



**DR.M.G.R
EDUCATIONAL AND RESEARCH INSTITUTE
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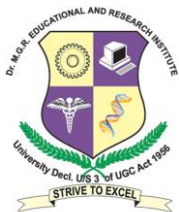
DEPARTMENT OF CHEMICAL ENGINEERING

**B.Tech- Chemical Engineering – Part Time
2013 Regulation**

I SEMESTER						
S.NO	Sub.Code	Title of Subject	L	T	P	C
1.	BMA 13024	Mathematics-I	3	1	0	4
2.	BPH 13005	Physics	3	0	0	3
3.	BCH 13005	Chemistry – I	3	0	0	3
4.	BME 13044	Engineering Graphics	1	0	3	4
Total			10	1	3	14

II SEMESTER						
S.NO	Sub.Code	Title of Subject	L	T	P	C
1.	BMA 13025	Mathematics II for civil and chemical Engineers	3	1	0	4
2.	BEE 13031	Basic Electrical and Electronics	3	0	0	3
3.	BCT 13001	Mechanical Engineering	3	0	0	3
4.	BCE13030	Mechanics of Solids	3	0	0	3
5.	BCH 13006	Chemistry II	3	0	0	3
Total			15	1	0	16

III SEMESTER						
S.NO	Sub.Code	Title of Subject	L	T	P	C
1.	BCT 13003	Computer Application	2	1	1	3
2.	BEE 13034	Electrical Technology	3	0	0	3
3.	BCT 13004	Introduction to chemical process Industries	3	0	0	3
4.	BCT 13005	Chemical Technology	3	0	0	3
5.	BCT 13006	Process in organic synthesis	3	0	0	3
Total			14	1	1	15



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IV SEMESTER						
S.NO	Sub.Code	Title of Subject	L	T	P	C
1.	BCT 13008	Chemical Process Calculation	3	0	0	3
2.	BCT 13009	Chemical Engineering Thermodynamics - I	3	0	0	3
3.	BCT 13011	Fluid Mechanics	3	0	0	3
4.	BCT 13010	Chemical Technology II	3	0	0	3
5.	BCT 13007	Mechanical Operations	3	0	0	3
Total			15	0	0	15

V SEMESTER						
S.NO	Sub.Code	Title of Subject	L	T	P	C
1.	BCT 13012	Chemical Engineering Thermodynamics –II	3	0	0	3
2.	BCT 13013	Chemical Reaction Engineering – I	3	0	0	3
3.	BCT 13014	Mass Transfer – I	3	0	0	3
4.	BCT 13015	Heat Transfer	3	0	0	3
5.	BCT 13017	Process Control and Dynamics	3	0	0	3
Total			15	0	0	15

VI SEMESTER						
S.NO	Sub.Code	Title of Subject	L	T	P	C
1.	BCT 13018	Chemical Reaction Engineering – II	3	0	0	3
2.	BCT 13019	Mass Transfer – II	3	0	0	3
3.	BCT 13020	Transport Phenomena	3	0	0	3
4.	BCT 13021	Safety in Chemical Process Industries	3	0	0	3
5.	BCE 13031	Environmental Science and Engineering	3	0	0	3
Total			15	0	0	15

VII SEMESTER						
S.NO	Sub.Code	Title of Subject	L	T	P	C
1.	BCT 13016	Chemical Process Equipment Design	3	0	0	3
2.	BMG 13002	Elective-I	3	0	0	3
3.	BCT 13L07	Industrial projects with computer simulation	0	0	6	9
Total			6	0	6	15



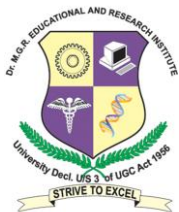
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I+II+III+IV+V+VI+VII=14+16+15+15+15+15+15= 105
Total credits earned for the award of the degree : 105

List of Electives						
S.No	Sub.Code	Course Title	L	T	P	C
1	BCT13E01	Food Technology	3	0	0	3
2	BCT13E02	Air pollution and control	3	0	0	3
3	BCT13E03	Green chemistry and Engineering	3	0	0	3
4	BCT13E04	Environmental Engineering	3	0	0	3
5	BCT13E05	Waste water Treatment	3	0	0	3
6	BCT13E06	Drugs and Pharmaceutical Technology	3	0	0	3
7	BCT13E07	Fertilizer Technology	3	0	0	3
8	BCT13E08	Petroleum Technology	3	0	0	3
9	BCT13E09	Pulp and Paper Technology	3	0	0	3
10	BCT13E10	Polymer Technology	3	0	0	3
11	BCT13E11	Fundamentals of Nano Science	3	0	0	3
12	BCT13E12	Frontiers of Chemical Engineering	3	0	0	3
13	BCT13E13	Professional Ethics in Engineering	3	0	0	3
14	BCT13E14	Industrial Instrumentation	3	0	0	3
15	BMG13002	Total Quality Management	3	0	0	3



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DEPARTMENT OF CHEMICAL ENGINEERING

SEMESTER I

BMA13024

MATHEMATICS I

3 1 0 4

OBJECTIVE:

- The aim of this course is to introduce the concepts of Matrices, Analytic functions and, Fourier series to chemical students.

UNIT I MATRICES

12 Hrs

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values – Cayley - Hamilton theorem (without proof) – Orthogonal reduction of a symmetric matrix to Diagonal form.

UNIT II DIFFERENTIAL EQUATIONS

12Hrs

Linear differential equations of second order with constant coefficients – Euler's equation – Simultaneous equations of first order with constant coefficients.

UNIT III ANALYTIC FUNCTIONS

12Hrs

Analytic functions – Cauchy Riemann equations in Cartesian and Polar form – Properties of analytic functions – Construction of analytic functions – Simple Transformations – Standard transformations : $w = z^2$, $w = e^z$, $w = \sin z$, $w = \cosh z$ – Bilinear transformations.

UNIT IV COMPLEX INTEGRATION

12Hrs

Cauchy's integral theorem (without proof) – Cauchy's integral formulae (without proof) – Taylor's and Laurent's series (without proof) – Singularities: Types – Residues – Cauchy's residue theorem (without proof) – Evaluation of real integrals by Contour Integration (excluding poles on real axis)

UNIT V FOURIER SERIES

12Hrs

Dirichlet's conditions – General Fourier series – Half range Sine & Cosine series – Parseval's identity – Harmonic Analysis.

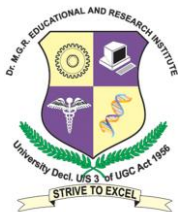
Total no. of Hrs: 60

Text Books:

1. Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2007).
2. Veerarajan T., *Engineering Mathematics (for semester III)*, Tata McGraw Hill Publishing Co., (2005).

Refernces:

1. Singaravelu, *Transforms and Partial Differential Equations*, Meenakshi Agency, (2009).
2. Kreyszig E., *Advanced Engineering Mathematics (9th ed.)*, John Wiley & Sons, (2011).
3. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers, (2012).



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DEPARTMENT OF CHEMICAL ENGINEERING

BPH13005

PHYSICS

3 0 0 3

OBJECTIVE:

- To introduce the basic physics concepts relevant to different branches of Engineering and Technology

UNIT I PROPERTIES OF MATTER

9Hrs

Elasticity – Stress-Strain diagram – Factors affecting elasticity – Twisting couple in a wire – Torsion Pendulum – Determination of Moment of Inertia and Rigidity Modulus – Bending Moment – Depression of a Cantilever – Determination of Young's Modulus by uniform and non-uniform bending – I shaped girders.

UNIT II ACCOUSTICS AND ULTRASONICS

9Hrs

Classification of sound – Characteristics of musical sound – Units of Loudness – decibel and phone – intensity of sound – Acoustic Pressure – Acoustics of Building – Reverberation time – Sabine's formula – absorption coefficient – sound absorbing materials – sound insulation in machines – ultrasonic – production, properties and applications.

UNIT III OPTICS AND LASERS

9Hrs

Principles of interference – coherent sources – Young's double slit experiment – Expression for band width – Fresnel's biprism – Fresnel and Fraunhofer diffraction – Plane diffraction grating – Theory and determination of wave lengths – Polarization – Double refraction – Nicol Prism – Production and analysis of different polarized lights – Optical activity – Polarimeter – Principle and characterization of LASER – He-Ne LASER – Application of LASER

UNIT IV MODERN PHYSICS

9Hrs

Quantum nature of energy – Dual nature of Matter – Einstein's Mass – Energy relation – Nuclear fission – Controlled chain reaction – Nuclear power reactor – Nuclear fusion – Crystalline and Non-Crystalline solids – Unit cell and Bravais Lattices – Miller indices – Packing factors of SC, BCC and FCC.

UNIT V NON-DESTRUCTIVE TESTING

9Hrs

Different steps involved in Non-destructive testing – Principles of X-ray radiographic techniques – Comparison between X-ray radiography and Gamma ray radiography – Liquid penetrant method – Ultrasonic method – Magnetic and electrical methods.

Total no. of Hrs: 45

Text Books:

1. Arumugam. M., "Engineering Physics", Anuradha Publishers, 1998.
2. Srinivasan, M.R., "Physics for Engineers", New Age International (P) Ltd., 1998.
3. Kin Sleer. L. E and Frey, A.R., "Fundamentals of Acoustics", Wiley Eastern Ltd., 1996.
4. Woodcock, J.P., "Ultrasonics", Adam Hilger Ltd., 1979.
5. McGonagle, W.U., "Non-destructive Testing Methods", McGraw Hill Book Co., 1961

References:

1. Masilamani, V and Azzeer, A. M., "Laser the light extraordinary", Anuradha Agencies, 1999.
2. Halliday, Resnick and Krane, "Physics Vol.II, John Wiley and Sons (P) Ltd., 1994.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCH13005 **CHEMISTRY - I** **3 0 0 3**

OBJECTIVE:

- To get an insight into energy sources and to understand the basics relevant to polymer materials and to control pollution

UNIT – I WATER

9Hrs

Sources and impurities – hardness of water – expression and estimation by EDTA – treatment of Water for boilers – Lime soda, Zealot and De-ionization Process – Internal treatment of boiler Water – Domestic Water Treatment – Coagulation, filtration and disinfecting – Reverse Osmosis.

UNIT – II ENERGY SOURCES

9Hrs

Classification of fuels – Gross and net Calorific Values – Proximate Analysis of Coal – Manufacture of coke – Refining of Petroleum – Cracking – Thermal and Catalytic – Petrol Knocking, Octane number – Unleaded Petrol – Diesel Knocking, Cetane number – Water Gas, Producer Gas and Bio-gas.

UNIT – III CORROSION AND ITS CONTROL

9Hrs

Corrosion – Chemical and Electrochemical – Factors affecting Electrochemical corrosion – Surface Anode, impressed current Cathodic protection – Surface Treatments and protective Coatings – Oil paint – Specail paints – Heat Resistant, fire retardant and luminous.

UNIT – IV POLYMERIC MATERIALS

9Hrs

Polymers – Addition and condensation – Thermoplastics and Thermosetting plastics – Preparation and uses of Polythene, PVC, Teflon, Terylene and Bakelite – Compounding of Plastics – natural Rubber – Vulcanization of Rubber – Synthetic Rubbers – Butyl, Nitrile and Styrene – Butadiene Rubber – Adhesives – Epoxides, urethanes and silicones.

UNIT – V POLLUTION AND ITS CONTROL

9Hrs

Causes of air and Water pollution – primary and secondary pollutants – Assessment of Water pollution – Definition and significance of BOD, DO and COD – Primary and Secondary treatment of Sewage – Environmental impact on Acid Rain, Green House Effect and Global Warming, Ozone Depletion – Smog – Pollution control by Cottrell Precipitator, Bio-filter and absorption towers.

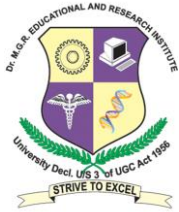
Total no. of Hrs: 45

Text books:

1. M.R. Balasubramanian, S. Krishnamurthy and V.Murugesan, “Engineering Chemistry”, Allied Publishers Ltd., 1993.
2. M.Karunanidhi, N. Ayyaswami, T. Ramachandran and H. Venkatraman, “Applied Chemistry”, Anuradha Agencies.

References:

1. P.C.Jain and Monik Jain, Engineering Chemistry, Dhanpath Raj and sons, Delhi 1993.
2. C.Daniel Yesudasan, “Engineering Chemistry”, Hi-tech Publications, 1999.



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DEPARTMENT OF CHEMICAL ENGINEERING

BME13044

ENGINEERING GRAPHICS

1 0 3 4

OBJECTIVES:

- To develop graphic skills for communications of concepts, ideas and design of Engineering products and expose to pictorial view of simple machines with basic commands.

UNIT – I PROJECTION OF POINTS, LINES AND PLANE SURFACES

9Hrs

Size layout and folding of drawing sheets – lettering and dimensioning – Orthographic projection of points – Projection of straight lines – Projection of planes

UNIT – II PROJECTION OF SOLIDS

9Hrs

Projections of simple solids like prism, pyramid, cylinder, cone and sphere – selection of solids like prism, pyramid, cylinder, cone and sphere in simple positions.

UNIT – III DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTION

9Hrs

Development of surfaces of solids – Prism, pyramids, cylinder, cone, sphere and cut solids

UNIT – IV ORTHOGRAPHIC PROJECTION

9Hrs

Isometric projections of solids (for simple objects)

UNIT – V COMPUTER AIDED DRAFTING

9Hrs

Conversion of pictorial view to orthographic view of simple machine members – Basic Auto-CAD commands.

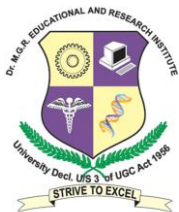
Total no. of Hrs: 45

TEXT BOOKS:

1. Venugopal, K. “Engineering Drawing and Graphics”, New Age International, Reprint, 2002.

REFERENCES:

1. N.D.Bhatt, “Elementary Engineering Drawing”, (first angle projection), Charotar Publishing Co., anand, 2003.
2. K.R. Gopalkrishnan, “Engineering Drawing”, Suba Publications, Bangalore, 2002.



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DEPARTMENT OF CHEMICAL ENGINEERING

SEMESTER II

BMA 13025 MATHEMATICS II FOR CIVIL AND CHEMICAL ENGINEERS 3 1 0 4

OBJECTIVE:

- The aim of this course is to introduce the concepts of Partial differential equations and, Transform methods for chemical students.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12Hrs

Formation of PDE by eliminating arbitrary constants and eliminating arbitrary functions – Solutions of standard types of first order equations – Lagrange's equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12Hrs

Classification of second order linear partial differential equations – Solutions of one dimensional wave equation, one-dimensional heat equation – Steady state solution of two dimensional heat equation (Cartesian coordinates only) – Fourier series solutions.

UNIT III LAPLACE TRANSFORMS I 12Hrs

Transforms of simple functions – Properties of Transforms – Inverse Transforms – Transforms of Derivatives and Integrals.

UNIT IV LAPLACE TRANSFORMS II 12Hrs

Periodic functions – Initial and final value theorems – Convolution theorem – Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients.

UNIT V FOURIER TRANSFORM 12Hrs

Statement of Fourier integral theorem – Fourier transform pairs – Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's theorem.

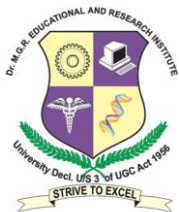
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TEXT BOOKS

1. Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2007).
2. Veerarajan T., *Engineering Mathematics (for semester III)*, Tata McGraw Hill Publishing Co., (2005).

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1. Singaravelu, *Transforms and Partial Differential Equations*, Meenakshi Agency, (2009).
2. Kreyszig E., *Advanced Engineering Mathematics (9th ed.)*, John Wiley & Sons, (2011).
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DEPARTMENT OF CHEMICAL ENGINEERING

BEE13031 BASIC ELECTRICAL AND ELECTRONICS 3 0 0 3

OBJECTIVE:

- To gain knowledge on circuit systems and digital measuring instruments required for instrumental analysis for chemical students

UNIT I DC CIRCUITS

9Hrs

Definition of electrical quantities – electric circuits – Kirchoff's laws- voltage division and current division – star- delta transformation- solution to simple circuits.

MAGNETIC CIRCUITS – Definition of Magnetic quantities – leakage flux and fringing effect – Magnetic circuit analysis – core losses – self inductance and mutual inductance – coefficient of coupling – Faraday's laws of induction – induced EMF

UNIT II AC FUNDAMENALS

9Hrs

Generation of alternating EMF – RMS and average value of periodic wave forms –Form factor and peak factor – Phase and Phase difference.

AC CIRCUITS: Representation of AC quantities in rectangular and polar form Analysis of RL, RC and RLC series AC circuits – Power and power factor. Three phase circuits – Line and phase values (analysis of balanced system only)

UNIT III ELECTRONICS

9Hrs

PN junction diode –Construction and Characteristics – Rectifier circuits –Zener diode- Voltage regulation – Bipolar junction transistors – Construction and Characteristics – common base and common emitter circuits – Transistor as an amplifier – Transistor as a switch.

UNIT IV DIGITAL SYSTEMS

9Hrs

Number system: Binary system, Decimal to binary, Octal system, Hexadecimal system, Binary – addition, subtraction, multiplication and division.

Logic gates; OR, AND, Exclusive – OR, NOR, NOT, NAND gates. Logic networks, Gate standardization, simple combinational logic circuits.

UNIT V MEASURING INSTRUMENTS:

9Hrs

Classification of measuring instruments Basic principles of indicating instruments- constructional details and working of PMMC, MI and Dynamometer type instruments as voltmeter/ammeter/wattmeter – Construction and working of single phase energy meter-Cathode ray oscilloscope.

Transducers: Classification – LVDT –Strain gauge – Hall effect transducers – piezo – electric and photo – electric transducers.

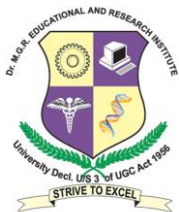
Total no. of Hrs: 45

TEXT BOOKS:

1. "Hughes Electrical technology", revised by I.M.C. Kenzie Smith, low price edition, Pearson Education, Seventh edition (2001).

REFERENCES

1. R.Muthusubramaniam, S.Salivahanana, K.A.Muraleedharan, "Basic Electric and Computer Engineering", Tata Mcraw Hill Publishing company, (2000)
2. T. Thygarajan, K.P.Sendur Chelvi, T.R.Rangaswamy, "Engineering Basic Electrical, Electronics and computer engineering", New age international (p) Limited, (1997)
3. M.S.Naidu, S.Kamashaiah, "Introduction to Electrical Engineering", Tata McGraw Hill Publishing Company, (2000).



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13001

MECHANICAL ENGINEERING

3 0 0 3

OBJECTIVE:

- To get insight into thermodynamic concepts and to study about properties of various engine systems

UNIT I LAWS OF THERMODYNAMICS

9Hrs

Basic concepts and hints; Zeroth law; First Law of Thermodynamics - Statement and application; Steady flow energy equation; Second law of Thermodynamics - Statement; Limitations Heat Engine; Heat Pump, Available energy, Kelvin - Plank statement and Clausius statement; Equivalence entropy; Reversibility; Entropy charts; Third law of Thermodynamics - Statement.

UNIT II HEATING AND EXPANSION OF GASES AND AIR STANDARD EFFICIENCY

9Hrs

Expressions for; work done; Internal energy, Hyperbolic and polytropic processes; Free expansion and Throttling. Carnot cycle; Stirlings Cycle: Joule Cycle; Otto Cycle; Diesel Cycle; Dual combustion Cycle.

UNIT III I.C. ENGINES, STEAM AND ITS PROPERTIES

9Hrs

Engine nomenclature and classifications; SI Engine: CI Engine; Four Stroke cycle' Two stroke cycle; Performance of I.C. Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption.

Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Superheated steam. Use of steam tables; volume of wet steam; Volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle; Modified Rankine cycle.

UNIT IV STEAM ENGINES AND TURBINES AND SIMPLE MECHANIS

9Hrs

Hypothetical indicator diagram of steam engine; Working of a simple steam engine; steam turbines - Impulse and Reaction types - Principles of operation.

Kinematic Link, Kinematic Pair Kinematic Chain; Slider Crank mechanism and inversions; Double slider crank mechanism and inversions.

UNIT V FLY WHEEL, DRIVES AND BALANCING

9Hrs

Turning moment Diagram; Fluctuation of Energy; Design of fly wheel. Belt and rope drives; Velocity ratio; slip; Ratio of tensions; Length of belt; Maximum HP; simple compound and Epicyclic gear trains. Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

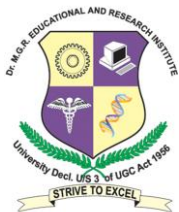
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TEXT BOOKS:

1. Smith, "Chemical Thermodynamics ", Reinhold Publishing Co., 1977.
2. Bhaskaran, K.A., and Venkatesh, A., "Engineering Thermodynamics ", Tata McGraw Hill, 1973.

REFERENCES:

1. Pandya A. and Shah, "Theory of Machines ", Charatakar Publishers, 1975.
2. Nag, P.E., " Engineering Thermodynamics ", II Edition, Tata McGraw Hill Publishing Co., Ltd., 1995.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCH13006

CHEMISTRY- II

3 0 0 3

OBJECTIVE

To understand the phase changes which will be help to understand the thermodynamic, heat transfer and mass transfer applications, also to know about the speciality materials

UNIT I ORGANO METALLIC COMPOUNDS AND HETEROCYCLIC COMPOUNDS 9Hrs

Grignard reagents and their synthetic utility - Organo Silicon compounds. Furan, Thiophone, Pyrrole, Pyridine, and Indole - Their important derivatives

UNIT II DYES AND DYEING 9Hrs

Colour and Constitution - Synthesis of some important azodyes (Methyl orange, Methyl red and Congo red) - Synthesis of Triphenylmethane dyes (Malachite green, Para Rosaniline Anthraquinone dyes (Alizarin). - Phthalein dyes - Eosin preparation - Introduction to Natural and Reactive dyes

UNIT III PHARMACEUTICAL CHEMISTRY 9Hrs

Synthesis of antimalarial drugs - Isopentaquine and chloroquine - Antibacterial drugs - Synthesis of sulphanilamide, sulphaphyridine.

UNIT IV COLLOIDS 9Hrs

Introduction to colloids - properties of colloids – Electro kinetic phenomena - Donnan Membrane equilibrium -Emulsions - Gels - colloidal electrolytes.

UNIT V PHOTOCHEMISTRY 9Hrs

Laws of Photochemistry, Quantum efficiency, Photo chemical reactions, Actinometry, Kinetics and mechanism of Hydrogen - Bromine reaction.

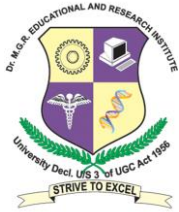
Total No of Hrs :45

TEXT BOOKS:

1. Puri B.H. and Sharma L.R., "Principles of Physical Chemistry ",S.Nagin Chand and Company, Delhi (1994).
2. Kund and Jain, " Physical Chemistry ", S. Chand and Company, Delhi (1996).
3. Gordon M.Barrow, " Physical Chemistry ", Sixth Edition, Tata McGraw Hill (1998).
4. Agarwal, O.P.," Synthetic Organic Chemistry ", Vth Edition, 1980-81, Goel Publishing house, Meerut.
5. Ashutoshkar, " Medicinal Organic Chemistry ",NewAge International Private Ltd., 1993, Chennai.

REFERENCES:

1. Bahl, B.S. and Arun Bahl, " Advanced Organic Chemistry ", IIIrd Edition(1994),Sultan Chand and sons, New Delhi.
2. Mrs. Lakshmi, S., " Pharmaceutical Chemistry ", First Edition (1995),Sultan Chand and Sons, New Delhi.
3. Morrison, R.T. and Boyd, R.N., " Organic Chemistry ", VI Edition,Prentice Hall Inc.(1996), USA.
4. Tiwari, K.S., Vishnoi, N.K. and Vishnoi, S.N., " A Text book of Organic Chemistry ",Second Edition, Vikas Publishing House (1998), New Delhi.



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DEPARTMENT OF CHEMICAL ENGINEERING

BEE 13034

ELECTRICAL TECHNOLOGY

3 0 0 3

OBJECTIVE

- To gain knowledge on circuit systems, machines, transformers and drives.

UNIT I DC CIRCUITS

9Hrs

Introduction - circuit parameters - Kirchhoff's laws - circuit reduction techniques - Thevenin's Theorem - Maximum power transfer theorem.

AC CIRCUITS: RMS and average value of periodic waves - form factor - phase and phase difference - RL, RC, RLC circuits - power and power factor - Introduction to three phase systems - solution of balanced three phase circuits.

UNIT II D.C. MACHINES

9Hrs

Construction details of DC machines - principles of operation of DC generator - EMF equation - Characteristics of DC generators - principle of DC motor - Back EMF - Torque equation - Characteristics shunt, series and compound motors - Losses and efficiency - Starters - Speed control - applications.

UNIT III TRANSFORMERS

9Hrs

Principles of ideal transformers - constructional details - EMF equation - Equivalent circuit - Voltage regulation - losses and efficiency - OC and SC tests on transformer - Autotransformer - Power supplies - basic principle of SMPS and UPS.

UNIT IV SYNCHRONOUS MACHINES AND INDUCTION MOTORS

9Hrs

CONSTRUCTION DETAILS - PRINCIPLES OF ALTERNATOR -

Construction details - principle of alternator - EMF equation - Voltage regulation - starting of synchronous motor - effect of field excitation - Induction motor - principle of operation - torque equation - torque-slip characteristics - starting methods and speed control - principle of single-phase induction motor - applications (Qualitative treatment only).

UNIT V ELECTRICAL DRIVES

9Hrs

Types of Electrical drives - Factors influencing the Choice of Electrical Drives, Heating and Cooling Curves - Loading Conditions and Classes of Duty - Determination of Power Rating - Drives for textile mills, Steel rolling mills, machine tools and Cranes & Hoist Drives. (Quantitative Treatment only)

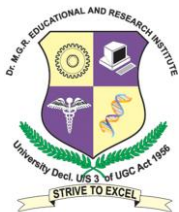
Total No of Hrs: 45

TEXT BOOKS:

1. S.K.Battacharya, "Electrical Machines" Tata McGraw Hill Publications, 2nd Edition, 1998.
2. Sudhakar & Shyammoan, "Circuits & Networks Analysis & Synthesis", Tata McGraw Hill, 2001.

REFERENCES:

1. J.A.Edminister, "Theory and Problems on Electrical Circuits" McGraw Hill, 1994.
2. I.J.Nagrath & D.P.Kothari, "Electrical Machines", TMH publications



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13004 INTRODUCTION TO CHEMICAL PROCESS INDUSTRIES 3 0 0 3

OBJECTIVE

- To make the students understand the basic requirements of chemical process industries.

UNIT I : WATER

9Hrs

Hard and soft – Industrial water – Water treatment – R.O – Boiler feed water.

UNIT II: STEAM

9Hrs

Properties – steam generators – solid, gas fuel fired – fluidized beds – scaling – steam traps accessories – types of fuels.

UNIT III: REFRIGERATION

9Hrs

Methods – refrigerants –refrigeration cycle – theory. compressed air –compressors – Humidification – equipments – cooling towers.

UNIT IV :CORROSION

9Hrs

Theory – measurement of corrosion – corrosion protection methods.

UNIT V :MATERIALS OF CONSTRUCTION

9Hrs

Materials of construction in process industries – important metals and alloys – their properties – non-metals and their properties – polymers and their properties.

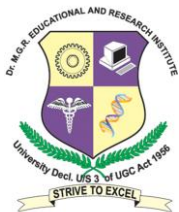
Total No of Hrs: 45

TEXT BOOK:

1. Eckenfelder – “*Industrial water pollution control* “ –McGraw Hill 1966
2. P.L.Balleney – “*Thermal engg*” Khanna publishers 1986

REFERENCES:

1. Perry’s “*Chemical Engineers Hand book*”.
2. P.N.Anandha Narayanan “*Basisrefrigerayion and air conditioning* “
Tata McGraw hill 2007



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13009 CHEMICAL ENGINEERING THERMODYNAMICS –I 3 0 0 3

OBJECTIVE:

- To understand the theory and applications of classical thermodynamics, thermodynamic properties, equations of state, methods used to describe and predict phase equilibria.

UNIT – I FUNDAMENTAL CONCEPTS IN THERMODYNAMICS 9Hrs

Introduction – systems – surrounding – thermodynamic property – heat – work – energy forms

UNIT - II FIRST LAW OF THERMODYNAMICS 9Hrs

First law of thermodynamics - batch systems – open systems – applications – chemical reactions

UNIT - III SECOND LAW OF THERMODYNAMICS 9Hrs

Second law -carnot's principle – reversible – irreversible processes – entropy –criterion for reversible – irreversible – entropy balance

UNIT - IV REFRIGERATION AND LIQUEFACTION 9Hrs

Heat engines – refrigeration – cycles.

UNIT – V THERMODYNAMIC PROPERTIES OF FLUIDS 9Hrs

Fluids – state equations – ideal gas – actual gas equations – application.

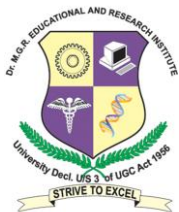
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TEXT BOOKS

1. Smith, J.M., and Van Ness, H.C., "Introduction to Chemical Engineering Thermodynamics ", Kogakushai 1976.
2. Narayanan K.V" A text book of chemical engineering thermodynamics" Prentice Hall of India Pvt. Ltd 2001

REFERENCES

1. Hougen, O.A., Watson, K.M., and Ragatz, R.A., " *Chemical Process Principles Part II, Thermodynamics* ", John Wiley 1970.
2. Dodge, B.F., " *Chemical Engineering Thermodynamics* ", McGraw-Hill, 1960.
3. Sandler, S.I., " *Chemical and Engineering Thermodynamics 2nd edn.* ", Wiley, 1989.
4. Kyle, B.G., " *Chemical and Process Thermodynamics 2nd edn.* ", Prentice Hall of India Pvt.Ltd., 1990.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13011

FLUID MECHANICS

3 0 0 3

OBJECTIVE

- To understand basic concept of fluid flow and its application to chemical process industries including pipe flow, fluid machinery and agitation and mixing.

UNIT I INTRODUCTION

9Hrs

Concept of fluid - the fluid as a continuum - properties of a fluid – density -viscosity –surface tension – heat capacity – vapour pressure.

UNIT II FLUID STATICS

9Hrs

Application to manometry – Floatation – gravity settling – centrifugal separation – acceleration.

UNIT III FLOW OF FLUIDS

9Hrs

Bernoulli's theorem and application – laminar flow – turbulent flow – pressure drop – Newtonian and non-Newtonian flow.

UNIT IV COMPRESSIBLE FLUID FLOW

9Hrs

Mach no – nozzle flow – flow of fluid through packed bed – fluidization.

UNIT V INDUSTRIAL PIPING

9Hrs

Valves – fluid moving machinery – pumps – characteristics of centrifugal pump – other types of pumps – compressors – work – blowers of pumps

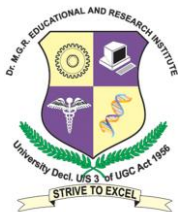
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Text Books

1. Noel de Nevers, "*Fluid Mechanics for Chemical Engineers*", Second Edition, McGraw-Hill, 1991.
2. McCabe, W.L, Smith J.C and Harriot .P., "*Unit Operations in Chemical Engineering*", McGraw-Hill, Sixth Edition 2000.

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1. *Chemical engineering hand book* by Perry.
2. White, F.M., "*Fluid Mechanics*", 4th Edition, McGraw-Hill Inc., 1999.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13010

CHEMICAL TECHNOLOGY-II

3 0 0 3

OBJECTIVE

- To make the students understand the various unit operations and unit processes practiced in chemical industries.

UNIT I PULP AND PAPER INDUSTRIES

9Hrs

Wood and Wood extracts – Wood Chemicals - Cellulose derivatives, Manufacture of pulp – different processes of pulping – Manufacture of paper – Manufacture of Boards

UNIT II SUGAR, STARCH INDUSTRIES AND OILS, FATS, SOAPS AND DETERGENT INDUSTRIES

9Hrs

Raw and refined sugar, by products of sugar industries, Starch and starch derivatives. Vegetable oils and animal fats, their nature, analysis and extraction methods, hydrogenation of oils, fatty acids and alcohols, waxes, soaps, synthetic detergents.

UNIT III PETROLEUM AND PETROCHEMICAL INDUSTRIES

9Hrs

Petroleum refining, physical and chemical conversion products, lubricating oils, petrochemical precursors, methane, olefines, acetylenes and aromatics and products obtained from them by various unit processes.

UNIT IV RUBBER AND POLYMERS

9Hrs

Monomers – Thermosetting and Thermoplastic materials – General properties and Applications of Resins – Polymerisation processes – different types - Natural rubber; Synthetic rubber such as SBR, NBR, CR - Fundamental methods of processing of synthetic Rubbers.

UNIT V SYNTHETIC FIBRE AND FILM INDUSTRIES

9Hrs

Natural and synthetic fibres – properties of - Poly amides – manufacture of Nylon 6. 6. Polyesters Fibres – manufacturer of – Cellulosic Fibres – Viscose Rayon production manufacture of films - cellulose Acetate, PVC, Polyesters - polyethylene

Total No of Hrs: 45

Text Books

1. Austin, G.T., " *Shreve's Chemical Process Industries* ", Fifth Edition, McGraw-Hill International Book Co, Singapore, 1984.
2. Dryden, C.E., " *Outlines of Chemical Technology* ", Edited and Revised by Gopala Rao. M. and M.Sittig, Second edition, Affiliated East-West press, 1993.

References

1. Kent, J.A.(ed), " *Riggel's Hand Book of Industrial Chemistry* ", Van Nostrand Reinhold, 1974.
2. *CHEMTECH 1-4*, Chemical Engineering Education Development Centre I.I.T., Madras 1975-78.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13007

MECHANICAL OPERATIONS

3 0 0 3

OBJECTIVE

- To make the students familiar with basic principles of practical size measurement and distribution.
- To acquire basic knowledge in practical technology and phenomena relevant to specific surface of particles.

UNIT I PARTICLE CHARACTERISTICS AND SIZE ANALYSIS

9Hrs

General characteristics of solids, their behaviour under different external forces, agglomeration, techniques for size analysis.

UNIT II SIZE REDUCTION

9Hrs

Laws of size reduction, classification of equipment, methods of size reduction, disintegration, preparation of colloids.

UNIT III MECHANICAL SEPARATIONS

9Hrs

Screening and Screening equipment, effectiveness of screens, gravity settling, sedimentation, thickening, centrifugal separation, impingement methods, industrial dust removing equipment with special reference to electrostatic and magnetic separators, heavy media separations, floatation.

UNIT IV FILTRATION, MIXING AND AGITATION

9Hrs

Theory of filtration, Batch and continuous filters, centrifuges, membrane and ultra filtration. Equipment for blending and kneading, dispersion, power for agitation, correlations.

UNIT V STORAGE AND CONVEYING OF SOLIDS

9Hrs

Conveyors, elevators, pneumatic conveying, Different methods for storage of solids.

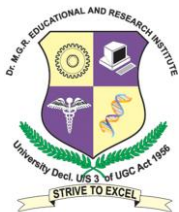
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TEXT BOOK

1. McCabe, W.L, Smith J.C and Harriot, P., " *Unit Operations in Chemical Engineering* ", McGraw-Hill Fourth Edition, 1984.

REFERENCES

1. Coulson, J.M., Richardson, J.F., " *Chemical Engineering* ", Volume 2, Third Edition, Pergamon Press, 1977.



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DEPARTMENT OF CHEMICAL ENGINEERING

SEMESTER V

BCT13012 CHEMICAL ENGINEERING THERMODYNAMICS-II 3 0 0 3

OBJECTIVE:

- To provide knowledge of thermodynamic properties of real fluids and mixtures to design chemical process plants.

UNIT I APPLICATION OF THERMODYNAMICS TO GAS EQUATIONS 9Hrs

Partial derivatives—exact differentials – Maxwells relations – thermodynamic – properties equation – application to actual gas equation.

UNIT II FUGACITY CORRELATIONS 9Hrs

Residual properties – fugacity – fugacity coefficient - correlation

UNIT III SOLUTION THERMODYNAMIC THERORY 9Hrs

Solutions – actual – ideals – excess free energy – activity – activity coefficients – correlations

UNIT IV V.L.E FROM EQUATION OF STATES 9Hrs

V.L.E correlation – data generation – result – gas – liquid system – Henry's law – liquid – liquid , liquid – solid gas – solid equilibrium.

UNIT V CHEMICAL REACTION EQUILIBRIA 9Hrs

Chemical reaction equilibrium – equilibrium constant – calculations

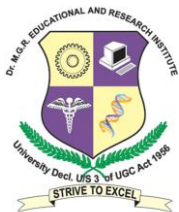
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TEXT BOOKS

1. Smith , J.M., Van Ness, H.C., " *Introduction to Chemical Engineering Thermodynamics* ", Kogakushai 1976.
2. Kyle, B.G., "*Chemical and Process Thermodynamics 2nd edn.* "Prentice Hall of India Pvt.Ltd., 1990.

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1. Hougen, O.A., Watson, K.M., and Ragatz, R.A., "*Chemical Process Principles Part II*", Thermodynamics, John Wiley..
2. Dodge, B.F., "*ChemicalEngineering Thermodynamics* ", McGraw-Hill, 1
3. Sandler, S.I., "*Chemical and Engineering Thermodynamics* ", 2nd Edition., Wiley.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13013

CHEMICAL REACTION ENGINEERING-I

3 0 0 3

OBJECTIVES:

- To apply knowledge from calculus, differential equations, thermodynamics, general chemistry, and material and energy balances to solve reactor design problems.
- To examine reaction rate data to determine rate laws, and to use them to design chemical reactors.
- To simulate several types of reactors in order to choose the most appropriate reactor for a given need, To design chemical reactors with associated cooling/heating equipment)

UNIT I REACTION KINETICS

9Hrs

Law of mass action, rate equation, elementary, non-elementary reactions and their mechanisms, theories of reaction rate and temperature dependency, analysis of experimental reactor data, evaluation of rate equation, integral and differential analysis for constant variable volume system, fitting of data complex reaction mechanism.

UNIT II IDEAL REACTORS

9Hrs

Design for homogeneous systems, batch, stirred tank and tubular flow reactor, design of reactors for multiple reactions, combination reactor system, size comparison of reactors.

UNIT III CHOICE OF REACTORS

9Hrs

Factors affecting choice, optimum yield and conversion, selectivity, reactivity and yield problems, consecutive, parallel and mixed reactions, recycle.

UNIT IV HEAT EFFECTS IN REACTORS

9Hrs

Isothermal and nonisothermal homogeneous reactor systems, adiabatic reactors, rates of heat exchanges for different reactors, design for constant rate heat input and constant heat transfer coefficient, operation, batch and continuous reactors, optimum temperature progression.

UNIT V REACTOR STABILITY AND REACTION EQUILIBRIA

9Hrs

Criteria for stability of reactors, limit cycles and oscillating reaction, parameter sensitivity. Equilibrium in chemically reactive systems, evaluation of reaction equilibrium constant, effect of temperature on equilibrium, application to system involving gaseous components, computation of equilibrium composition.

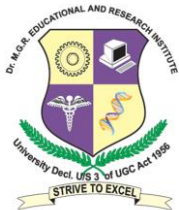
Total No of Hrs: 45

TEXT BOOKS

1. Levenspiel.O, " *Chemical Reaction Engineering* ", John Wiley, Second Edition, 1972.

REFERENCES

1. Smith.J.M., " *Chemical Engineering Kinetics* ", McGraw-Hill Third Edition, 1981.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13014

MASS TRANSFER-I

3 0 0 3

OBJECTIVES

- The purpose of this course is to introduce the undergraduate students with the most important separation equipments in the process industry.
- To provide proper understanding of unit operations.

UNIT I DIFFUSION

9Hrs

Molecular and eddy diffusion in gases and liquids, steady state diffusion under stagnant and laminar flow conditions Diffusivity measurement and prediction, multicomponent diffusion, diffusion in solids and its applications.

UNIT II MASS TRANSFER COEFFICIENTS

9Hrs

Concept of mass transfer coefficients, mass transfer under laminar and turbulent flow past solids, boundary layers, mass transfer at fluids surfaces correlation of mass transfer coefficients, JD , HTU , and NTU concepts, theories of mass transfer and their applications, interphase mass transfer and over all mass transfer coefficients in binary and multicomponent systems, application to gas-liquid and liquid-liquid systems.

UNIT III HUMIDIFICATION AND AIR CONDITIONING

9Hrs

Basic concepts, psychrometric chart construction, Humidification and dehumidification operations, design calculations, cooling tower principle and operation, types of equipment, design calculation.

UNIT IV DRYING

9Hrs

Theory and mechanism of drying, drying characteristics of materials, batch and continuous drying, calculation for continuous drying, drying equipment, design and performance of various drying equipments.

UNIT V CRYSTALLISATION

9Hrs

Nuclei formation and crystal growth, theory of crystallisation, growth coefficients and the factors affecting these in crystallisation, batch and continuous industrial crystallisers, principle of design of equipment.

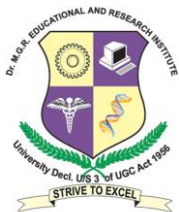
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Text Books

1. McCabe, W.L., Smith, J.C., and Harriot, P., " *Unit Operations in Chemical Engineering* ", McGraw-Hill Edn, 1993.
2. Coulson, J.M., Richardson, J.F., " *Chemical Engineering* " Vol. I, Pergamon Press, 1977.
3. Foust, A.S. Wenzel, L.A., Clump, C.W., Naus, L., and Anderson, L.B., " *Principles of Unit Operations* ", Second Edition, Wiley, 1980.

References

1. Treybal, R.E., " *Mass Transfer Operations* ", McGraw-Hill Kogakusha, 1980.
2. Roman Zarzytci, Andrzej Chacuk, " *Absorption: Fundamentals and Application* ", Pergamon Press, 1993.
3. Skelland, A.H.P., " *Diffusional Mass Transfer* ", Krieger, Malabar FL (1985). Strigle (jr), R.F., " *Packed Tower Design and Applications* ", Second Edition, Gulf Publishing Company, USA., 1994.



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BCT 13015

HEAT TRANSFER

3 0 0 3

OBJECTIVE:

- To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.

UNIT I BASIC PRINCIPLES AND CONDUCTION

9Hrs

Importance of heat transfer in Chemical Engineering operations - Modes of heat transfer - Mean temperature difference. Concept of heat conduction - Fourier's law of heat conduction - one dimensional steady state heat conduction equation for flat plate, hollow cylinder, hollow sphere - Heat conduction through a series of resistances - Analogy between flow of heat and flow of electricity - Thermal conductivity measurement; effect of temperature on thermal conductivity; conduction through liquids.

UNIT II FILM COEFFICIENTS AND THEIR APPLICATION

9Hrs

Individual and overall heat transfer coefficients and the relationship between them - Conduction with heat source - Two dimensional steady state conduction - Analytical and graphical methods - Transient heat conduction.

UNIT III CONVECTION

9Hrs

Concept of heat transfer by convection - Natural and forced convection - Application of dimensional analysis for convection - Equations for forced convection under laminar, transition and turbulent conditions - Equations for natural convection - Heat transfer from condensing vapours, heat transfer to boiling liquids - Influence of boundary layer on heat transfer - Heat transfer to molten metals - Heat transfer in packed and fluidised beds.

UNIT IV HEAT EXCHANGERS

9Hrs

Parallel and counter flow heat exchangers - Log mean temperature difference - Single pass and multipass heat exchangers; plate heat exchangers; use of correction factor charts; heat exchangers effectiveness; number of transfer unit - Chart for different configurations - Fouling factors and wilson's plot - Design of various types of heat exchangers - Design of furnaces - Design of condensers, - Design of tubular reactors.

UNIT V RADIATION AND EVAPORATION

9Hrs

Concept of thermal radiations - Black body concept - Stefan Boltzman's law -concept of grey body - radiation between surfaces.

Types of evaporation - single effect and multiple effect evaporation - Design calculation for single and multiple effect evaporation.

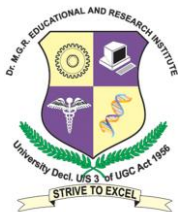
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TEXT BOOKS

1. McCabe, W.L., Smith, J.C., and Harriot, P., " *Unit Operations in Chemical Engineering* ", McGraw-Hill Recent Edn.
2. Binay K.Dutta " *Heat Transfer Principles and Applications* ", Prentice Hall of India, 2001.
3. Kern, D.Q., " *Process Heat Transfer* ", McGraw-Hill - Revised edition - 1999.

REFERENCES

1. Coulson, J.M., Richardson, J.F., " *Chemical Engineering* ", Vol.I., Pergamon and ECBS, 1970.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13019

MASS TRANSFER-II

3 0 0 3

OBJECTIVE

- The subject provides knowledge to design an equipment used in separation process, which in turn has direct impact on the cost of final product.

UNIT I ABSORPTION

9Hrs

Equilibrium and operating line concept in absorption calculations; types of contactors, design of packed and plate type absorbers; Operating characteristics of stagewise and differential contactors, concepts of NTU, HTU and overall volumetric mass transfer coefficients; multicomponent absorption; mechanism and model of absorption with chemical reaction; thermal effects in absorption process.

UNIT II DISTILLATION

9Hrs

Vapour-liquid equilibria, Raoult's law and deviations from ideality, methods of distillation; fractionation of binary and multicomponent system; design calculations by McCabe-Thiele and Ponchon-Savarit, methods; continuous contact distillation tower (packed tower) design; extractive and azeotropic; distillation low pressure distillation; steam distillation.

UNIT III LIQUID-LIQUID EXTRACTION

9Hrs

Equilibrium in ternary systems; equilibrium stagewise contact calculations for batch and continuous extractors, differential contact extraction equipment - spray, packed and mechanically agitated contactors and their design calculations; pulsed extractors, centrifugal extractors.

UNIT IV SOLID-LIQUID EXTRACTION (LEACHING)

9Hrs

Solid-liquid equilibria; leaching equipment-batch and continuous types; calculation of number of stages.

UNIT V ADSORPTION, ION EXCHANGE AND MISCELLANEOUS SEPARATION PROCESSES

9Hrs

Theories of adsorption of gases and liquids; industrial adsorbents, adsorption equipment for batch and continuous operation; design calculation of ion-exchange resins; principle of ion-exchange; industrial equipment. Membrane separation process; solid and liquid membranes; concept of osmosis; reverse osmosis; electrodialysis; their applications; foam separation process; Thermal and sweep diffusion process.

Total No of Hrs: 45

TEXT BOOKS

1. R.E.Treybal, " *Mass Transfer Operations* ", McGraw-Hill, Kogakusha, 1980.
2. W.L.McCabe J.C.Smith, and Harriot. P., " *Unit Operations of Chemical Engineering* ", sixth edition McGraw-Hill. International Edition, 2001.

REFERENCES

1. C.Judson King " *Separation Processes* ", Tata McGraw-Hill 1974.
2. A.H.P.Skelland, " *Diffusional Mass Transfer* ", Krieger, Malapur, FL (1985).
3. Roman Zarfyki and Andrzej Chacuk, " *Absorption Fundamentals and Applications*", Pergamo Press, 1993.
4. P.Wankat " *Equilibrium Stage Separations* ", Prentice Hall, 1993.
5. R.F.Strigle (jr), " *Packed Tower Design and Application* ", 2nd Edn Gulf Publishing company U.S.A. 1994.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13020

TRANSPORT PHENOMENA

3 0 0 3

OBJECTIVE:

- The topic emphasises on development and application of various analysis .
- To give a clear picture of solving problems based on transport process in industries.

UNIT I PHILOSOPHY AND FUNDAMENTALS OF TRANSPORT PHENOMENA 9Hrs

Importance of transport phenomena; analogous nature of transfer process; basic concepts, conservation laws; continuous concept, field, reference frames, substantial derivative and boundary conditions; methods of analysis; differential, integral and experimental methods.

UNIT II TRANSPORT BY MOLECULAR MOTION 9Hrs

Phenomenological laws of transport properties Newtonian and non Newtonian fluids; rheological models; theories of transport properties of gases and liquids; effect of pressure and temperature.

UNIT III ONE DIMENSIONAL TRANSPORT IN LAMINAR FLOW (SHELL BALANCE) 9Hrs

General method of shell balance approach to transfer problems; Choosing the shape of the shell; most common boundary conditions; momentum flux and velocity distribution for flow of Newtonian and non-newtonian fluids in pipes for flow of Newtonian fluids in planes, slits and annulus heat flux and temperature distribution for heat sources such as electrical, nuclear viscous and chemical; forced and free convection; mass flux and concentration profile for diffusion in stagnant gas, systems involving reaction and forced convection.

UNIT IV EQUATIONS OF CHANGE AND THEIR APPLICATIONS 9Hrs

Conservation laws and equations of change; Development of equations of continuity motion and energy in single multicomponents systems in rectangular co-ordinates and the forms in curvilinear co-ordinates; simplified forms of equations for special cases, solutions of momentum mass and heat transfer problems discussed under shell balance by applications of equation of change, scale factors; applications in scale-up

UNIT V TRANSPORT IN TURBULENT AND BOUNDARY LAYER FLOW ANALOGIES BETWEEN TRANSPORT PROCESSES 9Hrs

Turbulents phenomena; phenomenological relations for transfer fluxes; time smoothed equations of change and their applications for turbulent flow in pipes; boundary layer theory; laminar and turbulent hydrodynamics thermal and concentration boundary layer and their thicknesses; analysis of flow over flat surface. ANALOGIES BETWEEN TRANSPORT PROCESSES: Importance of analogy; development and applications of analogies between momentum and mass transfer; Reynolds, Prandtl, Von Karman and Colburn analogies.

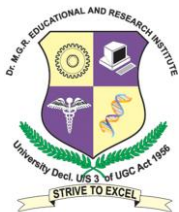
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TEXT BOOK

1. R.B. Bird, W.E. Stewart and E.W. Lightfoot, "Transport Phenomena", John Wiley, 1978
2. Robert, S Brodkey, Harry C. Hershey, "Transport Phenomena", McGraw-Hill International Edn 1988.

REFERENCE

1. L.S.Sissom, and D.R.Pitts, "Elements of Transport Phenomena", McGraw-Hill, New York, 1972.
2. R.W.Fahien, "Elementary Transport Phenomena", McGraw-Hill, New York, 1983.
3. J.R. Welty, R.W. Wilson, and C.W.Wicks, "Fundamentals of Momentum Heat and Mass Transfer", 2nd Edn. John Wiley, New York, 1973.
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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13021 SAFETY IN CHEMICAL PROCESS INDUSTRIES 3 0 0 3

OBJECTIVES

- To impart the principles of safety in chemical process operations.
- To educate the students the importance of safety procedures and safety regulations in chemical industries.

UNIT I INTRODUCTION

9Hrs

Safety in industries – need for development – importance of safety consciousness in Indian Chemical Industry – social environmental setup – Tolerance limit of the society – Psychological attitude towards safety programmes

UNIT II SAFETY PROGRAMMES

9Hrs

Elements of safety programmes – Effective realization – Economic and social benefits – Effective communication training at various levels of production and operation.

UNIT III SAFETY PERFORMANCE

9Hrs

Appraisal – Effective steps to implement safety procedures – Periodic inspection and study of plant layout and constant maintenance – Periodic advice and checking to follow safety procedures – proper selection and replacement of handling equipments – personal protective equipment.

UNIT IV ACCIDENTS

9Hrs

Industrial accidents – accident costs – identification of accident spots – remedial measure – identification and analysis of causes of injury to men and machines – accident prevention – accident proneness – vocational guidance, fault free analysis – Fire prevention and fire protection.

UNIT V HEALTH HAZARDS AND LEGAL ASPECTS

9Hrs

Health hazards – occupational – Industrial health hazards – health Standards and rules – safe working environments – parliamentary legislation – Factories act – Labor Welfare Act – ESI Act – Workmen Compensation Act.

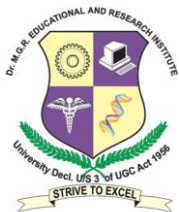
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TEXT BOOK

1. William Handley, *Industrial Safety Hand Book*, Mc Graw-Hill Book Company, 2nd edition, 1969.
2. Fawatt, H.H and Wood, W.S., *Safety and Accident Prevention in Chemical operation*, Interscience, 1965.

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1. Heinrich, H.W, Dan Perterson, P.E and Nester Rood, *Industrial Accident Prevention*, McGraw- Hill, 1980.
2. Blake, R.P., *Industrial Safety*, PHI, III ed, 1963.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13031 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

OBJECTIVE

- To help to master the factors responsible for environmental degradation. Consequences relevant to air, water and soil pollution are included in the syllabus.

UNIT I AIR POLLUTION

9Hrs

Introduction to factors influencing environment-Environmental degradation and consequential hazards-Types of air pollution-Ozone layer depletion-Acid rain-acid jolt-Green house effect and climatic changes-Carcinogenic pollutants.

UNIT II WATER POLLUTION

9Hrs

Introduction of BOD and COD – importance and experimental determination- Waste water treatment and recycling- Methods of sterilization of drinking water- Correlation between dissolved oxygen and quality of water.

UNIT III SOIL POLLUTION

9Hrs

Soil pollution-Saline intrusion- Long range pollution-Consequence of indiscriminate solid waste dumping-Effect of fertilizers and Pesticide residue on the soil-blue jaundice (Cyanosis)-Preparation of bio pesticides.

UNIT IV NOISE POLLUTION

9Hrs

Noise pollution-allowed decibel levels-Health hazards of exposure to noise-Abatement technologies.

UNITV ABATEMENT TECHNOLOGY

9Hrs

Abatement technologies to suit the pollutant-alternate non conventional energy sources-Morbidity and mortality.

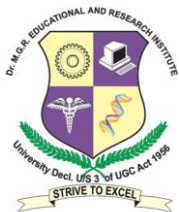
Total No of Hrs: 45

TEXT BOOKS:

1. *Industrial chemistry* by Dr.B.K.Sharma 7th edition.

REFERENCE:

- 1.*Introduction to Environmental Engineering and Science* by Gilbert M.Masters, Prentice Hall, 2004.



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DEPARTMENT OF CHEMICAL ENGINEERING

SEMESTER VII

BCT 13016 CHEMICAL PROCESS EQUIPMENT DESIGN 3 0 0 3

OBJECTIVE

- To acquire basic understanding of design parameter, complete knowledge of design procedures for commonly used process equipment and their attachments (e.g. internal and external pressure vessels, tall vessels, high pressure vessels, supports etc.), and different types of equipment testing methods.

UNIT I VESSELS AND ITS SUPPORTS

9Hrs

Design of storage vessels for non-volatile and volatile fluids – design of pressure vessels – design of vessel supports.

UNIT II HEAT EXCHANGERS AND EVAPORATORS

9Hrs

Design of Heat Exchangers – Double pipe – shell & tube – finned tube – plate heat exchangers – design of evaporators – single & multi effect.

UNIT III ABSORBER AND DISTILLATION COLUMN

9Hrs

Design of mass transfer operation equipment – Absorber – Distillation column – Plate and packed columns.

UNIT IV DRYERS AND COOLING TOWERS

9Hrs

Design of Dryers – Rotary – Spray dryers – cooling towers

UNIT V AGITATED VESSELS, FILTERS AND CYCLONES

9Hrs

Design of Agitated vessels – filters – cyclones

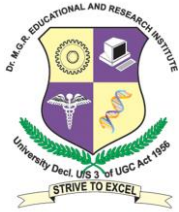
Total No. of Hrs: 45

Text Books:

1. M.V.Joshi and V.V. Mahajan, “*Process Equipment Design*”, MacMillan India Ltd.
2. S.D.Dawande, “*Process Design of Equipments*”, Central Techno Publications, Nagpur, 2000.

References:

1. *Indian Standard Specifications* IS-803, 1962; IS-4072, 1967; IS-2825, 1969. Indian Standards Institution, New Delhi.
2. R.H. Perry, “*Chemical Engineers’ Handbook*”, McGraw Hill.
3. W.L.McCabe, J.C.Smith and Harriet, “*Unit Operation of Chemical Engineering*”, McGraw Hill.
4. Robert Treybal, “*Mass Transfer Operations*”, McGraw Hill.
5. J.M. Coulson and J.Richardson, “*Chemical Engineering*”, vol. 6, Asian Books Printers Ltd.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT 13L07

PROJECT WORK

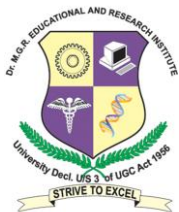
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Project:

Project works are to be done by the students whose duration will be larger than one week.

Criteria for Project Design:

1. Projects suggested by the staff on the basis of collected industrial problem.
2. Projects to cater to development of infrastructure of the department.
3. Projects to cater to preparation for application for funding agents.
4. Projects to cater to obtaining relevant data for doctoral programme.
5. Projects to recalibrate and standardize existing equipment.
6. Projects to establish relevant instrumentation and analytical procedures.
7. Projects to give students an opportunity if they suggest an innovative / alternate approach to the existing solution.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E02

AIR POLLUTION AND CONTROL

3 0 0 3

OBJECTIVE:

- To enable the students to learn about Air Pollution, effects of air pollution.
- Sampling of pollutants, Meteorology and air pollution, atmospheric stability, Plume rise and dispersion and Prediction of air quality

UNIT I INTRODUCTION

9Hrs

Air Pollution Regulatory Framework History – Air Pollution Regulatory Framework - Regulatory System – Laws and Regulations – Clean air Act – Provisions for Recent Developments.

UNIT II AIR POLLUTION GASES

9Hrs

Measurement fundamentals – chemicals and physical properties – Phase 77 –Equebonem conseqoation laws – Incinerators – Design and Performance –Operation and Maintainance - Absorbers – Design operation and improving performances Absorbers.

UNIT III PARTICULATE AIR POLLUTION

9Hrs

Particle Collection mechanisms– Fluid particle Dynamics – Particle size Distribution – Efficiency – Gravity Settling chambers Cyclones- Electrostatic precepatorsBannouses

UNIT IV HYBRID SYSTEM

9Hrs

Heat electrostatic precepitation – Genizing Heat Scrubbers – Dry Scrubbers –Electrostatically Augmented Fabric Fillration

UNIT V AIR POLLUTION CONTROL EQUIPMENT

9Hrs

Introduction – Installation – Cost Model.

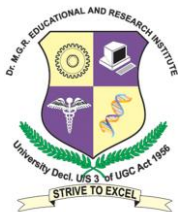
Total No. of Hrs: 45

Text books:

1. Air Pollution Control Engg, Noel de nevey – Mcgrew Hill.

References:

1. Air Pollution Control Equipment Louis Theodore, Burley Intuscence 2008.
2. Air Pollution Control CD Cooper and FC.AlleyWairland Press III Edition2002.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E03

GREEN CHEMISTRY AND ENGINEERING

3 0 0 3

OBJECTIVE:

- To make the students aware of global environmental issues, concepts behind pollution prevention, environmental risks, green chemistry, methods to evaluate environmental costs and life cycle assessments.

UNIT I ENVIRONMENTAL ISSUES AND ASSESMENT

9Hrs

Overview of Major Environmental Issues, Global Environmental Issues. Air Quality Issues. Water Quality Issues, Ecology, Natural Resources, Description of Risk. Value of Risk Assessment in the Engineering Profession. Risk-Based Environmental Law. Risk Assessment Concepts. Hazard Assessment. Dose-Response. Risk Characterization.

UNIT II PREVENION OF POLLUTION

9Hrs

Pollution Prevention- Pollution Prevention Concepts and Terminology. Chemical Process Safety. Responsibilities for Environmental Protection. Environmental Persistence. Classifying Environmental Risks Based on Chemical Structure. Exposure Assessment for Chemicals in the Ambient Environment.

UNIT III GREEN CHEMISTRY PRINCIPLES

9Hrs

Green Chemistry. Green Chemistry Methodologies. Quantitative/Optimization- Based Frameworks for the Design of Green Chemical Synthesis Pathways. Green Chemistry Pollution Prevention in Material Selection for UNIT Operations. Pollution Prevention for Chemical Reactors. Pollution Prevention for Separation Devices. Pollution Prevention Applications for Separative Reactors. Pollution Prevention in Storage Tanks and Fugitive Sources.

UNIT IV WASTE PRODUCTION, PROBLEMS AND PREVENION

9Hrs

Process Energy Integration. Process Mass Integration. Case Study of a Process Flow sheet- Estimation of Environmental Fates of Emissions and Wastes.

UNIT V MEASURING AND CONTROLLING ENVIRONMENTAL PERFORMANCE

9Hrs

Magnitudes of Environmental Costs. A Framework for Evaluating Environmental Costs. Hidden Environmental Costs. Liability Costs. Internal Intangible Costs. External Intangible Costs. Introduction to Product Life Cycle Concepts. Life- Cycle Assessment. Life-Cycle Impact Assessments. Streamlined Life-Cycle Assessments. Uses of Life-Cycle Studies.

Total No. of Hrs:45

Textbooks:

1. Mukesh Doble and Anil Kumar Kruthiventi, Green Chemistry and Engineering, Elsevier, Burlington, USA, 2007.

References:

2. Allen, D.T., Shonnard, D.R, Green Engineering: Environmentally Conscious Design of Chemical Processes. Prentice Hall PTR 2002.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E04

ENVIRONMENTAL ENGINEERING

3 0 0 3

OBJECTIVE:

- To provide technical expertise in Environmental Engineering which will enable them to have a career and professional accomplishment in the public or private sector

UNIT I ENVIRONMENT AWARENESS

9Hrs

Environment – friendly chemical Process; Hazard and risk analysis; Environmental Audit.

UNIT II CHEMICAL ENGINEERING PROCESSES

9Hrs

UNIT Operations – application of - Abatement of water pollution; Current strategies to control air pollution; Disposal of solid wastes

UNIT III RECYCLING METHODOLOGY

9Hrs

Economic recovery and recycling of waste; Transport fuel- Bio-diesel for a cleaner environment.

UNIT IV CLEANTECHNOLOGY

9Hrs

Towards Eco- friendly products of chemical industry; Pesticides –Their transfer and Transformation in the environment, Biological and electrochemical technology for effluent treatments

UNITV POLLUTION PREVENTION

9Hrs

Mass exchange network synthesis for pollution control and minimization Implications of environmental constraints for process design, policies for regulation of environmental impacts, Concept of common effluent treatment; Environmental legislations, Role of Government and Industries

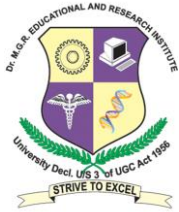
TOTAL No. of Hrs: 45

TEXTBOOKS:

1. Rao, C.S Environmental Pollution control Engineering, Wiley- Eastern Ltd.1991.
2. Peavy H.S. Rowe D.R., and George Technological, Environmental Engineering, Mc Graw Hill Book Company, Ny, 1985.
3. Rao M.N and H.V.N. Rao. “Air pollution” ,Tata McGraw Hill Publishing Co.Ltd.1989.Theodore L and Buomlore A.J Air pollution control equipments. Prentice
4. Hall Inc, NY. 1982.

REFERENCES:

1. Coulson, J.M. Richardson, J.F and R.K Sinnott, Chemical Engineering Vol.6, Pergomon Press, 1989.
2. Gilbert M.Mastrs, Introduction to Environmental Engineering and Science,Prentice - Hall of India, New Delhi, 1994.
3. Wahi S.K., Agnihotri A.K and Sharmma J.S (Editors) EnvironmentalManagement in Petroleum Industry, Wiley Eastern Ltd., New Delhi 1996.
4. Smith, R., “Chemical Process Design”, McGraw Hill, New York, 1995.
5. Paul L Bishop (2000) “Pollution Prevention Fundamentals and Practice”, McGraw Hill, International.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E05

WASTE WATER TREATMENT

3 0 03

OBJECTIVE:

- To focus on the wastewater transport system and the theory and design technique for the wastewater treatment process.

UNIT I WASTE WATER TREATMENT AN OVERVIEW

9Hrs

Terminology – Regulations – Health and Environment Concerns in wastewater management – Constituents in waste water inorganic – Organic and metallic constituents.

UNIT II PROCESS ANALYSIS AND SELECTION

9Hrs

Components of waste water flows – Analysis of Data – Reactors used in wastewater treatment – Mass Balance Analysis – Modeling of ideal and non ideal flow in Reactors – Process Selection.

UNIT III CHEMICAL UNIT PROCESSES

9Hrs

Role of UNIT processes in waste water treatment chemical coagulation – Chemical precipitation for improved plant performance chemical oxidation – Neutralization – Chemical Storage.

UNIT IV BIOLOGICAL TREATMENT

9Hrs

Overview of biological Treatment – Microbial metabolism – Bacterial growth and energetics – Aerobic biological oxidation – Anaerobic fermentation and oxidation – Trickling filters – Rotating biological contractors – Combined aerobic processes – Activated sludge film packing.

UNIT V ADVANCED WASTE WATER TREATMENT

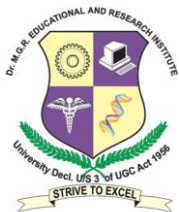
9Hrs

Technologies used in advanced treatment – Classification of technologies. Removal of Colloids and suspended particles – Depth Filtration – Surface Filtration – Membrane Filtration Absorption – Ion Exchange – Advanced oxidation process.

TOTAL No. of Hrs: 45

Text books:

1. Waste water Engineering Treatment and Reuse: Mc Graw Hill, G.Tchobanoglous, FI Biston, 2002.
2. Industrial Waste Water Management Treatment and Disposal by WasteWater Mc Graw Hill III Edition 2008.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E07

FERTILIZER TECHNOLOGY

3 0 0 3

OBJECTIVE:

- To enable the students to learn the fertilizer manufacturing including new or modified fertilizer products and new techniques

UNIT I NITROGENOUS FERTILISERS

9Hrs

Methods of production of nitrogenous fertilizer-ammonium sulphate, nitrate, urea and calcium ammonium nitrate; ammonium chloride and their methods of production, characteristics and specifications, storage and handling.

UNIT II PHOSPHATIC FERTILISERS

9Hrs

Raw materials; phosphate rock, sulphur; pyrites etc., processes for the production of sulphuric and phosphoric acids; phosphates fertilizers – groundrock phosphate; bone meal-single superphosphate, triple superphosphate, triplesuperphosphate, thermal phosphates and their methods of production, characteristics and specifications.

UNIT III POTASSIC FERTILISERS

9Hrs

Methods of production of potassium chloride, potassium sulphate their characteristics and specifications.

UNIT IV COMPLEX AND NPK FERTILISERS

9Hrs

Methods of production of ammonium phosphate, sulphate di ammonium phosphate, nitrophosphates, urea, ammonium phosphate, mono-ammonium phosphate and various grades of NPK fertilizers produced in the country.

UNIT V MISCELLANEOUS FERTILISERS

9Hrs

Mixed fertilizers and granulated mixtures; biofertilizers, nutrients, secondary nutrients and micro nutrients; fluid fertilizers, controlled release fertilizers, controlled release fertilizers.

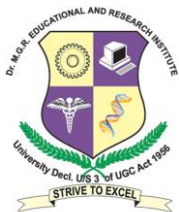
TOTAL No. of Hrs: 45

TEXT BOOKS:

1. "Handbook of fertilizer technology", Association of India, New Delhi, 1977.
2. Menno, M.G.; "Fertilizer Industry - An Introductory Survey", Higginbothams Pvt. Ltd., 1973.

REFERENCES:

1. Sauchelli, V.; "The Chemistry and Technology of Fertilizers", ACS MONOGRAPH No. 148, Reinhold Publishing Cor. New York, 1980.
2. Fertiliser Manual, "UNITED Nations Industrial Development Organisation", UNITED Nations, New York, 1967.
3. Slack, A.V.; Chemistry and Technology of Fertilisers, Interscience, New York, 1966.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E08

PETROLEUM TECHNOLOGY

3 0 03

OBJECTIVE:

- To make the students understand petroleum engineering principles, their application to petroleum and natural gas manufacturing problems.

UNIT I INTRODUCTION

9Hrs

Refinery products – Refinery Feeds – crude distillation – Coking and thermal process.

UNIT II CATALYTIC CRACKING

9Hrs

Catalytic Cracking - Catalytical hydro cracking – Hydro processing and Reused processing hydro treating.

UNIT III CATALYTICAL

9Hrs

Reforming and isomerization alkylation and polymerization – Product blending –Supporting processes.

UNIT IV LUBRICATING

9Hrs

Lubricating oil blending stocks petrochemical feedstocks.

UNIT V COST EVALUATION

9Hrs

Cost Evaluation – Economic evaluation of petroleum reused and refineries.

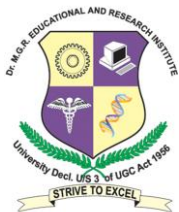
TOTAL No. of Hrs: 45

Text books:

1. Petroleum Refining : Technology and economics CRC Press V Edition 2007J.CH Garry ,Hardward G.E and M.J.Kaiser.

References:

1. Modern Petroleum Technology Upstream Vol I A.G. Lucas Hurley Edition, 2002



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BCT13E10

POLYMER TECHNOLOGY

3 00 3

OBJECTIVE:

- To enable the students to compute molecular weight averages from the molecular weight distribution, Condensation polymerization and transition in polymers

UNIT I INTRODUCTION

6Hrs

History of Macromolecules – structure of natural products like cellulose, rubber, proteins – concepts of macro molecules – Staudinger’s theory of macromolecules – difference between simple organic molecules and macromolecules.

UNIT II ADDITION POLYMERIZATION

12Hrs

Chemistry of Olefins and Dienes – double bonds – Chemistry of free radicals – monomers – functionality – Polymerization: Initiation – types of initiation – free radical polymerization – cationic polymerization – anionic polymerization – coordination polymerization – industrial polymerization – bulk, emulsion, suspension and solution polymerization techniques – Kinetics – Copolymerization concepts.

UNIT III CONDENSATION POLYMERIZATION

9Hrs

Simple condensation reactions – Extension of condensation reactions to polymer synthesis – functional group reactivity – polycondensation – kinetics of polycondensation- Carother’s equation – Linear polymers by polycondensation – Interfacial polymerization – crosslinked polymers by condensation – gel point.

UNIT IV MOLECULAR WEIGHTS OF POLYMERS

9Hrs

Difference in molecular weights between simple molecules and polymers – number average and weight average molecular weights – Degree of polymerization and molecular weight – molecular weight distribution – Polydispersity – molecular weight determination. Different methods – Gel Permeation Chromatography – Osmometry, Light Scattering.

UNIT V TRANSITIONS IN POLYMERS

9Hrs

First and second order transitions – Glass transition, T_g – multiple transitions in polymers – experimental study – significance of transition temperatures – crystallinity in polymers – effect of crystallization – in polymers – factors affecting crystallization crystal nucleation and growth – relationship between T_g and T_m – Relationship between properties and crystalline structure.

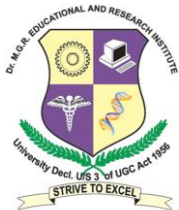
TOTAL No. of Hrs: 45

TEXTBOOKS:

1. Billmeyer.F.W., Jr, Text Book of Polymer Science, Ed. Wiley-Interscience, 1984.
2. Seymour.R.B., and Carraher.C.E., Jr., Polymer Chemistry, 2nd Ed., Marcel Dekker, 1988.
3. Gowariker.V.T., Viswanathan.N.V., and Sreedar.J., Polymer Science, Wiley Eastern Ltd., 1988.

REFERENCES:

1. Joel,R.F; Polymer Science and Technology, Eastern Economy Edition, 1999.
2. Rodriguez, F., Cohen.C., Oberic.K and Arches, L.A., Principles of Polymer Systems, 5th edition.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E11

FUNDAMENTALS OF NANOSCIENCE

3 0 0 3

OBJECTIVE:

- To enable the students to learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION

9Hrs

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials- nanoparticles- quantum dots, nanowires-ultra-thin films- multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION

9Hrs

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS

9Hrs

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis (arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides- ZnO, TiO₂, MgO, ZrO₂, NiO, nanoalumina, CaO, AgTiO₂, Ferrites, Nanoclays 9Hrs 0 functionalization and applications- Quantum wires, Quantum dots- preparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES

9Hrs

X-ray diffraction technique, Scanning Electron Microscopy –environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS Nanoindentation

UNIT V APPLICATIONS

9Hrs

NanoInfoTech: Information storage- nanocomputer, molecular switch, superchip, nanocrystal, Nanobiotechnology: nanoprobe in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging- Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery

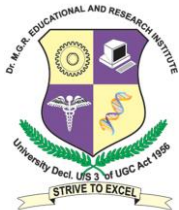
TOTAL No. of Hrs: 45

Textbooks:

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale characterization of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

References:

1. G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor), "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E13

PROFESSIONAL ETHICS IN ENGINEERING

3 0 0 3

OBJECTIVE:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES

10Hrs

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS

9Hrs

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION

9Hrs

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS

9Hrs

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES

8Hrs

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

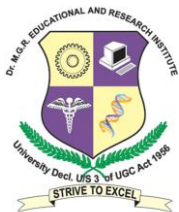
Total No. of Hrs: 45

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGrawHill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd., New Delhi 2013.
6. World Community Service Centre, ' Value Education', Vethathiripublications, Erode, 2011



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DEPARTMENT OF CHEMICAL ENGINEERING

BCT13E14

INDUSTRIAL INSTRUMENTATION

3 0 0 3

OBJECTIVE:

- To impart knowledge on measuring of process variables, analytical instrumentation, automatic process controls.

UNIT I MEASUREMENT

5Hrs

Introduction – Variables, UNITS & standards of measurement, Measurement terms – characteristic. Data Analysis.

UNIT II MEASUREMENT OF PARAMETERS

12Hrs

Process Variables Measurement–Temperature systems– Thermocouples, Thermo resistive system, Filled-system thermometers, Radiation thermometry, Location of temperature measuring devices in equipments, Pressure system –Mechanical pressure elements Pressure Transducers and Transmitters, Vacuum measurement, Resonant wire pressure Transducer, Flow system –Differential producers, Variable area flow meters, Velocity, vortex, mass, ultrasonic & other flow meters, positive displacement flow meters, Open – channel flow measurements, Force systems, Strain gauges Humidity Moisture system, Humidity Measurement, Moisture measurement system, Rheological system, Viscosity measurement, Radiation system, Nuclear radiation instrumentation.

UNIT III ANALYTICAL INSTRUMENTATION

12Hrs

Analytical instrumentation – Analysis instruments, Sample conditioning for process analyzers, X-ray Analytical methods, Quadrupole mass spectrometry, Ultra violet Absorption Analysis, Infra red process analyzers, Photometric reaction product analysers Oxygen analyzers, Oxidation – reduction potential measurements, pH measuring systems, Electrical conductivity and Resistivity measurements, Thermal conductivity, gas analysis, Combustible, Total hydrocarbon, and CO analyzer, Chromatography.

UNIT IV FUNDAMENTALS OF CONTROL SYSTEMS

9Hrs

Fundamentals of Automatic process control – Control algorithms-Automatic controllers – Electronic controllers -Electric controllers (Traditional) – Hydraulic controllers – Fluidics - Programmable controllers.

UNIT V SENSOR AND TRANSMITTERS

7Hrs

Sensors, Transmitters and control valves - Pressure, Flow, Level, Temperature and Composition sensors, Transmitters, Pneumatic and electronic control valves, Types, Actuator, accessories, Instrumentation symbols and Labels.

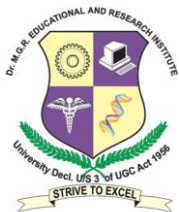
Total No. of Hrs: 45

Textbooks:

1. Fribance, “Industrial Instrumentation Fundamentals” ,Mc Graw Hill Co. Inc.New York 1985
2. Eckman D.P. “Industrial Instrumentation”, Wiley Eastern Ltd., 1989.
3. Considine D M and Considine G D “Process Instruments Controls”Handbook 3rd Edition, McGraw – Hill Book Co., NY, 1990.
4. Scborg D E, Edgar T.F and Mellichamp D.A, “Process Dynamics and Control” John Wiley 1989.

References:

1. Ernest Doebelin, Measurement systems, McGraw – Hill Book, Co., NY,1975.
2. Astrom K.J., Bjonwittenmark, Computer controlled systems, Prentice- Hall of India, New Delhi 1994.
3. Cartis Johnson, Process Control Instrumentation Technology, Prentice-Hall of India, New Delhi 1993.



**DR.M.G.R
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY**

(Decl. U/S 3 of the UGC Act 1956)

DEPARTMENT OF CHEMICAL ENGINEERING

BMG13002

TOTAL QUALITY MANAGEMENT

3 0 0 3

OBJECTIVE

- TQM provides idea about quality aspects of a raw material, process and final product, inclusive of marketing and sales.

UNIT I: INTRODUCTION

9Hrs

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II: TQM PRINCIPLES

9Hrs

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III: STATISTICAL PROCESS CONTROL (SPC)

9Hrs

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV: TQM Tools

9Hrs

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT V: QUALITY SYSTEMS

9Hrs

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits.

Total No of Hrs:45

TEXT BOOK

1. Dale H.Besterfield, et al., *Total Quality Management*, Pearson Education Asia, 1999. (Indian reprint 2002).

REFERENCES

1. James R.Evans & William M.Lindsay, *The Management and Control of Quality*, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. *“Total Quality Management*, McGraw Hill, 1991.
3. Oakland.J.S. *“Total Quality Management Butterworth – Heinemann Ltd., Oxford. 1989.*
4. Narayana V. and Sreenivasan, N.S. *Quality Management – Concepts and Tasks*, New Age International 1996.
5. Zeiri. *“Total Quality Management for Engineers Wood Head Publishers, 1991.*