



Rajiv Gandhi Technological University, Bhopal (MP)
B.E. (CM) Chemical Engineering
 Revised syllabus and Scheme of Examination effective from July 2007

THIRD SEMESTER

S. No	Course Category	Course Code (New)	Subject	Periods Per Week				Distribution of Marks				
				L	T	P	C	Theory	Practical	Internal Assessment		Total
										MST	TW	
1	BS-5	BE 301	Mathematics - III	3	1	0	4	100	-	20	-	120
2	DC 1	CM 302	Chemical Engg Thermodynamics	3	1	0	4	100	-	20	-	120
3	DC 2	CM 303	Chemical Instrumentation	3	1	2	6	100	50	20	30	200
4	DC 3	CM304	Material & Energy Balance	3	1	2	6	100	50	20	30	200
5	DC 4	CM 305	Advanced Engg. Chemistry	3	1	2	6	100	50	20	30	200
6	IT-2	CM 306	Java	0	0	4	4	-	50	-	50	100
7	NECC -1	CM 307	Self Study	0	0	1	1	-	-	-	30	30
8	NECC -2	CM 308	Seminar/Group Discussion etc.	0	0	1	1	-	-	-	30	30
Total				15	5	12	32	500	200	100	200	1000

BS	Basic Sciences	HS	Humanity Sciences
DC	Department Core	DID	Department Inter Disciplinary
IT	Information Technology subjects	NECC	Non Exam Credit Course
MST	Mid Semester Test	TW	Term Work (Session/ Practical)
C	Credits	L	Lecture Hrs
P	Practical Hrs	T	Tutorial Hrs



Rajiv Gandhi Technological University, Bhopal (MP)
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FOURTH SEMESTER

S. No	Course Category	Course Code (New)	Subject	Periods Per Week				Distribution of Marks				
				L	T	P	C	Theory	Practical	Internal Assessment		Total
										MST	TW	
1	DC 5	CM 401	Material Science & Technology	3	1	0	4	100	-	20	-	120
2	HS 2	CM/CE/ME/402	Energy Environment Ethics and Society	3	1	0	4	100	-	20	-	120
2	DC 6	CM403	Fuel Technology	3	1	2	6	100	50	20	30	200
3	DC 7	CM 404	Fluid Particle Mechanics	3	1	2	6	100	50	20	30	200
5	DID 1	CM 405	Fluid Mechanics	3	1	2	6	100	50	20	30	200
6	IT-3	CM 406	Java	0	0	4	4	-	50	-	50	100
7	NECC-3	CM 407	Self Study	0	0	1	1	-	-	-	30	30
8	NECC-4	CM 408	Seminar/Group Discussion etc.	0	0	1	1	-	-	-	30	30
Total				15	5	12	32	500	200	100	200	1000

BS	Basic Sciences	HS	Humanity Sciences
DC	Department Core	DID	Department Inter Disciplinary
IT	Information Technology subjects	NECC	Non Exam Credit Course
MST	Mid Semester Test	TW	Term Work (Session/ Practical)
C	Credits	L	Lecture Hrs
P	Practical Hrs	T	Tutorial Hrs

COURSE CONTENTS

Category	Title	Code	Credits-4C			Theory Papers
Basic Sciences BS-5	Mathematics-III	BE 301	L	T	P	Max Marks-100 Min Marks-35 Duration-3 Hrs
			3	1	0	

Unit 1 Functions of Complex Variables: Analytic functions, Harmonic Conjugate, Cauchy - Riemann Equations, Line integral, Cauchy's theorem, Cauchy's Integral formula, Singular points, Poles and Residues, Residue theorem, Evaluation of Real Integral, Bilinear Transformation.

Unit 2 Numerical Analysis: Difference operators, Errors and Approximations, Interpolation, Inverse interpolation, Numerical differentiation, Numerical Integration by using Simpson's method, Weddel's rule and Gauss legendre open quadrate formula.

Unit 3 Solutions of algebraic and transcendental equations(Regular False, Newton-Raphson, Iterative, Graffe's root squaring methods), Solutions of simultaneous algebraic equations, Solutions of ordinary differential equations (Tailor's Series, Picard's Method, Modified Euler's method, Runge Kutta Method, Predictor-Corrector Method), Solution of Partial differential equation.

Unit 4 Introduction to optimization by linear programming, only two variable problems solution by graphical and simplex method, concept of degeneracy and duality; simple three variable transport and assignment problems and modeling into LPP.

Unit 5 introduction to Q theory and Markovian process, time independent property of exponential distribution, solution of only M/M/1 (∞/∞ /FCFS) Queues; introduction to design of experiments, factorial design, sampling methods, Taguchi Loss Function, robust design methods, variance reduction and six (± 3) σ outliers in quality.

References:

1. Kreyszig E; Advanced Engineering Mathematics; Wiley Eastern Limited.
2. Ramana BV; Higher Engineering Mathematics; TMH
3. Grewal BS; Higher Engineering Mathematics; Khanna Publisher.
4. Taha H; Operations Research an Introduction; PHI
5. Ross; Taguchi techniques for Quality engineering, TMH
6. Spiegel; Theory and problems of probability and statistics; TMH
7. Chandrasekharaiah DS; Engineering Maths Part II & III; Prism Books Pvt.
8. Johnson; Miller and Freund's Probability and statistics for Engineers; PHI.
9. Jaggi, Mathur; Engineering Mathematics; Khanna Publisher.

COURSE CONTENTS

Category	Title	Code	Credits-4C			Theory Papers
Chemical Engg. DC-1	Chemical Engg- Thermodynamics	CM 302	L	T	P	Max Marks-100 Min Marks-35 Duration-3 Hrs
			3	1	0	

Unit I Basic concepts of work and heat system properties and state of system first law of thermodynamics and its application batch flow processes steady and unsteady state flow critical properties corresponding state compressibility PVT behavior of pure fluids virial equations cubic equation generalized correlation and eccentric factor behavior of liquid

Unit II Second law of T.D. and its application Carnot cycle, Carnot-theorem, thermodynamics temp scales concepts of entropy calculation of entropy for various systems entropy for real system effect of pressure on specific heat Joule Thompson effect third law of TD and its application

Unit III Thermodynamics properties of homogeneous mix property relationship for systems of variable compositions partial molar properties fugacity and fugacity coefficient of fugacity in ideal solution properties change of mixing activity heat effects in mixing excess properties activity effect in gaseous mix

Unit IV compression and expansion of fluids single stage multiple stage power requirements and efficiency along with effect and engineering along with effects clearance compression of real gas refrigeration ideal reversed Carnot cycle vapor compression refrigeration

Unit V Chemical potential and its physical significance effect of pressure and temperature on heat of reaction concept of free energy Van't Hoff's equation Clausius Clapeyron equation Gibbs-Bueche relationship of free energy with equilibrium constant equilibrium and its applications

References:

1. Smith J.M and Van Ness- Introduction to Chemical Engg Thermodynamics – 6th edition
2. Dodge B.F. Chemical Engineering – Thermodynamics – McGraw Hill
3. Balzhiser Samules and Eliassen-Chemical Engg- Thermodynamics Prentice Hall
4. Sandler S.I Chemical Engg-Thermodynamics-John Wiley and son
5. Rastogi and Mishra-Chemical Engg Thermodynamics

COURSE CONTENTS

Category	Title	Code	Credits-6C			Theory Papers
			L	T	P	
DC 2	Chemical Instrumentation	CM 303	3	1	2	Max Marks-100 Min Marks-35 Duration-3 Hrs

Unit 1 Introduction: Classification, parts, static & dynamic characteristics of instruments. Meters- Analog/ digital, AC/DC voltmeters, ammeters, ohmmeters and Multi-meters.

Unit 2 Transducers & their application in measurements of temperature, pressure, flow, level and displacement; passive transducers-resistive, inductive & capacitive; active transducers thermoelectric, piezoelectric & photoelectric; bridges-DC/AC bridges, LCR bridges

Unit 3 Converters and display devices-

A/D converters- various techniques of conversion and their characteristics

D/A converters- various techniques conversion and their characteristics

Display devices-number system, indicating system, display using LCD/LED & application in digital meter.

Unit 4 Oscilloscopes- types, control measurement of voltage, frequency and phase; types of probe, loading & measurement effect, specification. Signal generators; function generator, frequency synthesis technique and digital signal generators, introduction to signal analyzers.

Unit 5 Signal conditioning: filtering, amplification/ attenuation, linearization. Signal Conversion: P/I, I/P, I/V, V/I

Introduction to multiplexes / de-multiplexes

Introduction to DAS

References:

1. Albert D. Cooper- Modern Electronic Instrumentation, PHI
2. Eckman-Industrial Instrumentation
3. H.S. Kalsi- Electronic Instrumentation
4. Curties Johnson- Process Control Instrumentation Technique, IV Edn, PHI
5. Harriot; Process control; TMH
6. Patranabis; Principles of process control; TMH
7. Jaggi, Mathur; Engineering Mathematics; Khanna Publisher.
8. B.G. Liptak- Instrument Engineering 'Handbook, Volume 1 : Process Measurement
9. Austin E. Fribance- Industrial Instrumentation Fundamentals, new York: Mcgraw-Hill 1962
10. Ernest Doebelin- Measurement Systems: Application and Design, McGraw-Hill

List of Experiments (expandable):

1. Measurement of weight of pressure using strain gauge.
2. Measurement of displacement by LVDT.
3. Measurement of capacitance & self-inductance using Q-meter.
4. Measurement & calibration of temperature using thermister, RTD and thermocouple.
5. Measurement of water level using capacitance probe.
6. Measurement of water level using differential pressure meter
7. Study of seven segment display
8. Measurement of inductance having low Q-factor using Maxwell Bridge.
9. Measurement of flow using electromagnetic flow meter
10. Measurement of flow using differential pressure cell across orifice/ venturimeter

COURSE CONTENTS

Category	Title	Code	Credits-4C			Theory Papers
DC 3	Material & Energy Balance	CM 304	L	T	P	Max Marks-100 Min Marks-35 Duration-3 Hrs
			3	1	2	

Unit 1 Mathematical and Engineering calculation- Units, different unit systems, conversion of unit from one system to other dimensions dimensional analysis dimensional group fundamental of conservation of mass conservation of energy Basic of calculation.

Unit 2 Ideal Gases & Vapor pressure-Introduction of ideal gas, behavior of ideal gases, real gas, Vander Wal ϕ n , compressibility factor method to solve cubic equation vapour pressure Raoult's law Humidity relative humidity humid heat humid volume dew point humidity chart and its use.

Unit 3 Material balance-Introduction of component balance solving material balance, with and without simultaneous equ at steady state material balance, with and without simultaneous at unsteady stat recycle by pass and purge calculations.

Unit 4 Energy balance- Heat capacity calculation of enthalpy changes energy balances with chemical reaction Heat of vaporization heat of mixing heat of combustion.

Unit 5 Stoichiometry & unit operations-Introduction of unit operation, Distillation Crystallization Drying, Evaporation, Psychometry and its application

References:

1. O.A. Hougen, K.M. Watson, R.A. Ragatz; Chemical Process Principles Part I –CBS pub.
2. David M. Himmelblau- Basic Principles and calculations in chemical Engineering – PHI
3. B.I Bhatt, S.M. Vora; Stoichiometry; TMH.

List of Experiments (Expandable)

1. Determination of boiling point relation wrt concentration of caustic soda and verify Dehring' rule.
2. Application of dry and wet bulb thermometer to find out atmospheric humidity
3. Use of humidity chart to find enthalpy dew point humid heat and saturation.
4. Solubility at room temperature and boiling point of urea in water and verify the material balance.
5. Crystallization of copper sulfate in saturated solution by cooling and finding out the crystal yield.
6. To find out the heating value of coal using a calorimeter
7. Combustion of coal & performing the material balance
8. Proximate analysis of coal sample
9. Measurement of flame temp and compare actual & theoretical temp (Business- Burner, Sprit-Lamp, Kerosene Lamp).
10. To find the heat of reaction using calcium oxide and water.

COURSE CONTENTS

Category	Title	Code	Credits-6C			Theory Papers
DC 4	Advanced Engineering Chemistry	CM 305	L	T	P	Max Marks-100 Min Marks-35 Duration-3 Hrs
			3	1	2	

Unit I Electronic Effect: Chemical properties of molecules, hyper conjugation and steric effects, studies on formation and stability of carbonation and Carbonium ions (with Inductive effects, conjugation & resonance and their effects on physical & simple examples of SN and SN₂ reactions)

Unit II Properties of simple monomers: Production, properties & industrial applications of following monomers- Ethylene Styrene, Vinyl Chloride, Vinyl alcohol, Acrylic acid, Methyl Acrylate, Ethyl Acrylate & Methyl Methacrylate.

Unit III Oils and Fats: Vegetable oils by solvent extraction, processing of animal fats, hydrogenation and esterification of oils; Soaps and Detergnets Bathing & laundry soaps, cationic and anionic detergents; Specially cleaning, polishing and sanitation proportions, surface active agents, sulphonate oils.

Unit IV Chemical Kinetics: Rate constant, order and molecularity of a reaction, zero, 1st, 2nd and 3rd order reactions; Kinetics of opposing reactions, methods of determination of order of reactions; Reaction rate theories, Arrhenius, parameters, Catalysis (including enzyme catalysis), effect of catalysis on reaction rate.

Unit V Electrochemistry: Galvanic cell, EMF and its determination, free energy concept, Nernst equation of electrode potential, standard electrode potential; PH value, its measurement and pH metric titration, Conductance, its measurement in polar and non polar solvents; Debye & Huckel theory and its modifications in case of strong electrotypes, conductometric tiration.

Unit VI Phase Rule: Phases, Degrees of freedom, component definition and derivation of phase rule, phase diagram study of Pb-Ag & Zn-Mg systems.

References:

1. B.S.Bahl & G. D. Tuli- Essentials of physical Chemistry. S. Chand & Publishers.
2. Glasstone – Textbook on Physical Chemistry – Prentice Hall, India, New Delhi.
3. Dryden CE- Outlines of Chemical Technology- Prentice Hall, India, New Delhi
4. Levine; Physical Cheistry; TMH.
5. Sivasamkar; Engg Chemistry; TMH
6. Jain & Jain- Engineering Chemisry – Dhanpat Rai Publishing Company, Delhi.
7. Austin G.T, Shreeves; Chemical Process Industry – McGraw Hill – Kogmina

List of Experiments

1. To determine the viscosity of a viscous liquid by falling sphere method
2. Determination of saponification value of oil sample
3. Application of pH meter to find acidity and alkalinity of a solution.
4. To study the hydrolysis of cane sugar solution in the presence of an acid by Fehling's solution method and to find out the reaction constant.
5. To study the adsorption of benzoic acid on animal charcoal and room temperature and to determine the Freundlich constants k,n.
6. Determination of the strength of unknown hydrochloric acid (app. 0.1N) by titrating it against caustic soda by conducto-metric method.
7. To determine the % composition of a given binary liquid solution by polarimeter.
8. To determine the solubility of a sparingly soluble salt in water by conductance measurement.
9. Determination of pH of mixture of CH₃COOH and CH₃COONa and the dissociation constant of the acid.
10. Preparation of laundry soap and to determine its yield.

Course Contents

Category	Title	Code	Credits-4C			Practical
IT-2	JAVA	CM/CS/CE 306	L 0	T 0	P 4	Max. Marks-50 Min. Marks-25 Duration-

UNIT-I Basic Java Features - C++ Vs JAVA, JAVA virtual machine, Constant & Variables, Data Types, Class, Methods, Objects, Strings and Arrays, Type Casting, Operators, Precedence relations, Control Statements, Exception Handling, File and Streams, Visibility, Constructors, Operator and Methods Overloading, Static Members, Inheritance: Polymorphism, Abstract methods and Classes

UNIT-II Java Collective Frame Work - Data Structures: Introduction, Type-Wrapper Classes for Primitive Types, Dynamic Memory Allocation, Linked List, Stack, Queues, Trees, Generics: Introduction, Overloading Generic Methods, Generic Classes, Collections: Interface Collection and Class Collections, Lists, Array List and Iterator, Linked List, Vector. Collections Algorithms: Algorithm sorts, Algorithm shuffle, Algorithms reverse, fill, copy, max and min Algorithm binary Search, Algorithms add All, Stack Class of Package java. Util, Class Priority Queue and Interface Queue, Maps, Properties Class, Un-modifiable Collections.

UNIT-III Advance Java Features - Multithreading: Thread States, Priorities and Thread Scheduling, Life Cycle of a Thread, Thread Synchronization, Creating and Executing Threads, Multithreading with GUI, Monitors and Monitor Locks. Networking: Manipulating URLs, Reading a file on a Web Server, Socket programming, Security and the Network, RMI, Networking, Accessing Databases with JDBC: Relational Database, SQL, MySQL, Oracle

UNIT-IV Advance Java Technologies - Servlets: Overview and Architecture, Setting Up the Apache Tomcat Server, Handling HTTP get Requests, Deploying a web Application, Multitier Applications, Using JDBC from a Servlet, Java Server Pages (JSP): Overview, First JSP Example, Implicit Objects, Scripting, Standard Actions, Directives, Multimedia: Applets and Application: Loading, Displaying and Scaling Images, Animating a Series of Images, Loading and playing Audio clips

UNIT-V Advance Web/Internet Programming (Overview): J2ME, J2EE, EJB, XML.

References:

1. Deitel & Deitel, "JAVA, How to Program"; PHI, Pearson.
2. E. Balaguruswamy, "Programming In Java"; TMH Publications
3. The Complete Reference: Herbert Schildt, TMH
4. Peter Norton, "Peter Norton Guide To Java Programming", Techmedia.
5. Merlin Hughes, et al; [Java Network Programming](#) , Manning Publications/Prentice Hall

List of Program to be perform (Expandable)

1. Installation of J2SDK
2. Write a program to show Concept of CLASS in JAVA
3. Write a program to show Type Casting in JAVA
4. Write a program to show How Exception Handling is in JAVA
5. Write a Program to show Inheritance
6. Write a program to show Polymorphism
7. Write a program to show Interfacing between two classes
8. Write a program to Add a Class to a Package
9. Write a program to demonstrate AWT.
10. Write a program to Hide a Class
11. Write a Program to show Data Base Connectivity Using JAVA
12. Write a Program to show "HELLO JAVA " in Explorer using Applet
13. Write a Program to show Connectivity using JDBC
14. Write a program to demonstrate multithreading using Java.
15. Write a program to demonstrate applet life cycle.

Course Contents

Category	Title	Code	Credit-4C			Theory Paper
DC 5	Material Science and Technology	CM 401	L	T	P	Max.Marks-100 Min.Marks-35 Duration-3hrs.
			3	1	0	

Unit I Mechanical, Thermal & Electrical properties of Materials and their measurement.

Unit II Atomic Structure, Inter atomic attraction, Molecular structure, crystallinity, Solid solutions, crystal imperfections, Electronic structure and Electromagnetic properties/

Unit III Single phase metal deformation, Failure of Metals, Theories of alloying, phase relationship, iron-carbon diagram, Nomenclature of steels, utilization of cast iron, mild steel, stainless steel, lead and graphite in Chemical Engg. System.

Unit IV Theories of Corrosion and corrosion – control, stability of materials in service: Chemical, Thermal and Radiolytic stability.

Unit V Composite materials; Semiconductors, Superconductors, Surface Modifications using linings of plastics, rubber, glass, ceramics etc.

References:

1. VAMLACK; MATERIAL SCIENCE
2. WOOLEF; <Title>; VOL. 1,2,3,4.
3. Perry RH & Don WG; PERRYS CHEMICAL Engineering HAND BOOK; Mc Graw Hill.
4. Murthy; Structures and properties of Engg Materials; TMH
5. Narula; Material science; TMH
6. Vijaya; Material Science; TMH
7. O.P. Khanna; MATERIAL SCIENCE & METALLURGY; Dhanpat Rai Publication.
8. S.K. Hajra Choudhry; MATERIALS SCIENCE & PROCESSES; Indian Book Distrib Co.

COURSE CONTENTS

Category	Title	Code	Credits-4C			Theory Papers
			L	T	P	
Humanities and Science HS 2	Energy Environment Ethics and Society	AU/CE/CM/FT/IP/ME /TX 402	3	1	0	Max Mark-100 Min Mark-35 Duration-3Hrs

Unit 1 Energy: linkage with development, world energy scenario, fossil fuel resource- estimates and duration, India's energy scenario; Finite/ depleting energy resources, coal, oil, gas, nuclear fission, promises and present status of nuclear fusion energy; Renewable energy, solar, hydro, wind, biomass, ocean, tidal, wave and geothermal. Synergy between energy and environment, global environment issues, greenhouse gas emission, global warming, green energy solutions.

Unit 2 Society and environment: exponential growth in population, environmentally optimum sustainable population, free access resources and the tragedy of commons; environment problems and impact of P.A.T (Population, Affluence and Technology), environmentally beneficial and harmful technologies; environment impact assessment policies and auditing interaction between environment, life support systems and socio-culture system.

Unit 3 Ecosystem: definition, concepts, structure, realm of ecology, lithosphere, hydrosphere, biosphere, atmosphere-troposphere-stratosphere; energy balance to earth, matter and nutrient recycling in ecosystems; nitrogen, oxygen, carbon and water cycles, food producers, consumers and decomposers, food chains; biodiversity, threat and conservation of biodiversity. Worldviews and environmentally sustainable economic growth, introduction to Design For Environment (DFE), product lifecycle assessment for environment and ISO 14000; triple bottom-line of economic, environment and social performance; environmental ethics, its world impact and challenges.

Unit 4 (a) Air pollution-primary, secondary; chemical and photochemical reactions, effects of CO, NO, CH and particulates, acid rain, Ozone depletion; monitoring and control of pollutants
(b) Noise pollution-sources and control measures.
(c) Water pollution, analysis and management, heavy metals- and nuclear pollutions; industrial pollution from paper, pharmacy, distillery, tannery, fertilizer, food processing and small scale industries.

Unit 5 Ethics and moral values, ethical situations, objectives of ethics and its study, role morality and conflicts; values, policies and Organization Culture; Non-professional, quasi- and hard-professionals; preventive, personal, common and professional ethics; different ethical value criteria like utilitarian, virtue, right and duty ethics with discussion on the case of priority for improvement of urban (high traffic) or rural (low traffic) intersections causing equal number of fatalities; codes of ethics and their limitations; Institute of engineers code for corporate member, IEEE and ACM professional-code.

References:

1. Miller G. T Jr; Living in the environment; Cengage Publisher.
2. Cunningham W; Principles of Environmental Science: TMH
3. Harris CE, Prichard MS, Rabins MJ, Engineering Ethics; Cengage Pub.
4. Martin; Ethics in Engineering; TMH
5. Govindrajan, Natrajan, Santikumar; Engineering Ethics; PHI pub.
6. Rana SVS; Essentials of ecology and environment; PHI Pub.
7. Gerard Kiely, Environmental Engineering; TMH
8. Khan BH; Non Conventional energy resources; TMH Pub.
9. Raynold G.W. "Ethics in Information Technology; Cengage

COURSE CONTENTS

Category	Title	Code	Credits-4C			Theory Papers
Chemical Engineering DC-6	Fuel Technology	CM 403	L	T	P	Max Marks-100 Min Marks-35 Duration-3 Hrs
			3	1	2	

Unit I Solid Fuels: Coal & lignite reserves in India, Classifications of coal, Washing of Coal, Analysis of Coal, proximate and ultimate analysis.

Unit II Coal carbonization, Mechanism of Low temperature carbonization and high temperature carbonization, by product recovery from coke oven; properties of coke coal; grinding, pulverization, briquetting of solid fuels.

Unit III Liquid Fuels: Origin of petroleum production, Indian Petroleum resources and their nature, Petroleum processing, distillation, cracking thermal & catalytic, coaking, reforming, Isomerisations, Crude oil classification, Reserves of Hydrocarbon in INDIA, introduction to Petroleum refining & processing, atmospheric & Vacuum crystallization.

Unit IV Petroleum product and their utilization, blending of petrol for octane number boosting, Transport fuels: Disel, Petrol, AVL (Aviation Liquid Fuel), Kerosene, fuel & furnace oil, Testing of petroleum product: Flash Point, pore point, Fire point, Octane number, Cetene number, viscosity and viscosity index, API.

Unit V Gaseous fuels: Natural gas, Synthetic gases, their composition & properties, producer gas, Water gas, Coal Gas, LPG.

References:

1. Sarkar S. – FUEL AND COMBUSTION – 2nd ed. Orient Long men Ltd., Mumbai, 1996

List of Experiments (expandable):

2. To carry on proximate analysis of the given coal sample.
3. To determine the calorific value of the coal by Bomb-Calorimeter method.
4. Crushing, grinding, Pulverising and Screening of solid fuel.
5. To determine the viscosity of the given oil sample by Redwood Viscometer. No. 1 and No. 2
6. To determine the viscosity of a given oil sample by Saybolt viscometer.
7. To determine viscosity of a given coal tar with the help of tar viscometer.
8. To determine the flash and fire points of the given oil sample by Penskey Martin's apparatus..
9. To determine the flash and fire points of the given oil sample by Abel's apparatus.
10. To determine the flash and fire points of the given oil sample by Cleveland apparatus.
11. To determine the carbon residue of the given oil by Ramsbottom method.
12. To determine the carbon residue of the given oil by Conradson method.
13. To find out the calorific value of a gaseous fuel (LPG) by Boy's Gas calorimeter.
14. To determine cloud and pour point of given oil sample (coconut) by cloud and pour point apparatus.
15. To determine the composition of given gas by Orsat apparatus.
16. To determine the sulphur content of the given fuel oil sample by lamp method.
17. To determine the smoke point of the given kerosene sample.

Note: Each student should perform at least eight experiments out the above list.

COURSE CONTENTS

Category	Title	Code	Credits-6C			Theory Papers
Chemical Engineering DC-7	Fluid Particle Mechanics	CM 404	L	T	P	Max Marks-100 Min Marks-35 Duration-3 Hrs
			3	1	2	

Unit I Particulate Solid: Properties of particulate solids Evaluation of size & shape, surface and population of particles, standard screens and screen analysis of solids.

Unit II Size Reduction: Principles of comminution, size reduction; crushing, grinding, pulverizing and ultra fining size reduction equipment, power requirement in comminution.

Unit III Mixing: Mixing of solids, Mixing equipment's, Design & Power requirement of mixers, Mixer effectiveness and mixing index.

Unit IV Separation Principles of Separation techniques for system involving solids, liquids & gases, classification, sedimentation and filtration, Separation equipments.

Unit V Transportation and Handling of Solids Selection of conveying devices for solids: Belt, Chain, Screw – conveyors, Elevators and pneumatic conveying devices; Elementary design aspects of the devices. Visit to Chemical Engg. Industry engaged mainly with Mechanical Operation.

Unit VI Fluidization & Application Particulate & aggregative fluidization, Characteristic of fluidized bed due to particle size, size distribution, shape and density. Pressure drop through a fluidized bed, Character of dense phase fluidization as revealed by pressure drop fluctuations. Up flow and down flow fluidization, Fluid Catalytic process, bed drying, Mass transfer in fluidized beds.

References:

1. Perry RH & Don WG; PERRY'S CHEMICAL Engineering HAND BOOK; Mc Graw Hill.
2. Murthy; Structures and properties of Engg Materials; TMH

List of Experiments:

1. To analyse the given sample by differential, cumulative methods using standard screen.
2. Determination of size and surface area of irregular particles using a measuring gauge.
3. To study the crushing behaviour and to determine the Rittinger's and Bond's constant of the given solid in a Jaw crusher
4. To study the crushing behaviour and to determine the Rittinger's and Bond's constant of the given solid in a ball mill.

Course Contents

Category	Title	Code	Credits -6			Theory Papers
DID 1	Fluid Mechanics	AU/CE/CM/IP/ME 405	L	T	P	Max.Marks-100
			3	1	2	Min.Marks-35 Duration-3hrs.

Unit-I Review of Fluid Properties: Engineering units of measurement, mass, density, specific weight, specific volume, specific gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapor pressure. Fluid Static's : Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and Tainter gates); buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Unit-II Kinematics of Flow : Types of flow-ideal & real , steady & unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streaklines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow nets-their utility & method of drawing flow nets.

Unit-III Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications. Fluid Measurements: Velocity measurement (Pitot tube, Prandtl tube, current meters etc.); flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturimeter, weirs and notches).

Unit-IV Dimensional Analysis and Dynamic Similitude: Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, rotodynamic machines etc.)

Unit-V Laminar Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles.

References: -

1. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
2. Som and Biswas; Fluid Mechnics and machinery; TMH
3. Cengal; Fluid Mechanics; TMH
4. White ; Fluid Mechanics ; TMH
5. Essential of Engg Hyd. By JNIK DAKE; Afrikan Network & Sc Instt. (ANSTI)
6. A Text Book of fluid Mech. for Engg. Student by Franiss JRD
7. R Mohanty; Fluid Mechanics By; PHI
8. Fluid Mechanics; Gupta Pearson.

List of Experiment (Expandable):

1. To determine the local point pressure with the help of pitot tube.
2. To find out the terminal velocity of a spherical body in water.
3. Calibration of Venturimeter
4. Determination of C_c , C_v , C_d of Orifices
5. Calibration of Orifice Meter
6. Calibration of Nozzle meter and Mouth Piece
7. Reynolds experiment for demonstration of stream lines & turbulent flow
8. Determination of metacentric height
9. Determination of Friction Factor of a pipe
10. To study the characteristics of a centrifugal pump.
11. Verification of Impulse momentum principle.

COURSE CONTENTS

Category	Title	Code	Credits 4			Practical
IT 3	Dot.Net	CS/ME/IP 406	L	T	P	Max. Marks-50 Min. Marks-25
			0	0	4	

UNIT I Introduction .NET framework, features of .Net framework, architecture and component of .Net, elements of .Net.

UNIT II Basic Features Of C# Fundamentals, Classes and Objects, Inheritance and Polymorphism, Operator Overloading, Structures. **Advanced Features Of C#** Interfaces, Arrays, Indexers and Collections; Strings and Regular Expressions, Handling Exceptions, Delegates and Events.

UNIT III Installing ASP.NET framework, overview of the ASP .net framework, overview of CLR, class library, overview of ASP.net control, understanding HTML controls, study of standard controls, validations controls, rich controls. **Windows Forms:** All about windows form, MDI form, creating windows applications, adding controls to forms, handling Events, and using various Tolls

UNIT IV Understanding and handling controls events, **ADO.NET-** Component object model, ODBC, OLEDB, and SQL connected mode, disconnected mode, dataset, data-reader **Data base controls:** Overview of data access data control, using grid view controls, using details view and frame view controls, ado .net data readers, SQL data source control, object data source control, site map data source.

UNIT V XML: Introducing XML, Structure, and syntax of XML, document type definition (DTD), XML Schema, Document object model, Presenting and Handling XML. xml data source, using navigation controls, introduction of web parts, using java script, Web Services

References:

1. C# for Programmers by [Harvey Deitel](#), [Paul Deitel](#), Pearson Education
2. **Web Commerce Technology Handbook** by Daniel **Minoli**, Emma **Minoli** , TMH
3. Web Programming by Chris Bates, Wiley
4. XML Bible by Elliotte Rusty Harold ,
5. ASP .Net Complete Reference by McDonald, TMH.
6. DO .Net Complete Reference by Odey, TMH

List of Experiments/ program (Expandable):

1. Working with call backs and delegates in C#
2. Code access security with C#.
3. Creating a COM+ component with C#.
4. Creating a Windows Service with C#
5. Interacting with a Windows Service with C#
6. Using Reflection in C#
7. Sending Mail and SMTP Mail and C#
8. Perform String Manipulation with the String Builder and String Classes and C#:
9. Using the System .Net Web Client to Retrieve or Upload Data with C#
10. Reading and Writing XML Documents with the XML Text-Reader/-Writer Class and C#
11. Working with Page using ASP .Net.
12. Working with Forms using ASP .Net
13. Data Sources access through ADO.Net,
14. Working with Data readers , Transactions
15. Creating Web Application.