Code	Subject	Periods per week			Scheme of Examination					Total marks	Credit L+(T+P)/2
							Theory			Practical			
				L	T	P	ESE	CT	TA	ESE	TA		
1	Chemical Engineering	219611 (19)	Petroleum Refining and Petro Chemicals	4	1	-	100	20	20	-	-	140	5
2	Chemical Engineering	219612 (19)	Instrumentation Process Control	3	1	-	100	20	20	-	-	140	4
3	Chemical Engineering	219613 (19)	Mass Transfer operation – II	4	1	-	100	20	20	-	-	140	5
4	Chemical Engineering	219614 (19)	Utility Technology	4	1	-	100	20	20	-	-	140	5
5	Chemical Engineering	219621 (19)	Petroleum Refining and Petro Chemicals Lab	-	-	3				50	25	75	2
6	Chemical Engineering	219622 (19)	Instrumentation Process Control Lab	-	-	3				50	25	75	2
7	Chemical Engineering	219623 (19)	Mass Transfer Operation – II Lab	-	-	3				50	25	75	2
8	Chemical Engineering	219624 (19)	Utility Technology Lab	-		4				50	25	75	2
9	Chemical Engineering	219625 (19)	Project	-	-	4				100	40	140	2
Total				15	4	17	400	80	80	300	140	1000	29

L – Lecture
ESE – End Semester Examination

T – Tutorial
CT – Class Test

P – Practical
TA – Teacher's Assessment

CHHATTISHGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

(A) SEMESTER : VI

(B) COURSE TITLE : PETROLEUM REFINING & PETROCHEMICALS

(C) CODE (Theory) : 219611(19)

(D) BRANCH/DISCIPLINE : CHEMICAL ENGINEERING

(E) TEACHING AND EXAMINATION SCHEME :

Course code	Periods/Week (In Hours)			Scheme of Examination						Credit L+ (T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219611(19)	4	1	-	100	20	20	-	-	140	5
219621(19)	-	-	3	-	-	-	50	25	75	2

(F) DISTRIBUTION OF MARKS AND HOURS :

S. No.	CHAPTER No.	CHAPTER NAME	HOURS/PERIODS THEORY	MARKS
1	1	UNIT - I	16	20
2	2	UNIT - II	16	20
3	3	UNIT - III	16	20
4	4	UNIT - IV	16	20
5	5	UNIT - V	16	20

(G) DETAILED COURSE CONTENTS :

1. ORIGIN, COMPOSITION AND CHARACTERISTICS OF PETROLEUM CRUDES : Origin & formation of petroleum, Reserves & deposits of world, Indian petroleum industry. Oil exploration, Petroleum refining (Types, Location & Capacities). Composition of petroleum & Chemistry of petroleum. Evaluation of petroleum, Properties of petroleum fractions (listing only), Listing of Distillation characteristic, Important products, properties & test methods : Gas, Gasoline, Jet fuel, Naphtha, Kerosene, Diesel fuel, Lube oil, Bitumen,

2. PROCESSING OF CRUDE AND TREATMENT TECHNIQUES : Dehydration & desalting of crudes, Heating of crude - pipe still heaters; Distillation of petroleum; Arrangement of tower, ADU & VDU Topping operation, Blending of gasoline; Line Blending, Gasoline Blending, Integrated refinery. Fraction impurities Production and treatment of LPG: LNG technique, amine treatment of LPG, Sweating operation for gas, Treatment of gasoline: Copper chloride process, Unisol process (with flow diagram), Duo-sol process, Dualayer (with flow diagram), Inhibitor sweating, Led doctoring of gasoline, Merox sweating, Treatment of kerosene; Sulfur dioxide extraction (Edeleanu Process), Treatment of lubes; Sulfuric acid treatment, Clay treatment, solvent treatment (with flow diagram), Purification of wax- Definition, Composition of paraffin wax, Old and new method of dewaxing (Brief Introduction), MEK Dewaxing, Propane Deasphalting, Wax Finishing.

3. REFINERY OPERATIONS : Introduction and definition of Cracking, Thermal Cracking, Catalytic Cracking, Catalytic reforming, Naphtha cracking, Coking, Hydrogen processes, Alkylation's processes, Isomerization processes, Polymer gasoline, all with flow diagram Processes. Definition, History, Major petrochemical products and their producers in India, Principal raw material for petrochemical.

4. PETROCHEMICAL :

Methanol, Formaldehyde with flow diagrams. Ethylene (with flow diagram), Acetylene (only brief), Vinyl Chloride (with flow diagram), and Acetaldehyde, Acetic acid. Propylene (with flow diagram), Acetone & Cumene [Isopropyl benzene], Acrylonitrile, Acrylic Acid, M.M.A. Butadiene (with flow diagram), Iso butylenes, Butanol. Benzene, LAB (with flow diagram), Styrene, Toluene, Phenol, Benzaldehyde, Terephthalic acid & Dimethyl terephthalate (Brief), Phthalic anhydride & Malaic anhydride (Brief). Polyethylene - LDPE, HDPE, LLDPE, HMDPE (with flow diagram), Polypropylene; polyvinyl chloride (with flow diagram), Polyester, Polystyrene, PMMA (With Flow Diagram), Neoprin, PBR (with flow diagram), SBR.

5. TRANSPORTATION, SAFETY AND ENVIRONMENTAL ASPECTS OF PETROLEUM INDUSTRIES :- Transportation in pipes & tankers, Prevention of fire hazard, Control of harmful emission from petroleum industries.

COURSE TITLE : PETROLEUM REFINING & PETRO CHEMICALS LAB

PRACTICAL CODE : 219621(19)

TOTAL HOURS : 48 hrs

PRACTICAL/TERM-WORK :- Practical/term-work will consist of minimum ten experiments/exercises based on above topics.

TEXT/REFERENCE BOOK :-

- 1) Petroleum Refinery Engineering by - W. L. Nelson, Mc Graw Hills Publishers
- 2) Petroleum Processing by - R.J. Hengsbeck .
- 3) Advanced Petrochemicals - Dr. G. N. Sarkar, Khanna Publishers
- 4) Advance Petroleum Refinery - G. N. Sarkar
- 5) Petroleum Refining Technology by - Dr. Ramprasad, Khanna Publishers
- 6) Petrochemical by - Dr. B. K. B. Rao, Khanna Publishers

CHHATTISHGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : VI
(B) COURSE TITLE : INSTRUMENTATION AND PROCESS CONTROL
(C) CODE (Theory) : 219612(19)
(D) BRANCH/DISCIPLINE : CHEMICAL ENGINEERING
(E) TEACHING AND EXAMINATION SCHEME :

Course code	Periods/Week (In Hours)			Scheme of Examination						Credit L+ (T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219612(19)	3	1	-	100	20	20	-	-	140	4
219622(19)	-	-	3	-	-	-	50	25	75	2

(F) DISTRIBUTION OF MARKS AND HOURS :

S. No.	CHAPTER No.	CHAPTER NAME	HOURS/PERIODS THEORY	MARKS
1	1	UNIT - I	13	20
2	2	UNIT - II	13	20
3	3	UNIT - III	12	20
4	4	UNIT - IV	13	20
5	5	UNIT - V	13	20

(G) DETAILED COURSE CONTENTS :

UNIT - I

(a) Importance of instrumentation and process control in chemical process plants, classification of instruments such as measuring instruments, recording instrument etc. elements of instruments parts of instrument, static and dynamic characteristics of instruments, concept of first order and second order type instruments.

(b) Expansion Thermometers : Principle, type of expansion thermometers; Mercury in glass thermometer, Bimetallic thermometers, pressure spring thermometers and pneumatic pressure thermometers.

Thermocouples : Thermo electricity, seeback effect, peltier effect and Thomson effect, laws of thermoelectric circuits, working principle and application of industrial thermocouples, thermocouple lead wires, thermal well, thermocouple circuits, milivoltmeter circuit and null potentiometer circuit.

UNIT -- II

(a) Resistance thermometers : working principle, construction and application, circuits, Wheatstone bridge, Callendar Griffiths bridge.

(b) Radiation thermometer : Principle, construction and application of radiation thermometer, Radiation receiving element.

Lens type and mirror type radiation pyrometer principle and working of optical pyrometer and photoelectric pyrometer.

UNIT - III

Measurement of pressure and vacuum : Manometers, measuring elements for gauge pressure, differential pressure and vacuum. Bellows, Bourdon tube diaphragms, measurement of Absolute pressure simple bellows and double bellows, thermocouples, Pirani gauge, McLeod gauge, ionization gauge, indicating elements for measuring gauges.

UNIT - IV

(a) Level Measurement : Instruments for measuring liquid levels in open vessel and Closed vessel by direct and indirect method, measurement of interface level.

(B) Density and sp. gr. measurement ; liquid level method, hydro-meter method and displacement method.

(c) Composition analysis : Brief treatment of absorption, emission and mass spectroscopy. Working principle of gas chromatograph, thermal conductivity method, PH meter, Humidity measurement; hygrometer and psychrometer.

UNIT - V

Process control : Control systems, control elements, on-off and proportional control action, reset, rate control characteristics, applications, concept of automatic control for batch and continuous processes, Elementary ideal about pneumatic, electrical and hydraulic controllers.

COURSE TITLE : INSTRUMENTATION PROCESS CONTROL

PRACTICAL CODE : 219622(19)

Total Hours : 48 hrs

EXPERIMENTS :

1. Error calibration of flowmeters.
2. Error calibration of Temperature measuring devices.
3. Determination of humidity.
4. Level measurement.
5. Inter-facial level measurement.
6. Measurement of temp by radiation pyrometer.
7. Moisture determination by Karl-Fisher apparatus.
8. Composition analysis by spectrograph.
9. Study of level control loop system and Temp. control loop system.
10. Study of pressure and vacuum gauges.

TEXT/REFERENCE BOOKS :

1. Industrial Instrumentation by Donald P. K.
2. Instrumentation by Kirk and Rimbai.
3. Mechanical Measurement and control by Dr. D.S. Kumar.
4. Process systems analysis & control by Caughnour and Koppel.

CHHATTISHGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : VI
 (B) COURSE TITLE : MASS TRANSFER OPERATION - II
 (C) CODE (Theory) : 219613(19)
 (D) BRANCH/DISCIPLINE : CHEMICAL ENGINEERING
 (E) TEACHING AND EXAMINATION SCHEME :

Course code	Periods/Week (In Hours)			Scheme of Examination						Credit L+ (T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219613(19)	4	1	-	100	20	20	-	-	140	5
219623(19)	-	-	3	-	-	-	50	25	75	2

(F) DISTRIBUTION OF MARKS AND HOURS :

S. No.	CHAPTER No.	CHAPTER NAME	HOURS/PERIODS THEORY	MARKS
1	1	CRYSTALLIZATION	16	20
2	2	HUMIDIFICATION	16	20
3	3	DRYING	16	20
4	4	SOLID-LIQUID EXTRACTION	16	20
5	5	LIQUID-LIQUID EXTRACTION	16	20

(G) DETAILED COURSE CONTENTS :

UNIT - I

CRYSTALLIZATION : Definition, objective, crystallization from solution, magma, principles of crystallization, super saturation and methods to achieve super saturation Meir's theory of super saturation. Nucleation and crystal growth in a crystallizer, Agitated batch crystallizer, swen-son walker crystallizer and continuous vaccum crystallizer, material and energy balance in a crystallizer, caking of crystals and its preventions.

UNIT - II

HUMIDIFICATION : Introduction to Humidification, dehumidification, humidity, percentage humidity, relative humidity, humid heat, humid volume, dew point, wet bulb temp. and adiabatic saturation temp. Humidity chart and its uses, determination of humidity. Mechanism of water cooling in a cooling tower, description of natural draft, induced draft and forced draft cooling tower.

UNIT - III

DRYING : Concept of drying, classification of dryers, Mechanism of drying. Introduction to free moisture, bound moisture, unbound moisture, critical moisture, and equilibrium moisture. Rate of drying constant rate period and falling rate period, calculation of drying time, factors influencing the rate of drying. Drying equipments : Tray dryer, tunnel dryer, Rotary dryer, drum dryer, spray dryer and fluidized bed dryer, Shrinkage and casehardening.

UNIT - IV

SOLID-LIQUID EXTRACTION : Concept of leaching, leaching equipment Boll man extractor, Hilderbrandt extractor, Principles of continuous counter current leaching, calculation of no. of ideal stages for constant underflow, use of counter current decantation system in leaching.

UNIT - V

LIQUID-LIQUID EXTRACTION : Principles of liquid-liquid extraction, choice of solvent. Extraction equipments. Scheibel extractor, Agitated extraction tower, Rotating disc unit, Pulse column, representation of three component system on triangular diagram, concept of solubility curve and line.

COURSE TITLE : MASS TRANSFER OPERATION - II

\CODE (Practical) : 219623(19)

PERIODS : 48 hours

EXPERIMENT:

1. Calculation of crystallizer yield using Agitated batch crystallizer.
2. Calculation of drying time using tray dryer.
3. Calculation of drying time using Rotary dryer.
4. Experiment on fluidized bed dryer.
5. Determination of humidity using psychro meter.
6. Experiment on cooling tower.
7. Experiment on liquid-liquid extraction.
8. Experiment on solid-liquid extraction.

TEXT/REFERENCE BOOKS :

1. Unit operations of Chemical Engineering by Mc-Cabe Smith.
2. Introduction to Chemical Engineering by Badger and Benchro.
3. Chemical Engineering Vol. - II by Richardson & Coulson.

CHHATTISHGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : VI
 (B) COURSE TITLE : UTILITY TECHNOLOGY
 (C) CODE (Theory) : 219614(19)
 (D) BRANCH/DISCIPLINE : CHEMICAL ENGINEERING
 (E) TEACHING AND EXAMINATION SCHEME :

Course code	Periods/Week (In Hours)			Scheme of Examination						Credit L+ (T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219614(19)	4	1	-	100	20	20	-	-	140	5
219624(19)	-	-	4	-	-	-	50	25	75	2

(F) DISTRIBUTION OF MARKS AND HOURS :

S. No.	CHAPTER No.	CHAPTER NAME	HOURS/PERIODS THEORY	MARKS
1	1	UNIT - I	16	20
2	2	UNIT - II	16	20
3	3	UNIT - III	16	20
4	4	UNIT - IV	16	20
5	5	UNIT - V	16	20

(G) DETAILED COURSE CONTENTS :

UNIT - I

Solid fuels : Wood char-coal and coal, origin of coal, classification of coal by rank and their characteristics, significance of the constituents of coal : moisture, volatile matter. Ash and fixed carbon, ultimate and proximate analysis of coal, determination of calorific value of coal storage of coal - oxidation and spontaneous combustion, pulverised fuel : advantages and disadvantage merits and demerits of coal, coke; high temp and low temp. carbonization of coal . Simple combustion calculations.

UNIT - II

Petrol : Properties, knocking in I.C. Engine, octane number.

Diesel : Properties, knocking in diesel engine, cetane number.

Kerosene : Properties, uses and smoke point of Kerosene, synthetic fuel. General idea about power alcohol and benzol.

Biodiesel :- Properties, uses and production of biodiesel . Sampling of liquid fuels and testing of its different characteristics & properties.

UNIT - III

Gaseous fuels : Definition, manufacturing, main features and uses of following gaseous fuels.

- (a) Natural Gas (b) Liquefied petroleum gas (c) Gobar gas (d) Refinery gases (e) Producer gas (f) Water gas and carbureted water gas (g) Coke oven gas (H) Blast furnace gas.

UNIT - IV

Air Water and steam : Process air, and Instrument air, compressed air, properties and uses of steam, steam tables, wet steam, dryness fraction, super heated steam, steam economy in chemical plants. Boiler feed water, cooling water, water as a utility material in chemical industries, characteristics of water. Water for cooling tower, treatment of utility water; Dowtherm as heating medium.

UNIT - V

- (a) Refractories : Definition, classification and properties of refractories, requirement of good

refractory for a particular job, selection of refractoriness, study of some important refractories clay

refractories, silica refractories High alumina refractories and graphite refractories.

- (b) Waste Heat recovery in furnaces : Sources of heat loss from a furnace, description of waste heat boiler, recuperators, regenerators.

COURSE TITLE : UTILITY TECHNOLOGY

CODE (practical):219624(19)

Total Hours : 64 hrs.

EXPERIMENTS :

1. Proximate analysis of coal.
2. Ultimate analysis of coal.
3. Determination of calorific value of coal.
4. Determination of carbon residue of oil.
5. Determination of flash and fire point of oil.
6. Determination of viscosity of oil.
7. Determination of smoke point of Kerosene.
8. Determination of cloud and pour point of oil.

TEXT/REFERENCE BOOKS :

1. Elements of fuel furnaces and refractoriness by O.P. Gupta.

2. Engineering Chemistry by P.C. Jain, Monika Jain.
3. Thermal Engineering Heat Engines by P.L. Ballaney.
4. Fuel Technology, by Brane and King.

CHHATTISHGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI

- (A) SEMESTER : VI
(B) COURSE TITLE : PROJECT
(C) CODE (Theory) : 219625(19)
(D) BRANCH/DISCIPLINE : CHEMICAL ENGINEERING
(E) TEACHING AND EXAMINATION SCHEME :

Course code	Periods/Week (In Hours)			Scheme of Examination						Credit L+ (T+P)/2
	L	T	P	Theory			Practical		Total Marks	
				ESE	CT	TA	ESE	TA		
219625(19)	-	-	4	-	-	-	100	40	140	2

The object of this assignment (which may be taken as a home paper) is to provide the students with an opportunity to develop and demonstrate initiative, self confidence and ability to pick new problems independently and inculcate a spirit of enquiry. He will also have an occasion, through this work, to integrate and reinforce the skills required in separate subject studies. The topic of this assignment shall be on some situation problem relevant to Chemical Manufacture or design of some chemical processing equipments.

Each candidate appearing for the final year Diploma Examination shall be required to work on a problem relevant to Chemical Engineering assigned to him by an authorized faculty member not less than 4 months prior to the commencement of the final examination and submit to the Head of Deptt. The record of his work duly typewritten in A4 size bond paper properly bound. This shall be considered under the subject title project work.

COURSE TITLE : PROJECT

CODE (practical):219625(19)

Total Hours : 64 hrs.
