SEMESTER III

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA19301	Transforms and Boundary Value Problems	3	1	0	4
2	ES	EE19308	Electrical Machine Drives and Sensors	3	0	0	3
3	PC	CH19301	Physical Chemistry	3	0	0	3
4	PC	CM19302	Fluid Flow Operations	3	0	0	3
5	PC	CM19301	Chemical Process Calculations	3	0	0	3
6	MC	MC19301	Value Education	2	0	0	0
Practical							
1	PC	CM19303	Technical Analysis Laboratory	0	0	4	2
2	PC	CM19304	Fluid Mechanics Laboratory	0	0	4	2
3	EE	EN19301	English Proficiency Course Laboratory	0	0	2	1
			Total	**17**	**1**	**10**	**21**

SEMESTER IV

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA19404	Numerical Methods	3	1	0	4
2	PC	CM19401	Mechanical Operations	3	0	0	3
3	PC	CM19402	Heat Power Engineering	3	0	0	3
4	PC	CM19403	Process Organic Synthesis	3	0	0	3
5	PC	CM19404	Instrumental Methods of Analysis	3	0	0	3
6	MC	MC19401	Environmental Science and Engineering	3	0	0	0
Practical							
1	PC	CM19405	Mechanical Operations Laboratory	0	0	4	2
2	PC	CM19406	Physical and Organic Synthesis laboratory	0	0	4	2
			Total	**18**	**1**	**8**	**20**

MA19301 TRANSFORMS AND BOUNDARY VALUE PROBLEMS 3 1 0 4

COURSE OBJECTIVES

To enable students to

- introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- acquaint the students with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- formulate Partial Differential Equations and use Mathematical tools for the solution of PDE that model several physical processes
- develop the modeling of one dimensional equation of heat conduction, wave equation and two dimensional Laplace equation
- develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform does for continuous systems, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES **12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range series –Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS **12**

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms– Properties – Transforms of elementary functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations – Lagrange's linear equation – Solutions of four standard types of first order partial differential equations - Linear partial differential equationsof second order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

Solutions of One-dimensional wave and heat equation – Steady state two-dimensional heat equation.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS **12**

Z-transforms – Elementary properties – Inverse Z-transform – Convolution theorem –Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- derive Fourier series, their possible forms of representations of periodic functions
- identify and formulate a function in frequency domain whenever the function is defined in time domain
- formulate and solve partial differential equations that occur in many engineering applications
- model wave and heat equations, solve certain boundary value problems and use the solution methods in engineering applications.
- demonstrate the use of Z-transform to convert discrete functions into complex frequency domain representation

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", 41st Edition, Khanna Publications, Delhi, (2011).

REFERENCES

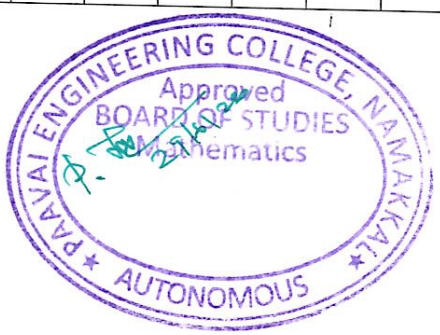
1. Narayanan S., ManickavasagamPillai.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" ,Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
2. Larry C. Andrews, Bhimsen K. Shivamoggi, "Integral Transforms for Engineers", SPIE Optical Engineering press, Washington USA (1999).
3. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, New Delhi (2010).
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and ProgrammeSpecific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	1	-	-	-	-	-	-	-	1	3	2
CO3	3	2	3	2	-	-	-	-	-	-	-	1	3	2
CO4	3	2	2	2	-	-	-	-	-	-	-	1	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	1	3	2



EE19308 **ELECTRICAL MACHINE DRIVES AND SENSORS** **3 0 0 3**

COURSE OBJECTIVES

To enable the students to

- acquire knowledge on the fundamentals of DC machines, starters and braking methods
- understand the basic concepts of induction motors.
- know the fundamentals and power ratings of electric drives.
- analyze the speed control of DC and AC drives.
- familiarize knowledge about transducer and sensors.

UNIT I DC MACHINES **9**

DC Generator-Construction and Principle of operation, EMF Equation, types, OCC and External characteristics curves; DC Motors-Principle of operation, types, Characteristics ; Starters , Braking methods

UNIT II AC MOTOR **9**

Three phase Induction motor- Construction, types, principle of operation, torque, slip characteristics and starting methods; Single Phase Induction Motor-Construction and working principle of operation.

UNIT III FUNDAMENTALS OF ELECTRIC DRIVES **9**

Basic Elements , Types of Electric Drives , factors influencing the choice of electrical drives; Heating and cooling curves , loading conditions and classes of duty , Selection of power rating for drive motors ; Load variation factors.

UNIT IV SOLID STATE SPEED CONTROL OF D.C. AND A.C DRIVES USING CONVENTIONAL METHODS **9**

Speed control of DC series and shunt motors , Armature and field control, Ward- Leonard control system , solid state control using controlled rectifiers (Single phase Half and Full wave); Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme ; Inverters and AC voltage regulators ; applications

UNIT V TRANSDUCERS AND SENSORS **9**

Introduction to transducers – LVDT, Piezoelectric transducer, Temperature transducer, Pressure transducers. Introduction to sensors-Signal Conditioning of Sensor, Position Sensors, Inductive Position Sensors, Inductive Proximity Sensors, Rotary Encoders, Temperature Sensors, Light Sensors, Chemical sensors, level Sensors and its types ; Applications.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of this course, students will be able to

- reproduce the concept of DC generator and implement it in practical applications.
- explain about AC motors and its working.
- formulate electric drives with various power rating.
- select DC and AC drives for industry and domestic application.
- analyze the concentration of chemicals using sensors.

TEXT BOOKS

1. Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, 2014.
2. VedamSubrahmaniam, "Electric Drives (concepts and applications)", Tata McGraw- Hill, 2016.
3. D. Patranabi, "Sensors and Transducers", PHI Learning Pvt. Ltd., 2016.

REFERENCES

1. Theraja B.L and Theraja A.K., "A Text book of Electrical Technology", Volume – II, S,Chand Co.,2016.
2. M.D.Singh, K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 2014.
3. Ian.R.Sinclair, "Sensors and Transducers", BSP Publication, 2015.
4. Bimal K Bose, "Modern Power Electronics and AC Drives", Prentice-Hall of India Pvt. Ltd., 2013.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	2	1	-	-	-	-	-	1	3	3
CO2	3	3	2	1	2	1	-	-	-	-	-	1	3	3
CO3	3	2	3	2	2	1	-	-	-	-	-	1	3	3
CO4	3	2	2	2	2	1	-	-	-	-	-	1	3	3
CO5	3	3	2	2	2	1	-	-	-	-	-	1	3	3

CH19301 **PHYSICAL CHEMISTRY** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- acquire knowledge in the field of chemical kinetics
- distinguish the basic of catalysis and bio-catalysis reactions
- comprehend the various types of photochemical reactions.
- investigate the types of solution and their kinetics and electro-kinetic behaviors.
- analyze liquids phases and variable solubility nature of solutes in the phases.

UNIT I CHEMICAL KINETICS 9

Rate of a reaction (problem) – Order of a reaction (problem) – Examples and rate equations for Zero order, First order, Second order and Third order reactions – Molecularity of a reaction (problem) – Unimolecular and Bimolecular reactions – Half-life period – Kinetics of parallel and opposing reactions– Activation energy – Arrhenius equation – Collision theory of reaction rates – Theory of absolutereaction rates.

UNIT II CATALYSIS AND SURFACE CHEMISTRY 9

General characteristics of catalytic reactions- Acid-Base catalysis-Heterogeneous catalysis-.Surfacereactions- Kinetics of surface reactions-Unimolecular surface reactions-Bimolecular surface reactions -Effect of temperature on surface reactions-Auto catalysis and Oscillatory reactions.

UNIT III PHOTOCHEMISTRY 9

Laws of Photochemistry, Beer – Lambert's law (problem) - Grothus&Drapper's law-StarkEinstein's law - Quantum efficiency (problem) – Reason for difference in quantum efficiency –Methodof determination of quantum yield. Photochemical reactions, Actinometry – Uranyl oxalate method only– Kinetics and mechanism of Hydrogen – Bromine reaction, Hydrogen – Chlorine reaction –Photosensitization- Photo inhibitor –Chemilumiscence.

UNIT IV COLLOIDS 9

Introduction to colloids – Classification of colloids – Preparation of colloids – Purification of colloidal solutions – Properties of colloids – Coagulation of solutions – Origin of charge on colloidal Particles – Determination of size of colloidal particles – Donnan Membrane equilibrium – Emulsions – Gels – Applications of colloids.

UNIT V THE DISTRIBUTION LAW 9

Distribution co-efficient - Distribution Law – Conditions for the validity of the Distribution law– I_2 – CCl_4–H_2O System – Nature of interaction of the solute with one of the solvents Dissociation-Association Applications of Distribution law – Process of Extraction.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- apply chemical kinetic concepts to improve chemical reactions.
- choose suitable catalysts based on applications to speed up reactions and to save energy.
- develop photochemical reactions and photo-physical processes for real world applications.
- design appropriate machines to prepare, to store and to transport various colloidal materials.
- make use of distribution concepts to prepare compounds and then to separate the desired compounds.

TEXT BOOKS

1. Puri B.H. Sharma L.R. and M.S.Prathama, "Principles of Physical Chemisry", S.Chand and Company, New Delhi (2012).
2. Kund and Jain, Physical Chemistry, S.Chand and Company, New Delhi (2011).

REFERENCES

1. Gordon M. Barrow, "Physical Chemistry", Eight Edition, Tata McGrawHill (2013).
2. Peter Atkins & Julio de Paula, Atkins "Physical Chemistry", 9th Edition, Oxford university press (2012).
3. Gurudeep Raj (2011),Advanced Physical chemistry, 34th edition, GoelPublishingHouse, Krishna Prakashan Media (P)Ltd.

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	2	2	2	2	-	-	2	2	3	2
CO2	2	1	2	1	2	2	2	-	2	-	1	2	2	1
CO3	2	1	2	2	1	2	1	2	-	3	1	2	2	2
CO4	2	2	3	2	2	1	2	-	2	-	1	2	1	2
CO5	2	2	3	1	2	2	2	2	2	3	2	2	3	2

CM19302 **FLUID FLOW OPERATIONS** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- understand the basic concepts of fluid statics and dimensional analysis
- learn the fluid flow operations in pipes and basic equations associated with flow through pipes.
- Acquire knowledge over packed and fluidized beds used in process industries
- understand the types of flow measuring devices and to determine coefficient of discharge.
- Acquire knowledge over classification of fluid moving machinery and their performance analysis.

UNIT I FLUID PROPERTIES AND STATICS 9

Physical properties of fluids – Classification of fluids – Pressure measurement – Manometers – Simple andDifferential – Concept of buoyancy – Fluid statics and its applications. Dimensional homogeneity, Rayleigh andBuckingham-π method – Significance of different dimensionless numbers.

UNIT II FLOW THROUGH CONDUITS 9

Types of flow– Shear stress distribution-Laminar and turbulent flow in pipes; Friction factor -Moody Chart – Losses in piping system; Introduction to Boundary layer; Flow through non-circular conduits; Basic equations- Continuity equation - Bernoulli's equation and its applications;

UNIT III FLOW AROUND SOLIDS 9

Drag and its types-Drag coefficient; Industrial applications of Packed and fluidized bed - Packing materials; Pressure drop across packed bed- Ergun's equation; Fluidization and its classification-Pressure drop across the fluidized bed – Minimum fluidization velocity- Motion of particles throughfluids–Terminal settling velocity;

UNIT IV FLOW METERING 9

Classification and Selection of flow meters; Principle, working and applications of Venturimeter, Orifice meter, Rotameter and Pitot tube; Determination of discharge coefficient; Other meters: Anemometer-Mass flow meter - High viscous flow meter; Notches and weirs;

UNIT V FLUID MOVING MACHINERY 9

Classification and selection of fluid moving machinery; Principle, working and applications of Centrifugal pump and Reciprocating pump-Characteristics curves of centrifugal pump; Elementaryprinciples of gear, air lift, diaphragm and submersible pumps; Types and application of valves and pipefittings;

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- apply the principles of dimensional analysis for engineering applications.
- analyze the types of fluid flow in pipes
- salvage and apply the concepts of flow around solids in packed and fluidized beds.
- evaluate and select the flow measuring devices in process industries.
- analyze the performance of fluid moving machinery and appraise the types of valves and pipe fittings in process industries.

TEXT BOOKS

1. Noel de Nevers, "Fluid Mechanics for Chemical Engineers", II[nd] Edition, McGraw-Hill, (1991).
2. A.P. Kulkarni, "Fluid Mechanics for Chemical Engineers" NiraliPrakshan Publication (2015).

REFERENCES

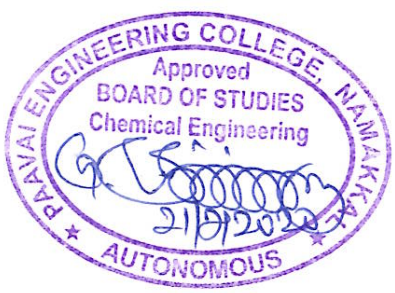
1. McCabe W.L, Smith, J C and Harriot. P "Unit operations in Chemical Engineering", McGraw Hill, VII Edition, (2006).
2. J.M.Coulson and J.F.Richardson, "Chemical Engineering Vol - I &II", 6[th]Edition Butterworth – New Delhi, (2000).
3. R.K. Bansal, "Fluid Mechanics and Hydraulic Machines", Revised Ninth Edition, Laxmi Publications(p) limited, (2014).

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	2	1	-	-	-	-	2	2	3	3
CO2	2	3	1	-	3	2	-	-	-	-	1	3	3	2
CO3	3	2	2	1	2	1	1	-	-	-	3	2	3	3
CO4	2	2	3	3	1	2	2	--	-	-	1	3	2	3
CO5	2	3	2	1	2	1	1	-	-	-	2	2	3	3



CM19301 **CHEMICAL PROCESS CALCULATIONS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- use different systems of units and convert one system of unit to another system.
- learn what material balance are, how to formulate, apply and solve them.
- know how to use the psychometric chart for determining humidity.
- facilitate the basics of thermo chemistry and thermo physics calculations.
- aquire knowledge relate to the air requirement for combustion calculations of fuels.

UNIT I BASIC CHEMICAL CALCULATIONS **9**

Units and Dimensions – Fundamental and derived units – conversions – Basis of calculations – Methods of gasexpression –Compositions of mixture and solutions. Ideal and real gas laws – Gas constant – Calculations ofpressure, volume and temperature using ideal gas law

UNIT II MATERIAL BALANCE WITHOUT CHEMICAL REACTION **9**

Law of conservation of mass – Application of material balance to unit operations like distillation, Evaporation, absorption, extraction, crystallization, drying and mixing/blending. Psychometric – Properties of atmospheric air, Humidity of air – Calculation of absolute, molal, relative and percentage Humidity– Use of Psychometric chart.

UNIT III MATERIAL BALANCE WITH CHEMICAL REACTION **9**

Stoichiometric Principles - Material balance with chemical reaction – Limiting and excess reactants– Percentexcess– Conversion, yield and selectivity – Recycle – Bypass and purging

UNIT IV ENERGY BALANCE **9**

Heat capacity of solids, liquids, gases and solutions–Standard heat of reaction, heats of formation, combustion, solution, mixing– Energy balance for systems with and withoutchemical reaction

UNIT V FUELS AND COMBUSTION **9**

Calculation of theoretical and excess air from combustion of solids, liquid and gaseous fuels–Calorific value of solid, liquid and gas fuels – GCV and NCV. Analysis of coal – orsat,Proximate, Ultimate

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- apply various types of units and dimensions, basic laws about behavior of fluids and solid.
- create material balance without chemical reactions and apply them for a given process.
- explore and solve material balance problems involving chemical reactions.
- gain knowledge to deal with the complexity of larger problems.

- analyze flue gas composition from the given fuel.

TEXT BOOKS

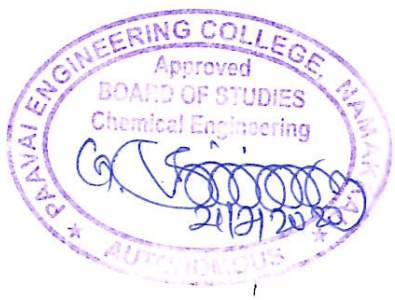
1. Bhatt, B.I. and Vora, S. M., "Stoichiometry", 4th Edition, Tata McGraw Hill Publishers Ltd., (2005).
2. K.A. Gavhane, „ Stoichiometry" NiraliPrakashanPublication's, (2015).

REFERENCES

1. Himmelblau, D., "Basic Principles and Calculations in Chemical Engineering", 6th Edition, Prentice Hall of India (P) Ltd., (2000).
2. Venkataramani, V. and Anantharaman, N., "Process calculations", Prentice Hall of India (P) Ltd., 2003.
3. K.V.Narayanan, B.Lakshmipathy,"Stochiometry and Process Calculation", PHI Learning Ltd.(2013).

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's **(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**														
CO's	**PO's**												**PSO's**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	2	2	1	-	-	-	-	2	2	3	3
CO2	2	3	3	-	3	2	-	-	-	-	1	1	3	3
CO3	2	2	1	3	2	1	-	-	-	-	2	2	3	3
CO4	2	3	2	1	3	1	-	--	-	-	1	3	3	3
CO5	2	2	3	2	2	2	-	-	-	-	2	2	3	3



MC19301 **VALUE EDUCATION** **2 0 0 0**

COURSE OBJECTIVES

To enable the students to

- develop the individual multi-dimensionally in physical, intellectual, emotional and spiritual dimensions.
- facilitate individuals think about and reflect on different values.
- understand their responsibility in making choices and the practical implications of expressing them.
- instigate to choose their personal, social, moral and spiritual values.
- design and chisel the overall personality of an individual.

UNIT I PERSONAL VALUES **6**

Value Education – Definition, Types of values; Human values - Respect, Acceptance, Consideration, Appreciation, Listening, Openness, Affection, Patience, Honesty, Forgiveness, Sacrifice, Authenticity, Self Control, Altruism, Tolerance and Understanding, Wisdom, Decision making, Self –actualization, Character formation towards positive Personality, Contentment; Religious Values -Humility, Sympathy and Compassion, Gratitude. Peace, Justice, Freedom, Equality.

UNIT II COMMUNAL VALUES **6**

Social Values - Pity and probity - Self control - Respect to - Age, Experience, Maturity, Family members, Neighbors - Universal Brotherhood - Flexibility -Peer pressure - Sensitization towards Gender Equality, Physically challenged, Intellectually challenged - Reliability - Unity - Modern Challenges of Adolescent Emotions and behavior - Comparison and Competition- Positive and Negative thoughts- Arrogance, Anger and Selfishness.

UNIT III ENGINEERING ETHICS **6**

Professional Values -Knowledge thirst - Sincerity in profession- Regularity, Responsibility, Punctuality and Faith - Perseverance - Courage - Competence - Co-operation- Curbing unethical practices - Integrity, Social Consciousness and Responsibility. Global Values - Computer Ethics – Moral Leadership - Code of Conduct - Corporate Social Responsibility.

UNIT IV SPIRITUAL VALUES **6**

Developing Spirituality - Thinking process, Moralization of Desires - Health benefits- Physical exercises- Mental peace - Meditation - Objectives, Types, Effects on body, mind and soul- Yoga - Objectives, Types, Asanas. Family values -family's structure, function, roles, beliefs, attitudes and ideals, Family Work Ethic, Family Time, Family Traditions.

UNIT V HUMAN RIGHTS **6**

Classification of Human Rights - Right to Life, Liberty and Dignity- Right to Equality - Right against Exploitation - Cultural and Educational Rights- Physical assault and Sexual harassment - Domestic violence.

TOTAL PERIODS: 30

COURSE OUTCOMES

At the end of this course, students will be able to

- cultivate the values needed for peaceful living in the existing society.
- comprehend humanistic values to develop peace in the world.
- foster ethics in profession and usage of Technology.
- orient with the importance of value education towards personal, group and spiritual attributes.
- nurture physical, mental, spiritual growth to face the competitive world.

TEXT BOOKS

1. Sharma, S.P. Moral and Value Education; Principles and Practices, Kanishka publishers, 2013.

REFERENCES

1. Little, William, An introduction of Ethics. Allied publisher, Indian Reprint 1955.
2. "Values (Collection of Essays)". Sri Ramakrishna Math. Chennai. 1996.

CO-PO MAPPING

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	-	2	2	-	-	2	-	2
CO2	-	-	-	2	-	2	-	1	3	2	1	3	-	2
CO3	-	-	3	2	2	3	2	3	3	1	3	3	2	3
CO4	-	-	3	1	-	2	-	-	1	-	-	3	2	-
CO5	-	-	-	-	-	1	-	-	-	-	-	3	-	-

CM19303 TECHNICAL ANALYSIS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- Calculate the chemical contents present in the given soap and oil samples and their separation methods.
- determine the chemical contents present in the given cement and coal samples their separation methods.
- analyze the different fuel analysis studies.
- estimate the chlorine content present in the given sample.

LIST OF EXPERIMENTS

I. Soap Analysis

a. Estimation of total fatty acid

b. Estimation of percentage alkali content

II. Oil Analysis

a. Estimation of free acid

b. Determination of Saponification value

c. Determination of iodine value

III. Cement Analysis

a. Estimation of Silica content

b. Estimation of mixed oxide content

c. Estimation of calcium oxide content

IV. Coal Analysis

a. Estimation of Sulphur present in coal

b. Ultimate analysis of coal

c. Proximate analysis of coal

V. Analysis of Bleaching Powder

a. Estimation of available chlorine

VI. Analysis of fuels

a. Flash point b. Fire point c. Cloud point d. Pour point e. Aniline point.

VI. Analysis of milk

a. Detection of adulterants in whole milk

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, students will be able to perform

- Estimation of TFM and alkali content in soap sample
- Determination of chemical contents present in cement and coal
- Various studies in analyzing fuel samples
- Determination of various adulterants in milk sample

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	1	2	1	-	-	-	-	2	2	3	3
CO2	2	1	3	-	2	1	-	-	-	-	1	2	3	3
CO3	3	2	2	1	2	1	-	-	-	-	1	2	3	3
CO4	2	2	2	1	2	1	-	--	-	-	1	2	3	3
CO5	3	1	2	1	2	1	-	-	-	-	2	2	3	3

CM19304 FLUID MECHANICS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- calibrate flow meters
- determine pump characteristics
- find pressure loss for fluid flows
- determine viscosity measurement

LIST OF EXPERIMENTS

1. Discharge coefficient of constant and variable head meters.
2. Calibration of weirs and notches.
3. Open drum orifice and draining time.
4. Flow through straight pipe.
5. Flow through annular pipe.
6. Flow through helical coil and spiral coil.
7. Losses in pipe fittings and valves.
8. Characteristic curves of pumps (Centrifugal, Reciprocating).
9. Pressure drop studies in packed column.
10. Pressure drop studies in Fluidized bed.
11. Viscosity measurement.
12. Calibration of Rotameter.

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, students will be able to,

- understand the fundamental fluid flow properties and its measurements.
- gain knowledge and Characteristics of pumps efficiency
- understand the fluid properties of different streams
- acquire knowledge about viscosity of fluids

REFERENCES

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

CO/PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme

SpecificOutcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	3	3	2	-	-	2	-	-	2	3	3
CO2	3	2	2	2	1	-	-	-	-	-	-		2	3
CO3	2	2	2	-	2	-	-	-	-	-	-	-	2	2
CO4	2	2	-	2	-	-	-	-	-	-	-	-	2	2
CO5	3	1	1	2	2	-	-	-	-	-	-	-	3	2

EN19301 **ENGLISH PROFICIENCY COURSE LABORATORY** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- familiarize with the reading skills such as skimming and scanning.
- practice writing tasks to the level expected.
- develop listening strategies such as listening for key words, making inferences and identifying main ideas.
- speak well without inhibition and to assist the students in improving their vocabulary, pronunciation and comprehension of grammar.
- enrich their LSRW skills so as to crack on-line proficiency tests and to bring their career aspirations true.

EXERCISES FOR PRACTICE

1. Listening Exercises from TOEFL
    a. Conversations, Lectures
2. Listening Exercises from IELTS
    a. Places and directions
    b. Actions and processes
3. Reading Exercises from PTE
    a. Re-order paragraphs
4. Reading Exercises from IELTS
    a. Opinions and attitudes
    b. Locating and matching information
5. Reading Exercises from BEC Vantage
    a. Single informational text with lexical gaps
    b. Error identification
6. Writing Exercises from PTE
    a. Summarize written text
7. Writing Exercises from IELTS
    a. Describing maps
    b. Describing diagrams
8. Speaking IELTS format
    a. Talking about familiar topics
    b. Giving a talk
    c. Discussion on a Topic

TOTAL PERIODS 30

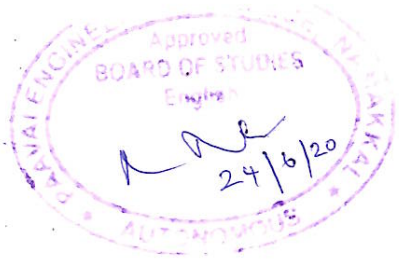
COURSE OUTCOMES

At the end of this course, the students will be able to

- skim, scan and infer the given texts and attend the tasks successfully.
- write coherently using appropriate vocabulary and grammar.
- listen to speeches and conversations and answer the questions.
- communicate fluently and effectively on any given topics.
- appear with confidence for on-line tests.

CO/PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programmes Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	3	-	-	-	3	2	-	-	-	2
CO2	-	-	2	2	-	-	1	1	3	2	-	2	-	2
CO3	-	-	-	-	-	3	1	2	3	2	2	3	2	-
CO4	-	-	-	-	-	2	2	3	3	2	2	-	2	-
CO5	-	-	2	-	-	1	2	-	3	3	-	1	2	3



MA19404 **NUMERICAL METHODS** **3 1 0 4**

COURSE OBJECTIVES

To enable students to

- apply various numerical techniques for solving algebraic/transcendental equations and system of linear equations
- analyse the knowledge of interpolation using numerical data
- develop the knowledge of numerical differentiation and numerical integration techniques
- solve numerically non-linear differential equations that cannot be solved by conventional analytical methods.
- apply finite difference methods of solving boundary value problems

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **12**

Solution of equation–Iteration method: Newton Raphson method – Solution of linear systems by Gauss-Seidel iterative method – Inverse of a matrix by Gauss Jordon method –Power method.

UNIT II INTERPOLATION AND APPROXIMATION **12**

Lagrange interpolation – Newton's Divided Difference, and cubic spline Interpolation – Newton's forward and backward difference formulas for equal intervals.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION **12**

Newton's interpolation formulae for differentiation – Numerical integration by trapezoidal rule and Simpson's 1/3 rule – Romberg's method – Two-point and Three-point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons' rule.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS **12**

Single step methods: Taylor series method for first order equation – Fourth order Runge– Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS **12**

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by Bender-Schimidt and Crank-Nicholson methods – One dimensional wave equation by explicit method and two dimensional Laplace and Poisson equations by Leibmann's method.

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- comprehend the basics of algebraic and transcendental equations and their numerical solutions.
- apply the interpolation methods for constructing approximate polynomials
- demonstrate the knowledge of numerical differentiation and integration in computational and simulation processes
- utilize the numerical methods of solving initial value problems occurring in various fields of science and engineering
- describe the computational methods of solving various boundary value problems

TEXT BOOKS

1. Erwin Kreyszig., "Advanced Engineering Mathematics" 10th edition, Wiley Publications, 2010.
2. T. Veerarajan. and T .Ramachandran, "Numerical Methods with programming in C", 2nd Ed., Tata McGraw-Hill, 2006.
3. Sankar Rao K " Numerical Methods For Scientisits And Engineers –3rd Edition Princtice Hall of India Private, New Delhi, 2007

REFERENCES

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Numerical Methods", S.Chand Co. Ltd., New Delhi, 2003
2. Gerald C.F. and Wheatley, P.O., "Applied Numerical Analysis" 6th Edition, Pearson Education Asia, New Delhi, 2002.
3. M.K.Jain , S.R.K. Iyangar , R.K.Jain , "Numerical Methods For Scientific & Engineering Computation" New Age International (P) Ltd , New Delhi , 2005.
4. M.B.K. Moorthy and P.Geetha, "Numerical Methods" , Tata McGraw Hill Publications company, New Delhi, 2011.

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

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	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO2	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO3	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO4	3	3	2	3	-	-	-	-	-	-	-	1	3	2
CO5	3	3	3	2	-	-	-	-	-	-	-	1	3	2

CM19401 **MECHANICAL OPERATIONS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- comprehend the Characteristics of particulate solids, and storage of solids.
- survive and aware of the best suitable size reduction equipment needed for a particular process industry.
- acquire knowledge in separating solids from solids, solids from liquids.
- familiarize mechanism of filtration and equipment's involved in process.
- gain knowledge on mixing of solid-solid, liquid – liquid components.

UNIT I PROPERTIES AND STORAGE OF SOLIDS **9**

Characterization of solid particles: Particle size and shape, Mean particle sizes and number of particle in a mixture, Particle size measurement methods - screen analysis Cumulative and Differential. Properties ofparticulate masses. Storage of solids - Bulk and Bin – Conveyors – Belt, Chain, Screw and Pneumatic conveying.

UNIT II SIZE REDUCTION **9**

Mechanism of size reduction – Choice of size reduction equipment – Energy and Power requirements in size reduction – Laws of size reduction - Principles of comminution.

UNIT III MECHANICAL SEPARATIONS **9**

Screening and types of Screening equipment – material balance over the screen – screen capacity – effectiveness of screens – Concept of gravity settling – sedimentation – thickening — electrostatic and magneticseparator – Froth floatation – centrifugal separation - Cyclone separator.

UNIT IV FILTRATION **9**

Theory and mechanism of filtration- cake filter - principles – pressure drop – constant pressure and rate filtration – Batch and continuous filters Equipment for filtration – Filter media and aids – Fundamentals and introduction to membrane, bio, micro filtration.

UNIT V MIXING AND AGITATION **9**

Equipment for agitation – impeller and their characteristics – flow patterns - power for agitation – correlations. Mixing of solids and pastes: equipments for solid mixing, kneading and dispersions.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- distinguish the various types of mechanical operations and its importance in industries.
- prefer the best type of operation needed for a specific industry by analyzing, interpreting and evaluating the data.
- preference and design various types of fluid-solid separation equipment based on the behaviour and properties of materials used in chemical industries
- reveal about filtration and their mechanism.
- assess their processing operation by effective agitation and mixing of fluids.

TEXT BOOKS

1. Kiran D Patil, "Mechanical Operations" 3rd Edition, Nirali Publication. (2016).
2. Foust, A. S., Wenzel, L.A., Clump, C.W., Naus, L., and Anderson, L.B., "Principles of Unit Operations", 2nd Edn., John Wiley & Sons, (1994).

REFERENCES

1. Coulson,J.M.and Richardson, J.F.,"Chemical Engineering" Vol. I, 4th Edn., Asian Books Pvt. Ltd.,India, (1998).
2. Anup K Swain, HemlataPatra, G K Roy, "Mechanical Operations", Tata McGraw Hill Education Private Limited, (2011)
3. McCabe, W.L, Smith J.C and Harriot, P., "Unit Operations in Chemical Engineering", McGraw-Hill, Fourth Edition, (1984).

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	1	2	2	-	-	-	-	2	2	3	3
CO2	2	2	2	2	3	1	-	-	-	-	1	1	3	3
CO3	3	2	2	1	2	2	-	-	-	-	2	2	3	3
CO4	2	3	2	2	1	1	-	--	-	-	1	1	3	3
CO5	3	2	2	1	2	1	-	-	-	-	3	2	3	3

CM19402 **HEAT POWER ENGINEERING** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- assess the basic fundamentals and laws of thermodynamics
- gain knowledge of thermo dynamic cycles and its efficiency
- study different types of boilers, mounting and accessories
- resolve the properties of steam and energy conservation opportunities in steam systems
- acquire knowledge of turbines and vacuum systems

UNIT I LAWS OF THERMODYNAMICS **9**

Property, state, path and process, quasi-static process, work, Energy. Thermodynamic systems-closed, open and isolated. Zeroth, First and Second laws of Thermodynamics (Basic concepts only), Internal energy, Specific heat capacity and Enthalpy.

UNIT II THERMODYNAMIC CYCLES **9**

Air standard Cycles: Carnot, Otto, Diesel and Combined cycle; Brayton and Rankine cycles – cycle efficiencies.

UNIT III PROPERTIES OF STEAM **9**

Properties of steam, mollier chart, dryness fraction of steam- Different types of calorimeters. Concept of Steam distribution systems. Steam traps- types and their characteristics. Energy conservation opportunities in steam systems.

UNIT IV BOILERS **9**

Types and classification of boilers: water tube, fire tube, coal, oil and gas fired boilers; Stoker fired, pulverized and fluidized bed boilers. Mountings and accessories. Performance and Efficiency of boilers.

UNIT V TURBINES AND VACUUM SYSTEMS **9**

Steam turbines- types and working principles: Reaction and impulse turbines; Application of co-generation principles in process industries. Gas turbines- principle and working. Production of Vacuum: Systems and Equipment- Vacuum Pumps, Steam Ejectors; Instrumental methods of Vacuum measurement.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- understand the conceptual laws of thermodynamics for application in thermodynamic cycles
- compute and analyse different thermodynamic cycles and calculate their thermal efficiencies
- categorize the boilers and perform simple calculations of boiler efficiencies
- understand the steam distribution and utilization systems to identify the energy conservation opportunities
- Comprehend principles of steam turbines and calculation of turbine efficiencies and understand

TEXT BOOKS

1. Rajput R.K., "Thermal Engineering", 9th Edition, Laxmi Publications, 2010.
2. Rudramoorthy R., "Thermal Engineering", 4th Edition, Tata McGraw Hill PublishingCompany, New Delhi, 2006.

REFERENCES

1. Kothandaraman, C.P., Domkundwar and Domkundwar, "Course in Thermodynamics and Heat Engines", 3rd Edition, DhanpatRai& Sons, New Delhi, 2011
2. Ballaney P.L., "Thermal Engineering", Khanna Publishers, New Delhi, 2005.

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	1	2	1	-	-	-	-	2	2	3	3
CO2	2	2	3	2	3	1	-	-	-	-	1	3	3	3
CO3	3	2	1	1	2	2	-	-	-	-	2	2	3	3
CO4	2	1	2	2	3	1	-	--	-	-	1	1	3	3
CO5	3	2	1	1	2	2	-	-	-	-	2	2	3	3

CM19403 **PROCESS ORGANIC SYNTHESIS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- familiarize the principle of nitration and manufacture of amino compounds
- have a basic ideas about production and properties of hydrogenation and alkylation
- comprehend types of oxidation hydrolysis processes, Esterification of organic compounds
- aquire knowledge about halogenation, sulfonation and sulfation
- provide fundamental knowledge of dye and drug synthesis

UNIT I NITROGEN AND AMINATION **9**

Principle of Nitrogen –N-nitro compounds and nitration esters, industrial equipment and processes. Amination; methods – reduction and Ammonolysis. Catalytic reaction, manufacture of amino compounds

UNIT II HYDROGENATION AND ALKYLATION **9**

Production and properties of hydrogen, Catalytic hydrogenation and hydrogenolysis; Methanation and Fischer- Tropschreaction. Types and factors affecting alkylation, industrial alkylation process.

UNIT III OXIDATION ,HYDROLYSIS AND ESTERFICATION **9**

Types of oxidation reaction – liquid-phase and Vapour-phase; Hydrolysis process and equipments esterification of inorganic and organic acids application in chemical industries

UNIT IV HALOGENATION, SULFONATION AND SULFATION **9**

Halogenation; Chlorination reaction; sulfonation and sulfation ; desulfonation reactions

UNIT V DYE AND DRUG SYNTHESIS **9**

Synthesis of dyes; Congo red, triphenylmethane dyes –malachite green, Para RosanilineAlizarain, Eosin; drug synthesis –Sulphanilamide, Chloroquinine, Penicillin, Erythromycin.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- understand the various unit process in synthesis of organic compounds
- apply for the application of organic compounds in various industries
- analyze chemicals reaction and reaction conditions
- identify reaction schemes and mechanisms for a number of important reaction used in organic synthesis
- characterize the synthesis of important dyes and drugs

TEXT BOOKS

1. Austin G.T., "Shreve's Chemical Process Industries ",5th edition (Special Reprint edition),McGraw Hill International co., 2005
2. GrogginsP.H.,"Unit Processes in Organic Synthesis", 5th edition (reprint), McGraw Hill International Co., 2001.

REFERENCES

1. K.S.Tewari&N.K.Vishnoi, "A Textbook of Organic Chemistry", 4thEdition, Vikas Publishing House,New Delhi, 2017.
2. Graham SolomonsT.W.,CraigB.Fryhle and scott A. Snyder,"Organic Chemistry",11th edition,International student version, John Wiley And sons inc, New York,2013.

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	PO's												**PSO's**	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2	1	2	1	-	-	-	-	2	2	3	3
CO2	3	2	3	2	1	2	-	-	-	-	1	2	3	3
CO3	2	2	1	2	2	1	-	-	-	-	2	3	3	3
CO4	3	2	2	1	1	2	-	--	-	-	1	2	3	3
CO5	2	3	3	2	2	1	-	-	-	-	2	1	3	3

CM19404 **INSTRUMENTAL METHODS OF ANALYSIS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- Discriminate between different radiation frequencies through the use of filters and prisms.
- appraise the concentration of a solute in a solution using Beer's law.
- identify the atomic configurations in molecules
- familiarity the chromatographic behavior and HPLC of solutes.
- be aware of the static and transient methods of analyzing the samples.

UNIT I INTRODUCTION OF SPECTROMETRY **9**

Properties of electromagnetic radiation- wave properties – components of optical instruments – Sources of– signal radiation – wavelength selectors – sample containers – radiation transducers – Signal process and read outs to noise ratio - sources of noise – Enhancement of signal to noise - types of optical instruments – Principle of Fourier Transform optical Measurements.

UNIT II MOLECULAR SPECTROSCOPY **9**

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beer's law – Theory of Instrumentation - Applications -Theory of fluorescence and Phosphorescence – Instrumentation – Applications –Infrared absorption spectrometry – IR instrumentation - Applications – Theory of Raman spectroscopy – Instrumentation – applications.

UNIT III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY **9**

Theory of NMR – environmental effects on NMR spectra – chemical shift- NMR spectrometers – applications of 1H and 13C NMR- Molecular mass spectra – ion sources – Mass spectrometer. Applications of molecular mass –Electron paramagnetic resonance- g values – instrumentation.

UNIT IV SEPARATION METHODS **9**

General description of chromatography – Band broadening and optimization of column performance- Liquid chromatography – Partition chromatography - Adsorption chromatography – Ion exchange chromatography –size exclusion chromatography- Affinity chromatography-principles of GC and applications – HPLC- Capillary electrophoresis – Applications.

UNIT V ELECTRO ANALYSIS AND SURFACE MICROSCOPY **9**

Electrochemical cells- Electrode potential cell potentials – potentiometry reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry – Cyclic and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probe microscopes – AFM and STM.

TOTAL PERIODS 45

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- know the role of analytical instrumentation in the production and evaluation of new products.
- comprehend electromagnetic radiation absorbed, scattered, or emitted by atoms.
- identify unknown or confirming the presence of suspected compounds in materials.
- stimulate and analyze the samples using chromatographic and HPLC techniques.
- progress the selectivity and sensitivity of the sample and its detection.

TEXT BOOKS

1. Willard "Instrumental Methods of Analysis" 7th edition, CBS Publishers & Distributors (2004).
2. H.Kumar, "Instrumental Methods of Chemical Analysis" PragatiPrakashan; (2016)

REFERENCES

3. D.A.Skoog, F. J. Holler, Stanky, R.Crouch, "Instrumental Methods of Analysis" Cengage Learning(2007).
4. Gurdeep R Chatwal Sham K Anand, "Instrumental Methods of Chemical Analysis", 1st edition, Himalaya publishing house (2015).

CO/PO Mapping:

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CO's	PO's												PSO's	
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CO1	2	2	2	1	2	1	-	-	-	-	2	3	3	3
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CO3	2	1	1	1	2	1	-	-	-	-	2	3	3	3
CO4	3	2	2	2	2	2	-	--	-	-	1	2	3	3
CO5	2	2	3	1	3	1	-	-	-	-	2	2	3	3

ENVIRONMENTAL SCIENCE AND ENGINEERING

MC19401 **(Common to all B.E./ B.Tech Programmes)** **3 0 0 0**

(Mandatory, Noncredit Course)

COURSE OBJECTIVES

To enable the students to

- recognize the interdisciplinary and holistic nature of the environment.
- create awareness on ecosystem and biodiversity preserve.
- study about the integrated themes of pollution control and waste management.
- understand the significance of natural resources and environment to stimulate sustainable development.
- assess the socio-economic, political and ethical issues on population with environment.

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9

Environment: Definition- scope - importance – need for public awareness. Forest resources: Use –over exploitation deforestation - effects on forests and tribal people. Water resources: Use – over utilization of-surface and ground water. Mineral resources Use – exploitation- environmental effects of extractingand using mineral resources – Food resources: effects of modern agriculture- fertilizer-pesticide problems. Role of an individual in conservation of natural resources. **Activity:** Slogan making event on conserving natural resources or plantation of trees.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem: Structure and function of an ecosystem – producers - consumers –decomposers– energy flow in the ecosystem – ecological succession – food chains - food webs andecological pyramids. Ecosystems- Types of ecosystem: Introduction - forest ecosystem –aquatic ecosystems(lakes, rivers). Biodiversity: Introduction– definition (genetic - species –ecosystem)Diversity- Value of biodiversity: Consumptive use - productive use – social values – ethical values-aesthetic values- Hotspots of biodiversity- Conservation of biodiversity: In-situ and ex-situconservation of biodiversity.

UNIT III POLLUTION 9

Pollution: Définition –air pollution - water pollution - marine pollution - noise pollution - thermal pollution. Solid waste management: Causes - effects - control measures of urban andindustrial wastes. Role of an individual in prevention of pollution. Disaster management Floods– earthquake - cyclone - landslides. Electronic waste -Sources-Causes and its effects.

UNIT IV SOCIAL ISSUES AND ENVIRONMENT **9**

Water conservation - rain water harvesting - watershed management. Environmental ethics:– climate change- global warming and its effects on flora and fauna - acid rain - ozone layer depletion - nuclear accidents- nuclear holocaust - Environment protection act: Air (Prevention and Control of Pollution) act– water (Prevention and control of Pollution) act .

UNIT V HUMAN POPULATION AND ENVIRONMENT **9**

Human population: Population growth - variation among nations – population explosion – family welfareprogramme– environment and human health – Human rights – value education – HIV/AIDS– women and child welfare. Role of information technology in environment and human health.

TOTAL : 45 PERIODS

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- explain the importance of interdisciplinary nature of environment studies, uses and exploitation of natural resources.
- analyze the different types of ecosystem and biodiversity, its values and protecting the environment from degradation.
- investigate the existing environmental challenges related to pollution and its management.
- select suitable strategies for sustainable management of components of environment.
- correlate the impacts of population and human activities on environment.

TEXT BOOKS

1. Raman Sivakumar, Introduction to Environmental Science and Engineering, 2nd Edn, TataMcGraw Hill Education Private Limited, New Delhi, (2010).
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, (2010).

REFERENCES

1. S. Divan, Environmental Law and Policy in India, Oxford University Press, New Delhi, 2001.
2. A.K.De, Environmental Chemistry, VI edition,2015 NewAge International (P) ltd Publication, New Delhi.
3. C.S.Rao, Environmental Pollution and Control engineering, 5th edition, New Age International (P) Publication, ltd NewDelhi 110002
4. Clair Nathan Sawyer, Perry L. McCarty, Gene F. Parkin, "Chemistry for Environmental Engineering

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CO4	2	2	2	2	2	1	-	--	-	-	1	3	3	3
CO5	2	2	3	1	1	1	-	-	-	-	2	2	3	3

CM19405 MECHANICAL OPERATIONS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- acquire a sound working knowledge on different types of crushing equipment's
- characterize different mechanical operation separators based on the size and efficiency.
- determine the experimental values and conclude the best fit model
- determine the specific cake resistence and the filters.

LIST OF EXPERIMENTS

1. Sieve analysis
2. Batch filtration studies using a Leaf filter
3. Batch filtration studies using a Plate and Frame Filter press
4. Characteristics of batch Sedimentation
5. Reduction ratio in Jaw Crusher
6. Reduction ratio in Ball mill
7. Reduction ratio of Roll Crusher
8. Separation characteristics of fine particles using Cyclone separator
9. Separation characteristics of Elutriator
10. Reduction ratio of Drop weight crusher
11. Mixing apparatus

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- Carry out experiments as a team to study the performance of various size reduction equipment's.
- Analyze and interpret the experimental data for solid handling to provide valid results.
- Select suitable equipment needed for a specific mechanical operation.
- Analyze the experimental data for differents size of the particles

REFERENCES

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

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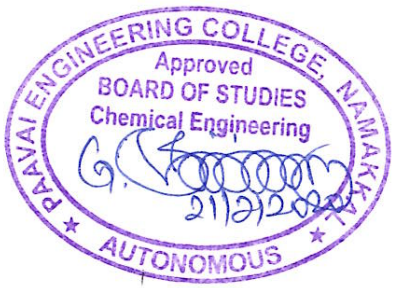
CO2	-	-	-	-	-	-	2	-	1	-	-	-	2	3
CO3	2	-	2	-	-	-	1	2	-	2	-	-	3	2
CO4	-	1	-	-	-	2	2	-	-	-	-	2	3	3
CO5	2	-	2	-	-	2	-	-	2	-	-	-	2	2



CM19406 PHYSICAL AND ORGANIC SYNTHESIS LABORATORY 0 0 4 2

COURSE OBJECTIVES

To enable students to

- gain knowledge on properties of water and estimate it
- understand amount of nitrogen presentation urea
- import knowledge on handling UV Spectrophotometer and flame photometer
- Prepare organic compounds
- learn basic principle involved in analysis and synthesis of different organic derivatives

LIST OF EXPERIMENTS

1. Determination of carbohydrates from unknown organic compounds
2. Identification of acids from unknown organic compounds
3. Determination of ester from unknown organic compounds
4. Estimation of amine from unknown organic compounds
5. Estimate the amount of nitrogen in urea by kjeldahls methods
6. Estimate the ions present in given solution using UV—visible spectrophotometer
7. Determine the amount of sodium and potassium ions present in water using flame photometer
8. Polarimetry inversion of cane sugar
9. Turbidity and colour of waste water
10. Preparation of meta di nitro benzene from nitro benzoate
11. Preparation of benzoic acids from ethyl benzoate.
12. Preparation of benzoic acid from benzaldehyde

TOTAL PERIODS 60

COURSE OUTCOMES

Upon the completion of the course, students will be able to

- Handle Nephelometer to estimate the turbidity of water
- Perform the experiment on nitrogen content in urea
- Utilize UV Spectrophotometer and flame photometer to estimate the ions in solution
- Prepare m-Dinitrobenzene and Benzoic Acid from organic chemicals
- Identify the nature and functional groups of organic compounds

REFERENCES

1. K.S.Tewari& N.K.Vishnoi, "A Textbook of organic chemistry" ,4th edition, vikas publishing house ,new delhi,2007
2. Graham solomons T.W.,CraigB.fryhle and scott a. Snyder "organic chemistry"11th dition,international stdent version,john wiley and sons inc,new york,2013

CO/PO Mapping:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's (1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	1	2	1	-	-	-	-	2	2	3	3
CO2	2	1	3	-	2	1	-	-	-	-	1	2	3	3
CO3	2	2	2	1	2	1	-	-	-	-	1	2	3	3
CO4	2	2	2	1	2	1	-	--	-	-	1	2	3	3
CO5	2	1	2	1	2	1	-	-	-	-	2	2	3	3