Approved in Academic Council Meeting held on 17th November 2018

University College of Technology(A), OU,Hyd.-7

SCHEME OF INSTRUCTION AND EXAMINATION (CBCS)
B. TECH. (CHEMICAL ENGG.) THIRD SEMESTER
(Effective from Academic Year 2017-2018)

S.No.	Course No.	Course Title	SCHEME OF INSTRUCTION HOURS PER WEEK		SCHEME OF EXAMINATION			Credits
			L	P	Duration, Hours	CIE	SEE	
1.	BS 301 MATH	Mathematics -III	4	-	3	25	75	4
2.	PC 302 INCT	Inorganic Chemical Technology	4	-	3	25	75	4
3.	PC 303 M&EB	Material & Energy Balances	4	-	3	25	75	4
4.	ES 304 E&EE	Electrical & Electronics Eng	4	-	3	25	75	4
5.	BS 305 PCHE	Physical Chemistry	4	-	3	25	75	4
Practicals								
6.	BS 351 PCHE	Physical Chemistry Lab	-	3	4	25	50	2
7.	ES 352 E&EE	Elect. & Electronics Engg. Lab	-	3	4	25	50	2
8.	PC 353 INCT	Inorganic Chemical Technology lab	-	3	4	25	50	2
Total			20	9		200	525	26

Approved in Academic Council Meeting held on 17th November 2018

University College of Technology(A), OU,Hyd.-7

SCHEME OF INSTRUCTION AND EXAMINATION (CBCS)
FOR B.TECH (CHEM.ENGG) FOURTH SEMESTER
(Effective from Academic Year 2017-2018)

S.No.	Course No.	Course Title	SCHEME OF INSTRUCTION HOURS PER WEEK		SCHEME OF EXAMINATION			Credits
			L	P	Duration, Hours	CIE	SEE	
1.	BS 401 MATH	Mathematics - IV	4	-	3	25	75	4
2.	PC 402 OCT	Org. Chem. Tech.	4	-	3	25	75	4
3.	PC 403 FM	Fluid Mechanics	4	-	3	25	75	4
4.	MC 404 ENVS	Environ. Studies	4	-	3	25	75	4
5.	PC 405 CETD	Chem. Eng. Thermodynamics I	4	-	3	25	75	4
Practicals								
6.	PC 451 OCT	Org. Chem. Tech. Lab	-	3	4	25	50	2
7.	PC 452 FM	Fluid Mechanics Lab	-	3	4	25	50	2
		Total	20	6		175	475	24

Approved in Academic Council Meeting held on 17th November 2018

University College of Technology(A), OU,Hyd.-7

BS301MATH

MATHEMATICS-III

Instruction per week : 4 Hours
Duration of SEE : 3 Hours
Credits : 4

CIE: 25 Marks
SEE : 75 Marks

Course Objectives :

a) To acquire the knowledge of Fourier series
b) To have the understanding of partial differential equations.
c) To understand the solution of initial and boundary value problems
d) To understand basic Numerical solution Methods.
e) To understand the advantages of Probability.

UNIT – I

Fourier series, Euler's formulae, Functions having arbitrary period, Even and odd functions Half range sine and cosine series.

UNIT – II

Formation of partial differential equations (PDE) : Lagrange's equation and its solution, Nonlinear equations of first order , Charpit's method , Four standard forms of first order PDEs. Solutions of linear second order partial differential equations with constant coefficients.

UNIT – III

Initial and Boundary value problems, Method of separation of variables , one dimensional heat and wave equation. Two dimensional Laplace equation and Two dimensional heat equation. Solution of algebraic and transcendental equations : Bisection method , Regular Falsi method, Newton Raphson method. Solution of system of linear equations : Gauss elimination method, Gauss – Seidel iterative method.

UNIT – IV

Interpolation, Newton Forward backward Interpolation Newton divided difference interpolation formula, Lagrange Interpolation formula, Numerical Differentiation, Numerical Integration ,Trapezoidal rule , Simpson's 1/3 & 3/8 rule. Numerical solutions of ODE : Picard's method , Taylor series method , Euler's method and Range-Kutta method.

UNIT – V

Definition of Probability, Conditional probability, Random variables, Binomial, Poisson – Normal distribution and Gaussian distribution.

EXAMINATION: Part-A for 25 Marks (with 10 Questions-**Compulsory)** & Part -B for 50 Marks (5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

Text book

1. B. S. Grewal, Higher Engineering Mathematics, 40th Ed., Khanna Publishers.
2. R. K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics,3rd Ed., Narosa Publishing House.

Reference books

1. Ervin Kreyszig, Advanced Engineering Mathematics, 8Th Ed., John Wiley & Sons Ltd., 2006.
2. M.D. Raisinghania, Theory of ordinary and partial Differential equations, S. Chand & Company Ltd., 1997.

Course Outcome:

1. Able to apply the knowledge of Fourier series
2. Able to apply the solutions of partial differential equations.
3. Able to apply the solution of initial and boundary value problems
4. Able to apply the basic Numerical solution Methods.
5. Able to apply the advantages of Probability.

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Approved in Academic Council Meeting held on 17th November 2018

University College of Technology(A), OU,Hyd.-7

PC302ICT

INORGANIC CHEMICAL TECHNOLOGY

Instruction per week : 4 Hours CIE: 25 Marks
Duration of SEE : 3 Hours SEE : 75 Marks
Credits : 4

Course Objectives :

a. To Know various inorganic chemical manufacturing processes.
b. To Know the important unit operations of some major inorganic chemical processes.
c. To Understand problem solving in chemical processes.
d. To Learn analysis and evaluation of complex industrial processes.

UNIT – I

Indian Chemical Industry: An overview. Basic Concepts of Unit operations and Unit processes; Water conditioning and environmental protection, Lime soda process, Ion exchange process. Energy: various sources of energy and applications. Fuels: fuel gases, Water gas, producer gas, Acetylene gas, oxygen and nitrogen by linde process. Industrial gases : Hydrogen gas, Carbon dioxide gas. Industrial Graphite and Carbon.

UNIT – II

Metallurgical Industries : Classification, Manufacture of Pig iron, Methods of Steel making, Manufacture of Aluminum, Copper, Alloys, Composition of iron, steel and alloys.

Ceramic Industries: Types of Ceramic products, Basic view of Materials, Chemical conversions, Manufacture of white waves, Manufacture of Refractories and their properties, Vitreous Enamels and their applications.

UNIT – III

Cement Industries: Raw Materials, Types of cements and mass properties and applications composition, Manufacture of Portland cement.

Glass Industries: Raw Materials, Special glasses, composition methods of manufacture of glass, Properties and Applications of various glasses.

Surface Coating Industries: Paints and varnishes and other applications.

UNIT – IV

Chlor – Alkali Industries: Manufacture of common salt, Soda ash, Caustic soda, Chlorine, Sodium bicarbonate, and their Industrial applications.

Acid Industries: Manufacture of sulphuric acid, dewier, Hydrochloric acid and Nitric acid.

UNIT – V

Fertilizers: Synthesis of ammonia, Urea, Calcium ammonium nitrate (CAN), Phosphate rock, Phosphoric acid, Super phosphate, Triple super phosphate, Diammonium phosphate (DAM), Potassium Fertilizers, Mixed fertilizers, Bio fertilizers.

Note: Raw materials, chemical reactions, flow sheets, Process and Uses are to be discussed.

EXAMINATION: Part-A for 25 Marks (with 10 Questions-**Compulsory)** & Part -B for 50 Marks
(5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

TEXT BOOK :

1. M. Gopala Rao & Marshall Sittis, Drydens Outlines of Chemical Technology , 3rd Edition, East West Press, 2004.

REFERENCE BOOKS:

1. K. Ghosal Salil, K Sanyal shymal & Siddhartha Datta, Introduction to Chemical Engineering, Tata McGraw - Hill Publishing Company Ltd, New Delhi,22nd Edition, 2009.
2. R. Norris Shreve , Chemical Process Industries,4th Edition. McGrew – Hill, New York, 1984.
3. E. Dryden Charles, Outlines of Chemical Technology, Willy Eastern Ltd, 2001.

Course Outcome:

1. Able to apply various inorganic chemical manufacturing processes.
2. Able to apply the important unit operations of some major inorganic chemical processes.
3. Able to apply problem solving in chemical processes.
4. Able to apply the techniques of analysis and evaluation of complex industrial processes.

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PC303M&EB

MATERIAL & ENERGY BALANCE

Instruction per week : 4 Hours CIE: 25 Marks
Duration of SEE : 3 Hours SEE : 75 Marks
Credits : 4

Course Objectives :

a. To Understands the stoichiometric approach to chemical reactions.
b. To Designs the humidification and dehumidification operations.
c. To Comprehends and solves the material balances in a simple flow sheet.
d. To Solves the energy balance in simple mixing and with reactions.

UNIT - I

Basic concepts-Graphical integration – Graphical differentiation – Use of semi-log, log-log and triangular graphs-Ideal gas – Expression of composition of solid. Liquid and gaseous mixtures- vapor pressure of pure component-Roulette's law and Henry's Law – Vapor pressure of liquid mixture, p-x-y and t-x-y diagrams for ideal solutions.

UNIT – II

Material balance without chemical reaction. Humidity – Use of psychometric charts – Solubility and crystallization for single solute systems – Material balances over absorption. Distillation, evaporation, crystallization, leaching, extraction, drying and mixing units under steady state operation.

UNIT – III

Material balance with chemical reaction – Material balance over units involving reactions including combustion. Proximate and ultimate analysis of coal, analysis of flue gas.

UNIT – IV

Material balances for processes involving by-pass, recycle and purging with and with out chemical reaction.

UNIT-V

Heat capacity, sensible and latent heat – Energy balances in operations involving phase change – Energy balance over heat exchanges, Dryers and simple evaporation systems.

Heat of reaction – Heat of formation and combustion – Effect of temperature of heat of reaction. Energy balance over reaction units – Adiabatic reaction temperature of products – Heating valves of fuels.

EXAMINATION: Part-A for 25 Marks (with 10 Questions-**Compulsory)** & Part -B for 50 Marks (5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

TEXT BOOKS:

1). B.I Bhatt & S.M.Vora, Stoichiomestry –, 4th Edition, Tata Mc.Graw Hill ,New Delhi,2006
2). O.A. Hougen, K.M. Watson and R.A. Ragatz, Chemical Process Principles, Part – I, 5th Edition, CBS Publishers, New Delhi,2004

REFERENCE BOOKS:

1). David M. Himmelblau, Basic Principles and Calculations Chemical Engineer, 5th Ed,. Prentice -Hall India Pvt. Ltd.2000
2) Nayeef Ghasem and Redhouane Henda, Principles of Chemical Engineering Processes, 2nd Ed. , CRC Press. (2015)

Course Outcome:

a. Able to apply the stoichiometric approach to chemical reactions.
b. Able to apply the Design of the humidification and dehumidification operations.
c. Able to apply the material balances in a simple flow sheet.
d. Able to apply the Solutions of the energy balance in simple mixing and with reactions.

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ES304E&EE

ELECTRICAL AND ELECTRONICS ENGINEERING

Instruction per week : 4 Hours
Duration of SEE : 3 Hours
Credits : 4

CIE: 25 Marks
SEE : 75 Marks

Course Objectives :

a. To learn how voltages and currents will be in each and every elements in the circuits for DC as well as AC excitations.
b. To learn the basic concepts of electrical machines with operation, control, testing and application.
c. To understand the principle of operation and characteristics of all electronic devices and small signal analysis of transistors.
d. To study the working of various oscillators and electronic devices

UNIT I

Introduction to Electrical Engineering: Essence of Electricity, Conductors, semiconductors and Insulators (Elementary Treatment Only)
D.C. Circuits : Kirchnoff's laws-Types of elements, types of sources, Series and parallel circuits, star and delta conversions- superposition theorem – thevenin's theorem – Norton's theorem ,Simple Numerical Examples

UNIT II

Electromagnetic induction: Faraday's law of electromagnetic induction, Lenz's Law, Flemings Right hand and Left Hand Rule
DC Machines: Principle of operation of DC machines ,Construction, Armature Winding-emf equation-torque production-Operation of DC machine as Generators and motor-Characteristics, Armature reaction losses and efficiency-Applications

UNIT III

AC circuits: Production of sinusoidal voltage, Phasor representation of sinusoidal quantities-Average & RMS values, Form Factor, RLC circuits excited by sinusoidal input ,calculation of Active and Reactive Power, Power factor
Single phase transformer: Features, Principle of Operation, Constructional details, Ideal transformer-Transformer on no-load and on Load, losses –efficiency and regulation-OC, SC tests-Applications.

UNIT-IV

Three phase induction motors : Production of rotating magnetic field, Principle of Operation – slip and rotor frequency , torque, losses and efficiency, Torque Slip Characteristics, Application Fractional –Kilowatt Motors: Principle of Operations of Stepper motors, Universal Motors, Applications

UNIT V

Introduction to Electronics: P-N junction – semiconductor diode –V-I characteristics of diode – Zener diode, Rectifiers – half wave , full wave rectifier – Filters.
Transistor –Transistor symbols, Transistor action, Transistor currents, Current amplifier factor, Relation between α and β – CB, CC,CE Configurations, Transistor as Amplifier

EXAMINATION: Part-A for 25 Marks (with 10 Questions-Compulsory) & Part -B for 50 Marks (5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

TEXT BOOKS:

1. V.K.Mehta, Principles of Electrical Engineering and Electronics-,28 th Edition,Sultan Chand & Co.2008
2. Naidu and Kamakshaiah, Introduction to Electrical Engineering,11th Edtion,TataMc.Graw Hill, New Delhi,2005

REFERENCE BOOKS:

1. B. L. Teraja, Electrical Technology Volume II -, 26 th Edition, S.Chand & Co., New Delhi,2008
2. Hughes, Electrical Technology-,VII editon, ELBS, New York,2000
3. Fitzerlad, Basic Electrical Engineering-,ELBS,7 th Edition,2000

Course Outcome:

a. Able to apply how voltages and currents will be in each and every elements in the circuits for DC as well as AC excitations.
b. Able to apply the basic concepts of electrical machines with operation, control, testing and application.
c. Able to apply the principle of operation and characteristics of all electronic devices and small signal analysis of transistors.
d. Able to apply the working of various oscillators and electronic devices

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University College of Technology(A), OU,Hyd.-7

BS305PCHE

PHYSICAL CHEMISTRY

Instruction per week : 4 Hours CIE: 25 Marks
Duration of SEE : 3 Hours SEE : 75 Marks
Credits : 4

Course Objectives :

To learn the physical properties of dilute solutions.
To understand the concept of electrical conductance of solutions.
To gain the knowledge in electrochemical cells
To learn about chemical reaction kinetics, molecular structure and

UNIT-I: DILUTE SOLUTIONS

Colligative properties – definition. Lowering of vapor pressure, Roaults Law, Elevation of boiling point, Depression of freezing point, and osmotic pressure. Experimental measurement of each of these properties. Van't Hoff's theory of dilute solutions-Statement, Abnormal Colligative properties- cases of association and dissociation of dissolved nonvolatile solutes.

UNIT-II: **ELECTRICAL CONDUCTANCE**

Conductance of electrolytic solutions mechanism. Review of Faraday's laws of electrolysis- their significance coulometer of silver or copper. Validity of Ohm's law, specific(κ) and equivalent conductance(Λ) , their dependence on dilution and experimental measurement.
Equivalent conductance at infinite dilution(Λ_0). Ionic mobility and transport number. Hittorf's method of determining transport number of ions. Kohlrausch's law of independent migration of ions and its application to determine : (i) Λ_0 of weak electrolytes, (ii) degree of dissociation of weak electrolytes ,(iii) Ionic mobilities, (iv) solubility and solubility product of sparingly soluble salts, and (v)Ionic product of water. Conducto metric titrations.

UNIT-III: ELECTROMOTIVE FORCE

Origin of potential across electrode- electrolyte interface, standard electrode potential (E^0). Galvanic or electrochemical cells. Conventional representation, measurement of cell emf. Reversible & irreversible cells. Types of reversible electrodes. Thermodynamics of reversible cells- Nernst expression for cell emf. Hydrogen, calomel, quinhydrone, and glass electrodes-pH determination . potentiometric titrations. Classification of electrochemical cells- chemical and concentration cells with and without-transference- representation of each type & expressions for cell emf without derivations.

UNIT-IV: CHEMICAL KINETICS

Scope, terminology- rate, rate constant, rate law, order, molecularity and half life time of chemical reaction. Derivation of integrated form of rate equation of zero, first, second and third order reactions-examples. Methods of determining the order of a chemical reaction. Effect of temperature on the rate-Arrhenius equation, concept of activation energy(E_a).Theories of reaction rates- collision and activated complex theories. Activation parameters($\Delta G^{\#}$, $\Delta S^{\#}$ & $\Delta H^{\#}$) – determination. Catalysis phenomenon-characteristics, Homogeneous and Heterogeneous catalysis – examples.

UNIT-V :PHYSICAL PROPERTIES AND MOLECUALR STRUCTURE:

Additive, constitutive and colligative properties- examples. Total molar polarization (p_t), orientation (p_o) and induced (p_i) components. Determination of total molar polarization- Claussius- Mosotti equation.

Dipole moment- determination and application of dipole moments for molecular structure elucidation- percentage ionic character of a bond.

Introduction to molecular spectroscopy- rotational (microwave), vibrational (infrared) spectra- selection rules. Type of information about the structure of a molecule from rotational and IR spectrum. Raman spectra.

EXAMINATION: Part-A for 25 Marks (with 10 Questions-Compulsory) & Part -B for 50 Marks (5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

TEXT BOOK:

1. S.Glasstone & Lewis, Elements of Physical Chemistry ,MacMillam Education Ltd,1987

REFERENCE BOOKS

1. W.J. Moore, Physical Chemistry-, Orient Longmann ,1982
2. S H Maron & C F Prutton, Principles of Physical Chemistry , Oxford & IBH Publishing Co,1965
3. B.R. Puri, & L. R. Sharma, Principles of Physical Chemistry, Vishal Publications .1980
4. B. D. Khosla , Physical Chemistry-, R.Chand & Co.,New Delhi,1988
5. P.L.Soni & O.P. Dharmarha Text Book of Physical Chemistry-, Sultan Chand & Co., New Delhi,1990
6. T. Navaneeth Rao, Problems in Physical Chemistry-, MacMillan Co., 1974

Course Outcome :

1. Able to apply the physical properties of dilute solutions.
2. Able to apply the concept of electrical conductance of solutions.
3. Able to apply the knowledge in electrochemical cells
4. Able to apply about chemical reaction kinetics, molecular structure and

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Approved in Academic Council Meeting held on 17th November 2018

University College of Technology(A), OU,Hyd.-7

BS351PCHE

PHYSICAL CHEMISTRY LAB

Instruction per week : 3 Hours
Duration of SEE : 4 Hours
Credits : 2

CIE: 25 Marks
SEE : 50 Marks

Course Objectives :

a. To demonstrate molecular state of acids
b. To demonstrate order of reactions
c. To demonstrate reaction between acids and bases by conductometric titrations
d. To demonstrate the potentiometric titrations

LIST OF EXPERIMENTS

(Minimum of 8 experiments in the list are to be performed)

1. Determination of molecular state of acetic acid by studying the distribution of acetic acid between n-butanol and water.
2. Determination of molecular state of benzoic acid by studying the distribution of benzoic acid between benzene and water.
3. Determination of order of the reaction of hydrolysis of methyl acetate in dilute hydrochloric acid.
4. Comparison of strength of acids by studying the hydrolysis of an ester.
5. Determination of the temperature coefficient in the catalyzed hydrolysis of an ester.
6. Determination of order of the reaction between potassium persulphate and potassium iodide.
7. Kinetic study of the reaction between $KMnO_4$ and $H_2C_2O_4$ catalyzed by Mn^{2+} ions.
8. Conductometric titration of strong acid versus strong base and week acid versus strong base.
9. Conductometric titration of weak acid versus strong base.
10. Conductometric titration of mixture of acids versus strong base.
11. Determination of order of the reaction of inversion of sucrose by polarimetry.
12. Determination of specific rotation of Glucose.
13. Verification of Beer-Lambert's law and determination of concentration of $K_2Cr_2O_7$ or $KMnO_4$.
14. Titration of HCl against Na OH using P^H meter.
15. Determination of rate constant of KI & persulphate reaction.
16. Potentiometric reduction titration of Fe^{2+} and $K_2Cr_2O_7$

Course Outcome :

a. Able to use molecular state of acids
b. Able to use order of reactions
c. Able to use reaction between acids and bases by conductometric titrations
d. Able to use the potentiometric titrations

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ES352E&EE

ELECTRICAL AND ELECTRONIC ENGINEERING LAB

Instruction per week : 3 Hours CIE: 25 Marks
Duration of SEE : 4 Hours SEE : 50 Marks
Credits : 2

Course Objectives :

a. To demonstrate how voltages and currents will be in each and every elements in the circuits for DC as well as AC excitations.
b. To train basic concepts of electrical machines with operation, control, testing and application.
c. To demonstrate the principle of operation and characteristics of all electronic devices and small signal analysis of transistors.
d. To study the working of various oscillators and electronic devices

List of experiments

(Minimum of 8 experiments in the list are to be performed)

1. Verification of the Venin's & Notron's theorems
2. Verification of maximum power transfer theorem & superposition theorem
3. Power factor measurement of and R-L series circuits
4. Calibration of single phase energy meter
5. Magnetization characteristics of separately excited generator
6. Load characteristics of shunt generator
7. Swinburnes test on D.C shunt motor
8. Seed control DC shunt motor
9. Brake test on DC shunt motor
10. Brake test on induction motor
11. Open circuit & short circuit tests on single phase transformer
12. Static characteristics of junction diode
13. Static characteristics of a common base and common emitter transistor circuit
14. Brake test on D series motor
15. Three – phase power measurement by two watt meter method
16. Regulation of single phase alternator

Course Outcome :

1. Able to apply how voltages and currents will be in each and every elements in the circuits for DC as well as AC excitations.
2. Able to apply the basic concepts of electrical machines with operation, control, testing and application.
3. Able to apply the principle of operation and characteristics of all electronic devices and small signal analysis of transistors.
4. Able to apply the working of various oscillators and electronic devices

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PC353ICT

INORGANIC CHEMICAL TECHNOLOGY LAB

Instruction per week : 3 Hours
Duration of SEE : 4 Hours
Credits : 2

CIE: 25 Marks
SEE : 50 Marks

Course Objectives :

1. To demonstrate the methods of alkalinity, hardness and chloride ion content of water sample, determining purity of washing soda, percentage of available chlorine in bleaching powder.
2. To study the redox methods to determine Fe2+ ions present in solution.
3. To apply principles and methods involved in using instruments like conductivity bridge, spectrophotometer, pH meter and potentio meter.

List of Experiments

1. Estimation of carbonates and Bicarbonates ions
2. Estimation of Hardness of water
3. Estimation of sulphates in water (Gravimetric Analysis)
4. Analysis of Iron Ore
5. Analysis of Copper Ore
6. Analysis of Manganese Ore
7. Estimation of Borax
8. Estimation of Calcium Ions in Natural Water
9. Estimation of Chlorine in Water Sample
10. Estimation of Oxygen in Water
11. Estimation of free and combined carbon-dioxide in water

Course Outcome:

1. Able to use the methods of alkalinity, hardness and chloride ion content of water sample, determining purity of washing soda, percentage of available chlorine in bleaching powder.
2. Able to use the redox methods to determine Fe2+ ions present in solution.
3. Able to use principles and methods involved in using instruments like conductivity bridge, spectrophotometer, pH meter and potentio meter.

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Approved in Academic Council Meeting held on 17th November 2018

University College of Technology(A), OU,Hyd.-7

BS401MATH

MATHEMATICS – IV

Instruction per week : 4 Hours CIE: 25 Marks
Duration of SEE : 3 Hours SEE : 75 Marks
Credits : 4

Course Objectives :

a. To Understand the concept of complex variables
b. To Understand different power series functions
c. To learn about solutions by Laplace Transforms
d. To learn about Fourier Transforms and Z- Transforms

UNIT – I

Functions of complex variables, Limits , continuity , Differentiability, An analyticity , Polar form of Cauchy Richman equations, Necessary and Sufficient conditions for analyticity, Harmonic functions.

UNIT – II

Complex Integration, Cauchy's Integral theorem , Cauchy's Integral formula, Cauchy's Integral formula for derivatives ,Cauchy's inequality , Liouvilles's theorem – Morera's Theorem and Bilinear transformation.

UNIT – III

Power series: Taylor series , Laurent series , Singular points , Residues , Residue theorem. Evaluation of real integrals using residue theorem.

UNIT – IV

Laplace transforms: Definition, Laplace transform of Elementary functions, Translation theorems, Laplace Transforms of Derivatives and Integrals, Inverse Laplace transforms , Convolution theorem. Applications of Laplace transform to differential equations.

UNIT – V

Fourier Transform, Fourier sine transform, Fourier cosine transform, Finite Fourier sine transform, Finite Fourier cosine transform. Applications of Fourier transforms to boundary value problems. Introduction to Z- Transforms.

EXAMINATION: Part-A for 25 Marks (with 10 Questions-**Compulsory)** & Part -B for 50 Marks (5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

TEXT BOOK

1) Ervin Kreyszig, Advanced Engineering Mathematics, 8Th Ed., John Wiley & Sons Ltd., 2006.

REFERENCE BOOKS

1) B. S. Grewal, Higher Engineering Mathematics, 40th Ed., Khanna Publishers.
2) R. K. Gupta, Integral transforms Varistha
3) R. K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics,3rd Ed., Narosa Publishing House.

Course Outcome :

a. Able to apply the concept of complex variables
b. Able to apply different power series functions
c. Able to apply solutions by Laplace Transforms
d. Able to apply Fourier Transforms and Z- Transforms

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PC402OCT

ORGANIC CHEMICAL TECHNOLOGY

Instruction per week : 4 Hours CIE: 25 Marks
Duration of SEE : 3 Hours SEE : 75 Marks
Credits : 4

Course Objectives :

a. To learn about Petroleum refining
b. To gain knowledge of polymer industry
c. To impart concepts of Paper and fibre industries.
d. To learn about Sugar and Soaps manufacturing industries.

UNIT – I

Petroleum Processing : Origin of Petroleum, Constituents of petroleum, various unit operations and unit processes, types of cracking and Refining, products of refining. Generalized overall refinery flow sheet from crude oil to saleable products. Petrochemical products.

UNIT – II

Polymer Industry: Definition and Types of Polymerization. Classification of plastics; Manufacture of polyethylene, LDPE, HDPE and PP.

UNIT – III

Classification of Natural Rubber, monomers for synthetic rubber. Manufacture of S.B.R.
Synthetic fibers : Classification, Manufacture of Nylon66, Polyester fiber, Viscose Rayon Fibre. Pulp & paper Industry : Methods of production of sulphate and sulphite pulp.
Recovery of chemicals from black liquor, Production of paper, Varieties of Additives used in paper.

UNIT – IV

Sugar and starch Industry : Manufacture of cane sugar and refining, production of starch from maize, uses of starch and sugar Bagasse. Black strop molasses, invert sugar.
Fermentation Industry :- Introduction, Manufacture of penicillin, Microorganism types, sporulation, culture media, Fermentation conditions.

UNIT – V

Oils, Soaps, Detergents: Definitions, constituents of oils, Extraction and expression of vegetable oil, Refining and Hydrogenation of oils. Continuous process for the production of Fatty acids Soaps & Detergents : Definitions and classification, manufacture of commercial detergents. Paints and varnishes: Manufacture of paints and vanishes, ingredients and composition of paints and vanishes.

Note: Flow Sheets, Chemical reactions and uses are to be discussed for all the manufactured product

EXAMINATION: Part-A for 25 Marks (with 10 Questions-**Compulsory)** & Part -B for 50 Marks (5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

TEXT BOOKS:

1.Shreve's Chemical Process Industries, 5th Edition, McGraw Hill, New York,1984.

REFERENCE BOOKS:

1.Shreve's Chemical Process Industries, 4th Edition, McGraw Hill, New York,1984.
2.M.Gopala Rao & Marshall Sitti, Drydens Out lines of Chemical Technology –,3 rd Edition East West Press, 2004

Course Outcome :

a. Able to apply Petroleum refining
b. Able to apply the knowledge of polymer industry
c. Able to apply concepts of Paper and fibre industries.
d. Able to apply the techniques of Sugar and Soaps manufacturing industries.

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Approved in Academic Council Meeting held on 17th November 2018

University College of Technology(A), OU,Hyd.-7

PC403FM

FLUID MECHANICS

Instruction per week : 4 Hours
Duration of SEE : 3 Hours
Credits : 4

CIE: 25 Marks
SEE : 75 Marks

Course Objectives :

a. To introduce basics and models for fluids.
b. To provide basics for formulating conservative principles.
c. To provide an understanding about compressible fluids and flow past immersed bodies.
d. To study methods for transporting and measuring of flow in various conduits.

UNIT-I

Fluid Flow Phenomena and Fluid Statics : Definition of fluid, shear rate and shear stress, Newtonian and Non-Newtonian fluids, Time dependent flow, viscosity and momentum flux, compressible, incompressible, real and ideal fluids, viscosities of gases and liquids, Laminar and Turbulent flows, Reynolds experiment, Boundary layers, Hydrostatic equilibrium, U-tube manometer, inclined manometer and two fluid manometer and inverted manometer.

UNIT-II

Basic equations of Fluid Flow : path lines, stream lines and stream tube, Mass balance –equation of continuity, one dimensional flow, mass velocity, differential momentum balance- equations of motion, coquette flow, macroscopic momentum balances, momentum of stream and momentum correction factor, layer flow with free surface. Mechanical energy equation-Bernoulli equation-corrections for effects of solid boundaries, kinetic energy correction factor, corrections for fluid friction, pump work in Bernoulli equation.

UNIT-III

Incompressible flow in pipes & channels and frictional losses : Shear stresses and skin friction, fanning friction factor, flow in noncircular channels, laminar flow of Newtonian and Non-Newtonian fluids, velocity distribution, Hagen Poiseuille equation, Turbulent flow, universal velocity distribution, Roughness, Mody's friction factor chart. Pipes and valves, fittings. Friction losses due to sudden expansion and contraction, Effects of fittings and valves, form frictional losses in the Bernoulli Equation. Dimensional analysis and Buckingham π-theorem and Rayleigh theorem– its applications and limitations.

UNIT-IV

Compressible Fluids and Non Newtonian fluids (with Differential Pressure estimation) Flow past immersed bodies and Fluidization : Motion of particles through fluids – Free settling and hindered settling, Drag and drag coefficient, Flow through packed beds of solids – Kozeny-

Carman equation, Burke-Plummer equation and Ergun equation. Fluidization and conditions for fluidization, Minimum fluidization velocity, particulate and bubbling fluidizations, Expansion of fluidized beds, Applications of fluidization.

UNIT-V

Transportation and metering of fluids : Centrifugal and Positive Displacement Pumps, Characteristics of pumps, suction lift and cavitation, NPSH, Flow meters- Venturi meter, orifice meters, Pitot tube, Rota meters and Notches and Weirs, Compressors and blowers.

EXAMINATION: Part-A for 25 Marks (with 10 Questions-Compulsory) & Part -B for 50 Marks (5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

TEXT BOOK :

1) Warren L. Mc Cabe, Julian C. Smith and Peter Harriott , Unit Operations of Chemical Engineering , 7^{th} Edition, McGraw Hill International Edition (2005).

REFERENCE BOOKS :

1) C.J.Geankopolis ,Transport process and unit operations , PHI New Delhi.,2004
2) James O. Wilkes, Fluid Mechanics for Chemical Engineers with Microfluidics and CFD, 2/E ,University of Michigan, Prentice Hall Int.,2006.

Course Outcome :

a. Able to use the concepts of basic models for fluids.
b. Able to apply basis for formulating conservative principles.
c. Able to provide an understanding about compressible fluids and flow past immersed bodies.
d. Able to use methods of transporting and measuring of flow in various conduits.

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MC404ENVS

ENVIRONMENTAL STUDIES

Instruction per week : 4 Hours CIE: 25 Marks
Duration of SEE : 3 Hours SEE : 75 Marks
Credits : 4

Course Objectives :

1. To learn various environmental pollution aspects and issues.
2. To learn a comprehensive insight into natural resources, ecosystem and biodiversity.
3. To learn the ways and means to protect the environment from various types of pollution.
4. To learn some fundamental knowledge on human welfare measures and environmental acts.
5. To learn the environmental problems like global warming, ozone layer depletion and acid rains.

UNIT-I

Environmental studies : Definition, scope and importance, need for public awareness. Natural resources: Water resources, use and over utilization of surface and ground water, floods, drought, conflicts over water, dams - benefits and problems. Effects of modern agriculture, fertilizer-pesticide problems, water logging salinity.

UNIT-II

Ecosystems : Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

Energy Resources : Growing energy needs, renewable and non-renewable energy sources. Land Resources, land as a resource, land degradation, soil erosion and desertification.

UNIT-III

Biodiversity : Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

UNIT-IV

Environmental Pollution : Causes, effects and control measures of air pollution, water pollution, soil pollutions, noise pollution, thermal pollution and solid waste management.

Environment protection act : Air, Water, forest and wild life acts, enforcement of environmental legislation.

UNIT-V

Social Issues and the Environment: Water conservation, watershed management, and environmental ethics. Climate change, global warning, acid, rain, ozone layer depletion.

Disaster management : Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology, disaster management cycle, and disaster management in India.

EXAMINATION: Part-A for 25 Marks (with 10 Questions-Compulsory) & Part -B for 50 Marks (5 Questions to be answered out of 7 of equal weightage selecting atleast one from each Unit)

TEXT BOOK:

1.Erach Bharucha, A Text Book of Environmental Studies for U.G. Course, , Universities Press, 2005.

REFERENCE BOOKS

1. E.P. Odum, Fundamentals of Ecology, W.B. Sunders Co., USA.
2. M.N. Rao and A.K. Datta, Waste Water Treatment, Oxford and IBH Publications
3. Benny Joseph, Environmental Studies, Tata McGraw-Hill, 2005
4.V.K. Sharma, Disaster Management, National Centre for Disaster Management, HPE, Delhi, 1999.

Course Outcome :

1. Able to solve various environmental pollution aspects and issues.
2. Able to study comprehensive insight into natural resources, ecosystem and biodiversity.
3. Able to educate the ways and means to protect the environment from various types of pollution.
4. Able to impart some fundamental knowledge on human welfare measures and environmental acts.
5. Able to Demonstrate the environmental problems like global warming, ozone layer depletion and acid rains.

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PC405CETD

CHEMICAL ENGINEERING THERMODYNAMICS-I

Instruction per week : 4 Hours
Duration of SEE : 3 Hours
Credits : 4

CIE: 25 Marks
SEE : 75 Marks

Course Objectives :

a. To provide the students with the terminology of thermodynamics like system, properties, processes, reversibility, equilibrium, phases, components; the relationship between heat and work by understanding the significance of the first law of thermodynamics;
b. To learn how to obtain or to estimate the thermal and volumetric properties of real fluids, the limitations imposed by the second law of thermodynamics on the conversion of heat to work.
c. To learn chemical reaction thermodynamics and its application to homogenous and heterogeneous chemical reactions with multiple components.
d. To learn the applications of energy balances in the analysis of batch, flow, and cyclical processes including power cycles, refrigeration.

UNIT - I

Introduction; The first Law and other basic concepts Joule's Experiments - Internal Energy - Formulation of the first law of the thermodynamics - the thermodynamic state and state functions – Equilibrium- The phase rule - The Reversible process - Constant Volume and Constant Pressure processes- Enthalpy- Heat Capacity.- Mass and Energy Balances for Open Systems- Volumetric Properties of Pure Fluids- PVT Behavior- The Virial equation of State- The Ideal Gas- Application of Virial Equations- Cubic Equations of State and generalized correlations for gases and Liquids.

UNIT - II

Heat Effects: Sensible Heat effects :– Latent Heats of pure substances - Standard Heat Reaction- Standard Heat of Formation- Standard Heat of Combustion_ Temperature dependence of ΔH^o, Heat Effects of Industrial Reactions, The Second Law of Thermodynamics:- Statements of second law- Heat engines Thermodynamic temperature scales- Entropy- Entropy changes of an ideal gas- Mathematical Statement of the Second Law, Entropy Balance for Open Systems, Calculation of Ideal Work, Lost Work- The Third Law of thermodynamics- Entropy from Microscopic Viewpoint

UNIT – III

Thermodynamic Properties of Fluids- Property Relations for Homogeneous Phases- Residual properties- The Two phase systems. Thermodynamic diagrams- Tables of Thermodynamic Properties- Generalized Property Correlations for Gases; Estimation of Auxiliary Physical Properties- properties of pure substances and mixture:- densities, molecular weights, boiling points, vapour pressures, critical pressure, critical volume and critical compressibility factor, acentric factor combining and mixing rules

UNIT - IV

Applications of Thermodynamics to Flow Processes:- Duct flow of Compressible Fluids, Turbines (Expanders), Compression Processes; Production of Power from Heat:- The Steam Power Plant- Internal Combustion Engines- Otto cycles and Diesel cycle; Jet Engines, Rocket Engines; Refrigeration and liquification:- The Carnot Refrigerator- The Vapour-Compression Cycle- The Choice of Refrigerant- Absorption Refrigeration- The Heat Pump- The various processes for liquification.

UNIT – V

Solution Thermodynamics:- Fundamental Property Relation- The Critical Potential and Phase Equillibria Partial Properties- Ideal Gas Mixtures- Fugacity and Fugacity Coefficient: Pure Species and Species in Solution Generalized Correlations for the Fugacity Coefficient- The Ideal Solution- Excess Properties- The concept of Activity and activity coefficients- The Gibbs-Duhem Equation

EXAMINATION: Part – A for 25 marks (with 10 questions: two question from each unit - Compulsory) and Part – B for 50 marks (5 questions to be answered out of 7 of equal weightage selecting at least one from each Unit).

Text Books:

1. J.M.Smith, H.C Van Ness and M. M. Abbott, Introduction to Chemical Engineering Thermodynamics by, Sixth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003
2. Thomas E Daubert, Chemical Engineering Thermodynamics, by, McGraw Hill International Editions, 1986

Reference Books:

1. J.Richard Elliott and Carl T. Lira, Introductory Chemical Engineering Thermodynamics, Second Edition, Prentice Hall, 2012
2. K. V. Narayanan Text Book of Chemical Engineering Thermodynamics, , PHI Learning Limited, 2004,
3. Y. V. C. Rao, Chemical Engineering Thermodynmics, by University Press (India) Private Limited, 2004

Course Outcome :

a. Able to use the terminology of thermodynamics like system, properties, processes, reversibility, equilibrium, phases, components; the relationship between heat and work by understanding the significance of the first law of thermodynamics;
b. Able to apply methods to estimate the thermal and volumetric properties of real fluids, the limitations imposed by the second law of thermodynamics on the conversion of heat to work.
c. Able to use chemical reaction thermodynamics and its application to homogenous and heterogeneous chemical reactions with multiple components.
d. Able to use the energy balances in the analysis of batch, flow, and cyclical processes including power cycles, refrigeration.

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PC451OCT

ORGANIC CHEMICAL TECHNOLOGY LAB

Instruction per week : 3 Hours CIE: 25 Marks
Duration of SEE : 4 Hours SEE : 50 Marks
Credits : 2

Course Objectives :

a. To instill students with an appreciation of knowledge in various organic compounds to solve practical problems.
b. To provide knowledge in soap manufacturing, analysis and estimation
c. To provide knowledge in oil (testing), analysis and estimation of glucose and sugar
d. To provide knowledge in analysis of ores and alloys

List of experiments

(Minimum of 8 experiments in the list is to be performed)

1. Preparation of Acetanilide
2. Preparation of Para-bromo acetanilide
3. Preparation of Nitro benzene
4. Preparation of Meta-dinitro benzene
5. Purification of organic products by recrystallization
6. Estimation of formaldehyde
7. Estimation of Glucose
8. Estimation of Sucrose
9. Estimation of Oils
10. Estimation of Acid Value
11. Estimation of Formaldehyde in formal in solution
12. Determination of molecular weight or equivalent weight for given acid
13. Estimation of Urea
14. Application of thin layer chromatography

Course Outcome :

a. Able to the knowledge of various organic compounds to solve practical problems.
b. Able to apply the knowledge of soap manufacturing, analysis and estimation
c. Able to apply the knowledge in oil (testing), analysis and estimation of glucose and sugar
d. Able to apply the knowledge of analysis of ores and alloys

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Approved in Academic Council Meeting held on 17th November 2018

University College of Technology(A), OU,Hyd.-7

PC452FM

FLUID MECHANICS LAB

Instruction per week : 3 Hours
Duration of SEE : 4 Hours
Credits : 2

CIE: 25 Marks
SEE : 50 Marks

Course Objectives :

a. Experimentation, observation and analysis of physical phenomena in Fluid Mechanics.
b. Training students in measurement of the physical properties of fluids
c. Provide experience in collection, analysis, interpretation and presentation of experimental data. Precision analysis and equipment limitations.
d. To measure the frictional losses in laminar and turbulent pipe flows

List of experiments

(Minimum of 8 experiments in the list are to be performed)

1. Determination of discharge coefficient for orifice meter and venturi meter and their variation with Reynolds number
2. a) Determination of weir meter constant K for v-notch and rectangular notch
   b) Calibration of rotameter and study of variation of flow rate with tube to float diameter.
3. Determination of Viscosity for Glycerol – water solution at different temperatures
4. Determination of friction factor for flow of water through annulus using Fanning's and Darcy's equations.
5. Determination of friction factor for flow through straight pipes of different diameters and study of variation of friction factor with Reynolds number
6. Determination of friction losses in pipe fittings
7. Determination of clearance volume and efficiency of an air compressor
8. Determination of characteristic curves for centrifugal pumps
9. a) Determination of friction factor for packed beds
   b) Determination of minimum fluidization of velocity
10. Determination of Pressure drop through helical coils
11. Determination of velocity profile of air in pipe by Pitot tube
12. Determination of critical velocity by Reynolds Experiments

Course Outcome :

a. Able to use the Experimentation, observation and analysis of physical phenomena of Fluid Mechanics.
b. Able to apply the measurement methods of the physical properties of fluids
c. Able to apply the experiences in collection, analysis, interpretation and presentation of experimental data, Precision analysis and equipment limitations.
d. Able to use the measurement techniques of frictional losses in laminar and turbulent pipe flows

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