KADI SARVA VISHWAVIDYALAYA

B.Sc. Curriculum as per NEP

for Semester 4

W.E.F. June 2024

KADI SARVA VISHWAVIDYALAYA

B.Sc. Programme – Structure

(Scheme for teaching and evaluation for B.Sc Programme (Basic/Honours)

Aligning to NEP–2020 as per Govt. of Gujarat Dated 11/07/2023

B.Sc. Semester IV Structure

Sr. no	Component	Course code	Course title	Duration In Hrs.		Credits	Maximum Marks		TOTAL
				Theory	Practical		CCE (Formative)	SEE (Summative)	
01	Major Courses (Select any three of same subject)	MBM233-2C	Enzymology and Microbial Metabolism	60	0	4*3 = 12	50	50	100
		MBM234-2C	Molecular Genetics of Prokaryotes	60	0				
		MBM235-2C	Microbiology Practical- IV	0	120				
		CHM236-2C	Inorganic & Analytical Chemistry-II	60	0				
		CHM237-2C	Organic & Physical Chemistry-II	60	0				
		CHM238-2C	Chemistry Practicals-IV	0	120				
		PHM239-2C	Basic Physics - V	60	0				
		PHM240-2C	Basic Physics - VI	60	0				
		PHM241-2C	Physics Practical-IV	0	120				
		MTM242-2C	Numerical Analysis	60	0				
		MTM243-2C	Differential Equations	60	0				
		MTM244-2C	Application of Numerical Analysis and Differential Equations	0	120				
02	Minor (Select any One)	MBE221-2C	Analytical techniques in Microbiology-I	30	60	4	50	50	100
		CHE222-2C	Chemistry in Daily Life-Agriculture Chemistry	30	60				
		PHE223-2C	Introduction to Computational Physics with Python	30	60				
		MTE224-2C	Python Programming	30	60				
03	AEC	AEC 213-2C	Personality Development	30	0	2	25	25	50
04	VAC	VAC207-2C	Disaster Management/ Climate change/ Renewable energy	30	0	2	25	25	50

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Sr. no	Component	Course code	Course title	Duration In Hrs.		Credits	Maximum Marks		TOTAL
				Theory	Practical		CCE (Formative)	SEE (Summative)	
05	SEC (Select any One)	SEC265-2C	Food Microbiology	30	0	2	25	25	50
		SEC266-2C	Industrial Chemistry-II	30	0				
		SEC267-2C	Physics in Biology and Medicine -II	30	0				
		SEC268-2C	Quantitative Aptitude-II	30	0				
	Total					22	275	275	550

Note:

1. The marks distribution is mainly divided into two components named Continuous and Comprehensi Evaluation (CCE) = 50 % and Semester End Evaluation (SEE) = 50 %.
2. Passing Percentage for each subject is 36%.

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Microbiology Semester IV -Major Course

MBM233-2C - Enzymology and Microbial Metabolism

COURSE OUTCOMES:

- CO1: Define the key terms and models in enzymology and predict how the factors affect the enzyme activity.
- CO2: Understand the concepts of enzyme kinetics, inhibition, and regulation based on experimental data of different regulatory mechanisms.
- CO3: Understand the concept of metabolism and describe metabolites.
- CO4: Describe and compare respiratory metabolism and fermentative metabolism.
- CO5: Discuss and compare the metabolic pathways and regulation for the carbohydrate metabolism.
- CO6: Discuss Lipid, Protein and Nucleic Acid metabolism and evaluate their end products.

Teaching and Evaluation scheme

Course code	Course Title	Credit	Teaching Scheme (Hrs. Per Week)	Examination Scheme			Total Marks
			Theory	Hrs.	Max Marks		
					CCE	SEE	
MBM233-2C	Enzymology and Microbial Metabolism	4	4	2.5	50	50	100

Unit I: Enzymes **Teaching Hours: 15 (Weightage 25%)**

- General Introduction, Physical and Chemical Properties of Enzymes
- Structure of enzymes: Active site, Prosthetic group, Apo enzyme, Holoenzyme, Co-enzymes, cofactors.
- Nomenclature and classification of enzymes. IUB system of enzyme classification
- Localization of enzymes: Extracellular and intracellular
- Mechanism of enzyme action: Transition state theory, Lock and Key and Induced Fit model
- Factors affecting enzyme activity.

Unit II: Enzymes-II **Teaching Hours: 15 (Weightage 25%)**

- Enzyme Kinetics- MM Equation
- Transformation of MM plot into linear plot

- Inhibition of enzyme activity: Competitive, noncompetitive and uncompetitive.
- Irreversible Inhibition
- Regulation: Types of regulatory mechanisms: Feedback inhibition, energy-linked control, precursor activation, zymogen activation, covalent modification and Allosterism.

Unit III: Introduction to Metabolism and Carbohydrate metabolism.

Teaching Hours: 15 (Weightage 25%)

- An overview of metabolism: Anabolism, Catabolism
- Primary and Secondary metabolites. Role of precursor metabolites in cell metabolism.
- Respiratory and fermentative metabolism
  - Basic concept of respiration, types of respiration.
  - Basic concept of fermentative metabolism.
- Carbohydrate metabolism:
  - Glycolysis and its regulation
  - TCA cycle and its regulation
  - PPP pathways and its regulation
  - Gluconeogenesis
  - Electron transport chain order and organization of carriers, proton gradient, respiratory controls and oxidative phosphorylation,
  - ATP-synthesis

Unit IV: Lipid, Protein and Nucleic Acid Metabolism **Teaching Hours: 15 (Weightage 25%)**

- Lipid metabolism:
  - β oxidation of fatty acids,
  - Ketone bodies -formation and degradation)
- Protein and Amino acid metabolism:
  - Degradation of amino acid.
  - Urea cycle.
  - Nitrogen balance
  - Regulation of amino acid metabolism in microbial system.
- Nucleic acid metabolism:
  - Biosynthesis and degradation of purines and pyrimidines.
  - Structure and Function of Ribonucleotide reductase.

***CCE**: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

***SEE:** Semester End Evaluation

Reference Books:

1. Enzymes- Trevor Palmer & Philip L. Bonner, 2nd Edition, Wood head Publishing, Cambridge, UK
2. Enzymology- T. Devasena, English Edition, Oxford University Press, Oxford, UK.
3. Microbiology- Pelczar, Chan, and Kreig, McGraw-Hill, New York, USA.
4. Microbiology- An Introduction- Tortora, G.J., Funke, B.R., Case, C.L., 8th Edition, Pearson/Benjamin Cummings, San Francisco, USA (Pearson UK HQ in London).
5. General Microbiology- Stainer, Ingharam, Wheelis and Painter, Macmillan Publication, London, UK.
6. Biology of Microorganisms- Brock and Madigan, Pearson Education, London, UK.
7. Fundamental Principles of Bacteriology - A.J. Salle, published by McGraw-Hill Book Company,

Inc., USA.
8. Introduction to Microbiology- Ingraham and Ingraham, S.Chand (G/L) & Company Ltd, India.

Suggested Reference Books:

1. Elementary Microbiology- H. A. Modi, Shanti Prakashan, India
2. Textbook of Microbiology- Dubey and Maheshwari, S. Chand Publishing, India.
3. Microbiology, A Practical Approach- Patel and Phanse, Lulu, North Carolina, USA
4. Experiments in Biotechnology- Nighojkar and Nighojka, International E-Publication, India.
5. General Microbiology- Powar and Daginawala, Himalaya Publishing House, India.
6. Fundamentals in Microbiology - Frobisher and Hinsdinn, 9th Edition, Thomson Learning, USA
7. Microbiology- S.S. Purohit, TATA McGraw Hill Publishing. Company Ltd. New Delhi, India.

	Course Outcomes	POs/PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Define the key terms and models in enzymology and predict how the factors affect the enzyme activity.	PO1, PO2, PO3, PO6, PSO1	U, R	C	15
CO2	Understand the concepts of enzyme kinetics, inhibition, and regulation based on experimental data of different regulatory mechanisms	PO1, PO2, PO3 PO6, PSO1, PSO2	U, R, An	C, P	15
CO3	Understand the concept of metabolism and describe metabolites.	PO1, PO2 PSO1	U, R	C	3
CO4	Describe and compare Respiratory metabolism and fermentative metabolism.	PO1, PO2 PSO1	U, E, An	C	3
CO5	Discuss and compare the metabolic pathways and regulation for the carbohydrate metabolism.	PO1, PO2, PO3,PO6, PSO1	U, R, E, An,	C	9
CO6	Discuss Lipid, Protein and Nucleic Acid Metabolism and evaluate their end products.	PO1, PO2, PO3, PO6 PSO1	U, R, E	C	15
	Total hours of Instruction				**60**

Mapping of COs with POs & PSOs

CO	PO										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3				3					3	
CO2	3	3				3					3	2
CO3	3	3									3	
CO4	3	3									3	
CO5	3	3	3			3					3	

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CO6	3	3	3			3					3	

3: High, 2: Medium, 1: Low

Microbiology Semester IV -Major Course

MBM234-2C - Molecular Genetics of Prokaryotes

COURSE OUTCOMES:

- CO1: Explain the structure and function of genetic material and evaluate the experimental evidence supporting DNA as the genetic material.
- CO2: Describe the molecular mechanism of DNA replication and the experimental evidence supporting its semi-conservative nature.
- CO3: Discuss mechanisms of horizontal gene transfer in bacteria and the impact of transposable elements on genetic variation.
- CO4: Describe the processes of transcription and translation in prokaryotes, including the roles of key enzymes and factors involved.
- CO5: Explain the characteristics of the genetic code, and describe the mechanisms regulating gene expression using lac and trp operons as models.
- CO6: Explain the types and molecular basis of mutations, analyze their consequences on gene function, and evaluate cellular repair mechanisms that maintain genetic stability.

TEACHING AND EVALUATION SCHEME:

Course code	Course Title	Credit	Teaching Scheme (Hrs. Per Week)	Examination Scheme			Total Marks
			Theory	Hrs.	Max Marks		
					CCE	SEE	
MBM234-2C	Molecular Genetics of Prokaryotes	4	4	2.5	50	50	100

Unit 1: Introduction of Genetics **Teaching Hours: 15 (Weightage25%)**

- **Nature of Genetic material**
  - Understanding of terms: Gene, allele, genotype, phenotype, intron, exon, cistron, recon, muton, plasmid, chromosome, genome, zygote, merozygote, CRISPR.
  - Experimental proof for Nucleic acid as genetic material: Work of Griffith; Avery, McCarty and MacLeod; Hershey and Chase
- **Gene structure and function**
  - Chemistry of DNA, Watson and Cricks model of DNA structure
  - Typical gene structure, functions of gene

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Unit 2: DNA replication and gene transfer **Teaching Hours: 15 (Weightage25%)**

- **DNA Replication**
  - Semi conservative nature, Meselson and Stahl's experiment
  - Molecular mechanism: Strand separation, formation of leading and lagging strand, formation of Okazaki fragments and their removal, proof reading.
  - Post-replicative modifications and their significance.
- **Gene Transfer**
  - Fundamentals of Horizontal and vertical gene transfer, merozygotic system
  - Transformation: Competence, DNA uptake in Gram positive and Gram negative bacteria
  - Transduction: Generalized and restricted transduction
  - Conjugation: Role of sex factor, transfer of genes during $F^+ \times F^-$, $Hfr \times F^-$ and sexduction
  - Transposable elements: General Characteristics, Transposition, Insertion sequences (IS) and Tn elements.

Unit 3: Gene Expression in Prokaryotes **Teaching Hours: 15 (Weightage25%)**

- **Transcription**
  - Initiation, role of enzyme, sigma factor, promoter, operator
  - Elongation
  - Termination: Rho dependent and Rho independent
- **Genetic Code:** Characteristics -Triplet nature, polarity, degeneracy, near universality and Wobble phenomenon
- **Translation:**
  - Initiation, 70 S initiation complex
  - Elongation: recognition, peptidyl transfer, translocation
  - Termination
  - Fate of ribosomes, polysome system, polycistronic RNA
- **Regulation of Gene Expression:**
  - Negative inducible control - lac operon
  - Negative repressible control - trp operon

Unit-4: Mutation& Repair **Teaching Hours: 15 (Weightage25%)**

- **Introduction**
  - Spontaneous and induced mutations, proof for spontaneity of mutation by replica plate method
  - Effect at DNA level, transition, transversion, insertion, deletion, development of A-P Sites
- **Molecular basis of mutation**
  - Chemical mutagenesis: 5-bromouracil, nitrous acid and acridine orange
  - Physical mutagenesis: Ultraviolet radiations
  - Biological Mutagenesis: Phage Mu,
- **Consequences of mutation**
  - Forward - silent, missense, nonsense, frame shift
  - Reverse – true reversion, suppressions (intragenic and extragenic only)
- **Repair mechanisms**
  - Direct repair: Photoreactivation, removal of A-P sites
  - Indirect repair: Excision repair, mismatch repair
  - SOS regulatory system

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

*SEE: Semester End Evaluation

Reference Books:

1. Genetics a Conceptual Approach- Benjamin A. Pierce, W.H. Freeman and Company, USA.
2. Genes XI- Benjamin Lewin, Jones & Bartlett Learning, USA.
3. Prescott Harley Kleins Microbiology -Willey, Joanne M; Sherwood, Linda; Woolverton, Christopher J; Prescott, Lansing M., 7th edition, McGraw-Hill Higher Education, USA.

Suggested Reference Books:

1. Principles of Genetics- Eldon J. Gardner, Michael J. Simmons, D. Peter Snustad, Wiley, USA.
2. Concepts of Genetics- William S. Klug, Michael R. Cummings, Pearson Education, USA.
3. Microbial Genetics- David Freifelder, Jones & Bartlett Learning, USA.
4. Genetics- M.P. Arora, N.S. Sandhu, Himalaya Publishing House, India.

	Course Outcomes	POs/PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Explain the structure and function of genetic material and discuss the experimental evidence supporting DNA as the genetic material.	PO1, PO2 PSO1	U, R	C	15
CO2	Describe the molecular mechanism of DNA replication and the experimental evidence supporting its semi-conservative nature.	PO1, PO2 PSO1	U, R	C	7
CO3	Discuss mechanisms of horizontal gene transfer in bacteria and the impact of transposable elements on genetic variation.	PO1, PO2 PSO1, PSO2	U, R, An, E	C, P	8
CO4	Describe the processes of transcription and translation in prokaryotes, including the roles of key enzymes and factors involved.	PO1, PO2, PSO1,	U, R	C	7
CO5	Explain the characteristics of the genetic code, and describe the mechanisms regulating gene expression using lac and trp operons as models.	PO1, PO2, PSO1	U, R, Ap, An	C	8
CO6	Explain the types and molecular basis of mutations, analyze their consequences on gene function, and evaluate cellular repair mechanisms that maintain genetic stability.	PO1, PO2, PO3, PSO1, PSO2	U, R, E, An	C, P	15
	Total hour of Instruction				**60**

Mapping of COs with POs & PSOs

CO	PO										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3									3	
CO2	3	3									3	
CO3	3	3									3	2

CO4	3	3									3	
CO5	3	3									3	
CO6	3	3	2								3	2

3: High, 2: Medium, 1: Low

Microbiology Semester IV -Major Course

MBM235-2C - Microbiology Practical- IV

COURSE OUTCOMES:

- CO1: Perform and interpret biochemical tests for carbohydrate fermentation and nitrogen utilization to differentiate microbial species.
- CO2: Describe the role and significance of microbial enzymes in biochemical identification and metabolism.
- CO3: Apply standard protocols to estimate the activity of enzymes like amylase and acid phosphatase.
- CO4: Analyze the influence of pH, temperature, substrate, and enzyme concentration on catalytic efficiency of enzymes.
- CO5: Apply mutagenesis techniques to study UV-induced effects on bacterial survival and isolate phenotypic mutants.
- CO6: Develop Proficiency in isolating antibiotic-resistant mutants and extract genomic DNA from microbes.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Credit	Teaching Scheme (Hrs. Per Week)	Examination Scheme			Total Marks
			Practical	Hrs.	Max Marks CCE	Max Marks SEE	
MBM235-2C	Microbiology Practical- IV	4	8	5	50	50	100

Unit 1 **Teaching Hours 60 (Weightage: 50%)**

1. Carbohydrate metabolism test: Sugar fermentation test, M-R test, V-P test, Citrate utilization test, TSI test.
2. Nitrogen Utilization test: Indole, H2S, Phenyl alanine, Ammonia
3. Enzyme detection test: Amylase, Protease, lipase, catalase, urease, nitrate reductase, oxidase, Dehydrogenase, Gelatinase, Deaminase, Decarboxylase
4. Estimation of activity of enzymes like Amylase, Acid Phosphatase
5. Effect of pH on enzyme activity.
6. Effect of temperature on enzyme activity.
7. Effect of substrate concentration on enzyme activity.
8. Effect of enzyme concentration on enzyme activity

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Unit 2 **Teaching Hours 60** **(Weightage: 50%)**

1. To study UV survival in *E.coli*.
2. To isolate UV induced lac- Mutants.
3. To Isolate Pigment Mutants of Serratia sp.
4. Isolation of antibiotic-resistant mutants by gradient plate technique.
5. Isolation of Streptomycin resistant mutant by Replica plate method.
6. To isolate bacterial Genomic DNA.
7. To isolate fungal Genomic DNA.

Reference Books: Experimental Microbiology- Patel R.J. and Patel R.K., Volume I and II, 9thEdition, Aditya Publisher, India.

	Course Outcome	POs/PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Perform and interpret biochemical tests for carbohydrate fermentation and nitrogen utilization to differentiate microbial species	PO1, PO2, PO3, PO6, PSO1, PSO2	U, Ap, An	C, P	24
CO2	Describe the role and significance of microbial enzymes in biochemical identification and metabolism.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, Ap, An	C, P	16
CO3	Apply standard protocols to estimate the activity of enzymes like amylase and acid phosphatase.	PO2, PO3, PSO1, PSO2	U, Ap	C, P	8
CO4	Analyze the influence of pH, temperature, substrate, and enzyme concentration on the catalytic efficiency of enzymes.	PO1, PO2, PO3, PO6, PSO2	Ap, An, E	P	22
CO5	Apply mutagenesis techniques to study UV-induced effects on bacterial survival and isolate phenotypic mutants.	PO2, PO3, PO6, PSO2	Ap, An, E	P	20
CO6	Develop Proficiency in isolating antibiotic-resistant mutants and extract genomic DNA from microbes.	PO1, PO2, PO3, PO4, PSO1, PSO2	U, Ap, Cr	C, P	30
	Total hour of Instruction				**120**

Mapping of COs with POs & PSOs

CO	PO										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3	3			3					3	3
CO2	3	3	3			3					3	3
CO3		3	3								3	3
CO4	3	3	3			3						3
CO5		3	3			3						3
CO6	3	3	3	2							3	3

3: High, 2: Medium, 1: Low

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Chemistry Semester IV Major Course

CHM236-2C INORGANIC & ANALYTICAL CHEMISTRY - II

Course Outcomes:

- CO1: Describe the concepts of coordination compounds, including ligands, Werner's theory, nomenclature, and isomerism.
- CO2: Explain valence bond theory for octahedral, tetrahedral, and square planar complexes and analyse the chelate effect and electronic configurations.
- CO3: Explain the basics of crystal field theory, including d-orbital splitting in different geometries, crystal field stabilisation energy, and factors affecting splitting, including the Jahn-Teller effect.
- CO4: Understand and apply complexometric and redox titration techniques for estimating metal ions and detecting endpoints accurately.
- CO5: Understand the fundamental principles and types of chromatography.
- CO6: Apply chromatographic methods for the separation and identification of compounds in mixtures.

Course Code	Course Title	Teaching Scheme Per Week		Credits	Examination Scheme			Total Marks
		Theory hrs Per Week	Practical hrs Per Week		Hrs.	Max Marks		
						CCE	SEE	
CHM236-2C	Inorganic& Analytical Chemistry-II	4	0	4	2.5	50	50	100

UNIT	
1	**TeachingHours:15** **(Weightage25%)** • **Coordination Compounds** –Introduction of coordination compounds Ligands and their classification, Werner's coordination theory and its experimental verification, electric neutrality principle, effective atomic number concept, nomenclature of coordination compounds, isomerism in coordination compounds, chelate and chelate effects.Valence bond theory of transition metal complexes- Octahedral, tetrahedral, square planer
2	**TeachingHours:15** **(Weightage25%)** • **Crystal Field Theory-**Introduction, Orientation of d-orbitals and Crystal Field Splitting of Energy Levels, Crystal Field Splitting in Octahedral complexes, Tetrahedral and square planer complexes. Crystal Field Stabilization Energy (CFSE), Factors influences the magnitude of Crystal Field Splitting. Crystal Field Effects on Lattice Energy; Jahn-Teller effect

3	**TeachingHours:15** **(Weightage25%)** • **Complexometric Titrations** -Theory of Complexometric titration involving EDTA, Study of EDTA complex formation, taking the disodium salt of EDTA and the effect of pH, Ways of locating the end point, Estimation of Nickel and copper by complexometric titration by EDTA • **Redox titration- Theory** of redox titration ϖ. Study of redox titration by electrochemical potential method. Ways of locating the endpoint for redox titration
4	**TeachingHours:15** **(Weightage25%)** • **Chromatography-**A. Classification of chromatographic methods: Principle of differential migration, description of the chromatographic process, distribution coefficients, modes of chromatography, and performing column chromatography. B. Chromatography–theory and practice: Introduction, the chromatograph (elution time and volume), capacity factor, column efficiency and resolution, sample preparation. C. • Paper chromatography: experimental modifications, various modes of development, nature of the paper, detection of spots, retardation factors, factors that affect the reproducibility of Rf values (due to paper, solvent system, sample, development procedure), selection of solvent, quantitative analysis.

***CCE:** Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

***SEE:** Semester End Evaluation

REFERENCESBOOKS

- Chemical Instrumentation :A Systematic approach-H.A.Strobel
- Principles of Instrumental Analysis: Douglas A. Skoog., F. James Holler, Stanley R. Crouch, Cengage Learning; 6th Edition.
- Quantitative Chemical Analysis : Daniel C.Harris,W HFreeman,NewYork.
- Principles of Analytical Chemistry J.H.Kennedy
- Analytical Chemistry-- Principles & Techniques L.G.Hargis
- Principles of Instrumental Analysis: Douglas A. Skoog., F. James Holler, Stanley R. Crouch, Cengage Learning; 6th Edition.
- Concise Inorganic Chemistry J.D.Lee,4th edition.
- Principles of inorganic chemistry, Puri, Sharma & Kalia.

SUGGESTED BOOKS:

- Inorganic chemistry by James Huheey, Keiter & Keiter
- Textbook of Inorganic Chemistry by Durran tand Durrant.
- Inorganic Chemistry by G.D.Tuli.
- Advance Inorganic Chemistry Vol-II Satya Prakash (S.Chand).
- Inorganic Chemistry: Principles of Structure and Reactivity by James E. Huheey, Ellen A.Keiter, Richard L.Keiter,Okhil K.Medhi.
- Advanced Inorganic Chemistry by Cotton and Wilkinson.
- Quantum Mechanics by R K Prasad.

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CO	Course Outcome	POs/ PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Describe the concepts of coordination compounds, including ligands, Werner's theory, nomenclature, and isomerism	PO1, PSO1	U	C	8
CO2	Explain valence bond theory for octahedral, tetrahedral, and square planar complexes and analyse the chelate effect and electronic configurations.	PO1, PO2, PSO1, PSO2	U, An	C	7
CO3	Explain the basics of crystal field theory, including d-orbital splitting in different geometries, crystal field stabilisation energy, and factors affecting splitting, including the Jahn-Teller effect.	PO1, PO2, PO3, PSO1	U, Ap	C	15
CO4	Understand and apply complexometric and redox titration techniques for estimating metal ions and detecting endpoints accurately.	PO1, PO2, PSO1, PSO2	Ap, An	C, P	15
CO5	Understand the fundamental principles and types of chromatography.	PO1, PSO1	U, Ap	C, P	8
CO6	Apply chromatographic methods for the separation and identification of compounds in mixtures.	PO1, PO2, PO3, PSO1, PSO2	U, Ev	C, P	7
	Total hours of Instruction				60

Mapping of COs with POs and PSOs

CO	PO										PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3										3	
CO2	3	3									3	3
CO3	3	3				2					3	
CO4	3	3									3	3
CO5	3										3	
CO6	3	3				2					3	3

3: High, 2: Medium, 1: Low

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Chemistry Semester IV Major Course

CHM237-2C ORGANIC & PHYSICAL CHEMISTRY - II

Course Outcomes:

- CO1: Describe the nomenclature, properties, preparation methods, and chemical reactions of alcohols and phenols
- CO2: Explain the nomenclature, structure, bonding, acidity, properties of carboxylic acids, including their method of preparation and chemical reaction.
- CO3: Discuss the key reactions of phenols and acids.
- CO4: Understand basic conductance terms and explain theories, laws of electrolytes and their applications.
- CO5: Illustrate Le Chatelier's principle, Nernst's distribution law, Electrochemical Series, Nernst Equation and thermodynamic derivation of the law of mass action.
- CO6: Explain fundamental terms in electrochemistry and describe SHE, Calomel, and glass electrodes.

Course Code	Course Title	Teaching Scheme Per Week		Credits	Examination Scheme			
		Theory hrs Per Week	Practical hrs Per Week		Hrs.	Max Marks		Total Marks
						CCE	SEE	
CHM237-2C	Organic& Physical Chemistry-II	4	0	4	2.5	50	50	100

CONTENT

UNIT	Particular
1	**Teaching Hours:15 (Weightage25%)** • **Alcohols** Nomenclature, methods of preparation, physical and chemical properties, identification of primary, secondary, and tertiary alcohols Unsaturated alcohols- Vinyl and Allyl alcohol Dihydric alcohol - Nomenclature, method of formation and chemical reactions of vicinal glycols. Trihydric alcohols-methods of formation, chemical reactions of glycerol. • **Phenols** – Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character, comparative acidic strength of alcohols and phenols, resonance stablization of phenoxide ion. Reactions of phenols (without mechanism)- Electrophilic aromatic substitution, acylation and carboxylation, Fries rearrangement, Clasien rearrangement, Gatterman synthesis, Hauben - Hoesch reaction, Lederer Manasse reaction and Reimer-Tiemann reaction.

2	**Teaching Hours:15 (Weightage25%)** • **Carboxylic Acids** - Nomenclature, structure and bonding, acidity of carboxylic acids, effects of substituents on acid strength, mechanism of decarboxylation, Methods of formation, physical properties and chemical reactions of dicarboxylic acids - oxalic, succinic and phthalic acid. • Substituted Acids –Methods of formation & chemical reactions of halo acids, hydroxy acids, malic, tartaric, citric and salicyclicacids.Unsaturated Acids - Acrylic and cinnamicacid.Introductiontoacidsderivatives-Prepartion,propertiesandusesof acid halides, amides, anhydrides andesters. Interconversion of acid derivatives by nucleophilic acyl substitution. HVZ reaction,Hofmann - bromamide reaction and ester hydrolysis(withoutmechanism).
3	**Teaching Hours:15 (Weightage25%)** • **Ionic Equilibria** - Arrhenius theory of electrolyte and its application, Ostwald's dilution law, its uses and limitations. Debye - Huckle theory of strong electrolytes, asymmetric, electrophoretic, DebyeFalkenhagen and Wein effects, Activity coefficient, mean activity coefficient, ionic strength, DebyeHuckel limiting law. Resistance, Conductance, Specific conductance, Equivalent Conductance, Molar Conductance, Equivalent Conductance atInfinite Dilution • **Chemical Equilibrium** - Equilibrium constant and free energy, thermodynamic derivation of law of mass action, distribution law and phase rule, Le Chatelier's principle, Nernst's distribution law for solute, principle of extraction of solute from solution and washing of precipitate
4	**Teaching Hours:15 (Weightage25%)** • **Electrochemistry**-Introduction of terms: Oxidation, Reduction, Redox, Anode, Cathode, Electrode, Half Cell, Oxidation & Reduction Potential. Electrochemical cell (Galvanic Cell)& Representation cell.Electrochemical Series and its Significance. Nernst Equation of Cell EMF and single electrode potential.EMF of a cell and its measurements, computation of cell EMF. Numerical • **Description of the following electrode** Standard Hydrogen Electrode. Calomel Electrode. Glass Electrode.

***CCE:** Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

***SEE:** Semester End Evaluation

REFERENCESBOOKS

- Organic chemistry by Morrison & Boyd Vth Edition
- Advance organic chemistry by R.K. Bansal.
- Organic chemistry by I.L.Finar Voll &.II Vth Edition
- Organic chemistry by pine, Hendrikson, Cramand Hammondl Vthedition...
- Advanced organic chemistry by Jerry March.
- Stereo chemistry: conformation and mechanism VIth edition by P.S. Kalsi.
- Advanced organic chemistry by Arun Bahal and B.S. Bahal.

SUGGESTED BOOKS:

- Organic Chemistry Vol.I, II, III by S. M. Mukherjee, S.P. Singh, R.P.Kapoor.
- Stereo Chemistry by Nasipuri.
- Advanced Physical Chemistry by Gurdeep Raj
- Physical Chemistry (Questions and Answers) by R.N. Madan G.D. Tully, S. Chand.
- Principles of Physical Chemistry by Puri, Sharma, Pathania.
- Essentials of Physical Chemistry by B.S. Bahal, Arun Bahal G.D. Tully.
- Physical Chemistry by G.H.Barrow,5thed.,MacGrawHill,1998,6thed.
- Physical Chemistry by W.J.Moore, 4th ed., Orient Longmans, 1969.

CO	Course Outcomes	POs/PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Describe the nomenclature, properties, preparation methods, and chemical reactions of alcohols and phenols	PO1, PSO1	U	C	12
CO2	Explain the nomenclature, structure, bonding, acidity, properties of carboxylic acids, including their method of preparation and chemical reaction.	PO1, PSO1	U, An	C	10
CO3	Discuss the key reactions of phenols and acids.	PO1, PO2, PSO1, PSO2	U, Ap	C	8
CO4	Understand basic conductance terms and explain theories, laws of electrolytes and their applications.	PO1, PSO1	U, R	C, P	10
CO5	Illustrate Le Chatelier's principle, Nernst's distribution law, Electrochemical Series, Nernst Equation and thermodynamic derivation of the law of mass action.	PO1, PO2, PSO1, PSO2	U, Ap	C	12
CO6	Explain fundamental terms in electrochemistry and describe SHE, Calomel, and glass electrodes.	PO1, PO3, PSO1	U, R	C, P	8
	Total hours of Instruction				**60**

Mapping of COs with POs and PSOs

CO	PO										PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3										3	
CO2	3										3	
CO3	3	2									3	2
CO4	3										3	
CO5	3	2									3	2
CO6	3		1								3	

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Chemistry Semester IV Major Course

CHM238-2C CHEMISTRY PRACTICALS - IV

Course Outcomes:

- CO1: Synthesize selected organic compounds using a single-step method
- CO2: Synthesize organic compounds using the green chemistry method
- CO3: Separation and identification of water-insoluble organic mixtures.
- CO4: Implement and determine Conductometric, pH-metric titration of chemical solutions.
- CO5: Analyze chemical kinetics and distribution phenomena to determine the reaction order.
- CO6: Demonstration of optical activity of an organic compound using Polarimeter techniques.

Course Code	Course Title	Teaching Scheme Per Week		Credits	Examination Scheme			Total Marks
					Hrs.	Max Marks		
		Theory hrs Per Week	Practical hrs Per Week			CCE	SEE	
CHM238-2C	Chemistry Practicals – IV	0	8	4	5	50	50	100

A. Organic Practicals **Teaching Hours: 60** **(Weightage 50%)**

- **Single step Organic preparation (Minimum Five)**
- Preparation of m-Dinitrobenzene from Nitrobenzene
- Preparation of p-Nitroacetanilide from Acetanilide
- Preparation of Acetanilide from Aniline (Green Preparation)
- Preparation of Benzilic Acid from Benzil (Green Preparation)
- Preparation of Di-benzalacetone from Benzaldehyde
- Preparation of p-bromoacetanilide from Acetanilide

- **Seperation of Organic Mixture (Water Insoluble) (Minimum Seven)**
- Separation and qualitative determination of binary organic mixture (Only Water Insoluble Solid Compounds taken), derivative of any one compound.
  Acid: Benzoic acid, phthalic acid, Salicylic acid, Cinnamic acid. Anthranilic acid, Nitro benzoic acid.
  Phenol: 1-Naphthol, 2-Naphthol, o-nitrophenol, m-nitrophenol, p-nitrophenol,

  Base: Diphenyl amine, p-toludine , o-nitro aniline, m-nitro aniline, p-nitro aniline,
  Neutral: Naphthalene, anthracene, acetanilide, m-di nitro benzene,

B. Physical Practicals (Minimum Ten) **Teaching Hours:60 (Weightage 50%)**

- Determination of cell constant
- Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- Determination of distribution coefficients of:
  (a) Iodine between water and carbontetrachloride.
  (b) Acetic / benzoic acid between water and cyclohexane
- Study the equilibrium of at least one of the following reactions by the distribution method:
  I_2 (aq) + $I^- \rightarrow I_3^-$(aq)Cu^{2+}(aq)
  + $nNH_3 \rightarrow Cu(NH_3)_n$
- Calibration of pH meter using 4 pH buffer solutions and determine the strength of the given acid/base using pH metric titrations (HCl Vs NaOH)
- To determine the Dissociation constant of the acid of mixtures of CH_3COONa and CH_3COOH by pH meter
- To study the kinetics of the reaction of decomposition of H_2O_2catalysed by iodine ion (Clock reaction)
- Find the solubility and heat of solution of the given organic acid at two different Temperatures
- Demonstration related to the optical activity of an organic compound by a Polarimeter.

***CCE:** Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

***SEE:** Semester End Evaluation

REFERENCES BOOK:

- Advanced Practical Chemistry by Jagdamba Singh, R.K.P. Singh, Jaya Singh, LDSYadav, I. R. Siddiqui, Jaya Shrivastava
- Advanced Inorganic Analysis by Agrawal Keemtilal,PragatiAdditions
- Practical Physical Chemistry by B.Vishwanathan and P.S.Ragvan

SUGGESTED BOOKS:

- Advanced Physical Chemistry Experiments by Gurtu – Gurtu Pragati Additions
- Textbook of Organic Chemistry by Parashar and Ahluvalia
- Comprehensive Practical Organic Chemistry by K Ahluwalia and Renu Aggarwal

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CO	Course Outcomes	POs/ PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Synthesize selected organic compounds using a single-step method	PO1, PSO1, PSO2	Ap, C	P	20
CO2	Synthesize organic compounds using the green chemistry method	PO1, PO4, PO9, PSO1, PSO2	An	P	20
CO3	Separation and identification of water-insoluble organic mixtures.	PO1, PO2, PSO2	Ap	P	20
CO4	Implement and determine Conductometric, pH-metric titration of chemical solutions.	PO1, PSO2	An	C, P	20
CO5	Analyse chemical kinetics and distribution phenomena to determine the reaction order.	PO1, PSO1, PSO2	Ap, E	C, P	20
CO6	Demonstration of optical activity of an organic compound using Polarimeter techniques.	PO1, PO2, PSO2	Ap, E	C, P	20
	Total hours of Instruction				**120**

Mapping of COs with POs and PSOs

CO	PO										PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3										3	3
CO2	3										3	3
CO3	3	2										3
CO4	3			1					1			3
CO5	3										3	3
CO6	3	2										3

3: High, 2: Medium, 1: Low

HDPatel

KADI SARVA VISHWAVIDYALAYA

Physics Semester IV Major Course

PHM239-2C Basic Physics-V

COURSEOUTCOMES (COs):

- **CO1:** Understand number systems and logic gates used in digital electronics.
- **CO2:** Design and explain logic circuits such as adders, subtractors, parity checkers using gates.
- **CO3:** Describe and apply concepts of radioactivity and radioactive decay in real-world applications.
- **CO4:** Explain working of nuclear detectors and particle accelerators.
- **CO5:** Analyse resolving power of optical systems and their limitations.
- **CO6:** Explain the structure of atomic spectra and quantum effects such as Zeeman and Stern-Gerlach.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme	Credits	Examination Scheme			
		Theory Per Week		Hrs.	Max Marks		Total Marks
					CCE	SEE	
PHM239-2C	Basic Physics-V (Major)	4	4	2.5	50	50	100

Unit 1: Digital Electronics — **Teaching Hours: 15 (Weightage 25%)**

Introduction, Number systems used in Digital Electronics, Decimal, Binary, Hexadecimal and Octal, Binary Codes-(A) BCD, (B) Gray, (C) Excess-3 Codes, introduction to basic logic gates, NAND,NOR and XOR gate, De-Morgan's theorem,(i) Binary to Gray Code Converter (ii) A Parity Checker (iii) The Half Adder (iv) The Full Adder (v) Parallel Adder (vi)Half subtractor, (vii)Full subtractor, Illustrative examples.

Unit 2: Radioactivity, Detectors & Accelerators — **Teaching Hours: 15 (Weightage 25%)**

Radioactivity: Introduction, Radioactive growth and decay, Ideal equilibrium, Transient equilibrium and secular equilibrium, Artificial Radioactivity, Determination of the age of Earth, Carbon Dating, Illustrative Examples

Detectors & Accelerators: Introduction, Detectors for Nuclear Particles, (i) Proportional Counter (ii) The Geiger Counter, (iii) Scintillation Counter, (iv) Solid state or Semiconductor detectors Linear Accelerator and Cyclotron

Unit-3 Resolving Power — **Teaching Hours: 15 (Weightage 25%)**

Resolving Power, Rayleigh's Criterion, Limit of resolution of the eye, Limit of resolution of a convex lens, Resolving Power of Optical Instrument, Conditions for Resolutions according to Lord Rayleigh, Resolving Power of a telescope, Relation between magnifying power of telescope, Resolving power of a microscope, ways of increasing resolution, Magnification versus resolution, resolving power of a Prism, ResolvingPower of a Plane transmission grating. Illustrative Examples

Unit-4 Introduction to Atomic Spectra — **Teaching Hours: 15 (Weightage 25%)**

Orbital and Magnetic Dipole Moment, Larmor Precession, Space quantization, Electron spin, Vector model of atom, Spectroscopic terms and their notations, Stern Gerlach Experiment, Pauli's Exclusion Principle. Zeeman Effect- Normal Zeeman Effect and anomalous Zeeman Effect, Explanation of Normal Zeeman Effect, Explanation of Anomalous Zeeman Effect, Paschen back effect.

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

*SEE: Semester End Evaluation

Reference Books

1) Hand book of Electronics by S. L. Gupta &V. Kumar, PragatiPrakashan
2) Digital Logic and Computer Design by M.Morris Mano, Pearson Publication
3) Nuclear PhysicsAn Introductionby S. B. Patel, New Age International Publishers
4) Nuclear Physics by D. C. Tayal, Himalaya Publishing House
5) A Textbook of Optics by N. Subrahmanyam, Brij Lal, M. N. Avadhanulu - S.Chand
6) Optics by Ajoy Ghatak, McGraw-Hill Education
7) Atomic & Molecular Spectra: Laser by Raj Kumar, Kedar Nath Ram Nath Prakashan
8) Atomic & Molecular physics by Guptakumar

CO No.	Course Outcomes (COs)	Mapped POs/PSOs	CL Cognitive level	KC Knowledge Category	Class Session
CO1	Understand number systems and logic gates used in digital electronics.	PO1, PO3 PSO1	U	C	7
CO2	Design and explain logic circuits such as adders, subtractors, parity checkers using gates.	PO1, PO4, PO6 PSO2	Ap, C	P	8
CO3	Describe and apply concepts of radioactivity and radioactive decay in real-world applications.	PO1, PO2 PSO1	U, Ap	C	7
CO4	Explain working of nuclear detectors and particle accelerators.	PO1, PO6 PSO2	U, An	C	8
CO5	Analyse resolving power of optical systems and their limitations.	PO1, PO3 PSO1	An, E	C	15
CO6	Explain the structure of atomic spectra and quantum effects such as Zeeman and Stern-Gerlach.	PO1, PO3, PO6 PSO1	U, An	C	15
				Total hour of Instruction	**60**

Mapping of Cos with Pos & PSOs

COs	POs										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3		3								3	
CO2	3			1		3						2
CO3	3	1									3	
CO4	3					3						2
CO5	3		3								3	
CO6	3		3			3					3	

3:High,2:Medium,1:Low

KADI SARVA VISHWAVIDYALAYA

Physics Semester IV - Major Course

PHM240-2C Basic Physics-VI

COURSEOUTCOMES (COs):

- **CO1:** Use Biot–Savart and Ampère's law to calculate magnetic fields for current distributions.
- **CO2:** Compare and evaluate magnetostatics with electrostatics.
- **CO3:** Apply Schrödinger's equation to physical systems like infinite potential wells.
- **CO4:** Explain basic plasma properties and its presence in nature and experiments.
- **CO5:** Analyse methods of synthesis of nanomaterials and their physical properties.
- **CO6:** Describe applications of Nano devices including nanotubes and magnetic materials

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme	Credits	Examination Scheme			
		Theory Per Week		Hrs.	Max Marks		Total Marks
					CCE	SEE	
PHM240-2C	Basic Physics-VI (Major)	4	4	2.5	50	50	100

Unit 1: Magnetostatics — **Teaching Hours: 15 (Weightage 25%)**

Magnetic Fields, Currents, The Sio - Savart Law, Steady Currents, The magnetic field of a steady current, The divergence and curl of S, Application of Ampere's law, Comparison of Magnetostatics and Electrostatics, Scalar and Vector potentials, The magnetic vector potential, Illustrative examples. related Problems.

Unit 2: Introduction to Quantum Mechanics — **Teaching Hours: 15 (Weightage 25%)**

The Schrodinger equation in one dimension, The statistical interpretation, Probability: Discrete Variables and Continuous Variables, Normalization, Momentum, The Uncertainty Principle, The infinite square well, Illustrative examples.

Unit-3 Basic concepts of Plasma — **Teaching Hours: 15 (Weightage 25%)**

Introduction, Composition and Characteristics of a Plasma, Collisions, Elastic collisions, Inelastic collisions, Surface Phenomena, Transport Phenomena, Diffusion and Mobility, Viscosity, Conductivity, Recombination, Ohm's law, Gas Discharge, Composition of various natural and Man-made Plasma, Plasma diagnostics, Plasma waves and Instabilities Confinement of Plasma, Space Plasma, Illustrative examples.

Unit-4 Nanomaterial and Nano Devices — **Teaching Hours: 15 (Weightage 25%)**

Introduction, synthesis of nano structured material, top-down approach in nanomaterial synthesis, bottom-up process synthesis of nanoparticles, Epitaxial Technique for synthesis of nanomaterial, chemical method nanomaterial synthesis, Nanotechnology and environment, properties andpossible applications.
Nano magnets, classification of Nano-magnetic materials, , Nano-magnetism in technology, applications of semiconductor nanostructures and devices, applications of semiconductor nanostructured, carbonnanotubes, types of carbon nanotubes, synthesis of carbon nanotubes, properties of carbon nanotubes, Applications, Illustrative examples

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*SEE: Semester End Evaluation

Reference Books

1) Introduction to ElectrodynamicsbyD. J.Griffiths, Pearson Education
2) Introduction to Quantum MechanicsbyD. J. Griffiths, Pearson Education
3) ElementsofPlasmaPhysicsbyS.N. Goswami,NewCentralbookAgency(P)Ltd., Calcutta.
4) Engineering Physics by V. Rajendran, McGraw Hill Education, New Delhi
5) Engineering Physics by H. K. Malik, A. K. Singh, McGraw Hill Education, New Delhi

CO No.	Course Outcomes (COs)	Mapped POs/PSOs	CL Cognitive level	KC Knowledge Category	Class Session
CO1	Use Biot–Savart and Ampère's law to calculate magnetic fields for current distributions.	PO1, PO2, PO3 PSO1	Ap, An	C	10
CO2	Compare and evaluate magnetostatics with electrostatics.	PO1, PO6 PSO1	An, E	C	5
CO3	Apply Schrödinger's equation to physical systems like infinite potential wells.	PO1, PO3 PSO1	Ap	C	15
CO4	Explain basic plasma properties and its presence in nature and experiments.	PO1, PO6 PSO2	U, An	C	15
CO5	Analyse methods of synthesis of nanomaterials and their physical properties.	PO1, PO4, PO6 PSO2	An, Ap	C	8
CO6	Describe applications of Nano devices including nanotubes and magnetic materials.	PO1, PO6 PSO2	U, Ap	P	7
				Total hour of Instruction	**60**

Mapping of Cos with Pos & PSOs

COs	POs										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	1	3								3	
CO2	3				1						3	
CO3	3		3								3	
CO4	3					3						3
CO5	3			1		3						3
CO6	3					3						3

3:High,2:Medium,1:Low

KADI SARVA VISHWAVIDYALAYA

Physics Semester IV - Major Course

PHM241-2C Physics Practical - IV

COURSEOUTCOMES (COs):

- **CO1:**Construct and verify logic circuits using universal logic gates and De Morgan's laws.
- **CO2:**Measure fluid viscosity and study surface area–volume ratio of nanomaterials.
- **CO3:**Analyse decay of temperature, wavelength via interference methods, and Schering bridge.
- **CO4:**Study characteristics of UJT, JFET and determine parameters like μ, rd, gm.
- **CO5:**Determine inductance using Anderson Bridge and resistance using Carey Foster bridge.
- **CO6:**Perform precision measurements using viscometer, photocell and diffraction setups.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Practical Per Week		Hrs.	Max Marks		
					CCE	SEE	
PHM241-2C	Physics Practical - IV	8	4	5	50	50	100

Unit-I(Weightage :50%)

1) Construction of AND, OR, NOT Gates using NAND & NOR Universal gates.
2) To compare the Capacity of two capacitors (C1/C2) by De Sauty method.
3) To find the viscosity of a fluid using coaxial viscometer.
4) To understand the Surface Area to Volume Ratio property of nanomaterials.
5) To study the absorption co-efficient of liquid using photocell.
6) To determine low value of 'C' using Schering bridge.
7) To find the wavelength of light using an Edser's "A" Diffraction Pattern.
8) To determine the value of unknown wavelength using Cauchy's constant.

Unit-II (Weightage :50%)

1) To verify De Morgan's Theorems using NAND gate (IC-7400)
2) To determine wavelength using Hartmann formula
3) To find the decay of Temperature when body is allowed to cool. (Thermocouple)
4) To measure the activation energy of a semiconductor.
5) To study the characteristics of UJT.
6) To find the characteristics of JFET & Determination of μ, rd, gm
7) To determine self-inductance with the help of Anderson Bridge.
8) To find a low resistance using Carey Foster bridge

***CCE:** Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

***SEE:** Semester End Evaluation

Note:

1) New Experiments can be introduced AND / OR replaced as per need by the permission of the Head / Principal of the institute.
2) Hands-on / Project /Model etc. will carried out additionally for the enhancement of related skills

KADI SARVA VISHWAVIDYALAYA

CO No.	Course Outcomes (COs)	Mapped POs/PSOs	CL Cognitive level	KC Knowledge Category	Class Session
CO1	Construct and verify logic circuits using universal logic gates and De Morgan's laws.	PO1, PO4, PO6 PSO2	Ap, An	P	20
CO2	Measure fluid viscosity and study surface area–volume ratio of nanomaterials.	PO1, PO2 PSO2	Ap, E	P	20
CO3	Analyze decay of temperature, wavelength via interference methods, and Schering bridge.	PO1, PO3, PO6 PSO1	Ap, E	C,P	20
CO4	Study characteristics of UJT, JFET and determine parameters like μ, rd, gm.	PO1, PO6 PSO2	An, Ap	P	20
CO5	Determine inductance using Anderson Bridge and resistance using Carey Foster bridge.	PO1, PO3 PSO1	Ap, An	C,P	20
CO6	Perform precision measurements using viscometer, photocell and diffraction setups.	PO1, PO2, PO6 PSO2	Ap, E	P	20
				Total hour of Instruction	**120**

Mapping of Cos with Pos & PSOs

COs	POs										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3			1		3						3
CO2	3	2										3
CO3	3		2			3					2	
CO4	3					3						3
CO5	3		2								2	
CO6	3	2				3						3

3:High,2:Medium,1:Low

KADI SARVA VISHWAVIDYALAYA

Mathematics Semester IV Major Course

MTM242-2C Numerical Analysis

Course Outcomes:

- CO1: Understand and use finite difference concepts and symbolic operators in polynomial approximations.
- CO2: Solve algebraic and transcendental equations using methods like Bisection, False Position, Newton-Raphson, and Secant.
- CO3: Apply Newton's forward, backward, and central interpolation techniques for estimating intermediate values.
- CO4: Use Gauss, Stirling, and Bessel interpolation formulas and work with unequal intervals using divided differences.
- CO5: Perform numerical differentiation and identify maxima and minima from tabulated data using interpolation formulas.
- CO6: Apply numerical integration techniques like Trapezoidal, Simpson's 1/3, and 3/8 rules to approximate definite integrals.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Theory Per Week		Hrs.	Max Marks		
					CCE	SEE	
MTM242-2C	Numerical Analysis	4	4	2.5	50	50	100

Unit 1 Finite Differences — **Teaching Hours: 15**

Approximations and errors in computation, Finite differences, Forward differences, Backward differences, Central differences, Differences of a polynomial, Factorial polynomial, Symbolic operators, Relation between operators.

Unit 2 Solution of Algebraic and Transcendental Equations — **Teaching Hours: 15**

Algebraic equations, Transcendental equations, Bisection method, Method of false position, Newton-Raphson method, Secant method.

Unit 3 Interpolation — **Teaching Hours: 15**

Introduction, Newton's forward and backward interpolation formula, Central difference interpolation formula, Gauss forward and backward interpolation formula, Sterling interpolation formula, Bessel's interpolation formula, Interpolation with unequal intervals, Divided differences and its properties, Newton's divided difference formula, Relation between divided and forward differences, Lagrange's interpolation formula for equal and unequal intervals

Unit 4 Numerical Differentiation and Integration **Teaching Hours: 15**

Numerical differentiation using Newton's forward and backward method, Maxima and minima of a tabulated function, Numerical integration: Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8th rule

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

*SEE: Semester End Evaluation

Reference Books:

1. Numerical Methods in Engineering and Science, Dr. B.S Grewal, Grewal J. S., Khanna Publication.
2. Numerical Analysis and Computational Procedures, S. A Mollah, Books & Allied Ltd.
3. Numerical Analysis, Kaiser S. Kunz, Mcgraw-hill Inc.
4. Methods in Numerical Analysis, K. L. Nielsen, Macmilllan Company.
5. Numerical Methods, V. N. Vedamurthy, N. Iyengar, Vikas Publishing, House Pvt. Ltd.
6. Numerical Mathematical Analysis, James B. Scarborough, Oxford University Press.
7. Numerical Analysis, Vithal A. Patel, Harcourt Brace College Publishers.
8. Introductory Methods of Numerical Analysis, S. S. Sastry, Prentice Hall of India Pvt. Ltd. New Delhi.

CO	Course Outcome	POs / PSOs	Cognitive level	Knowledge category	Class session
CO1	Understand and use finite difference concepts and symbolic operators in polynomial approximations.	PO1, PO2, PO6, PSO1, PSO2	U, Ap	C, P	15
CO2	Solve algebraic and transcendental equations using methods like Bisection, False Position, Newton-Raphson, and Secant.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, Ap, E	C, P	15
CO3	Apply Newton's forward, backward, and central interpolation techniques for estimating intermediate values.	PO1, PO3, PO6, PSO1	U, Ap, E	C, P	7
CO4	Use Gauss, Stirling, and Bessel interpolation formulas and work with unequal intervals using divided differences.	PO1, PO3, PO4, PO6, PSO1, PSO2	U, Ap	C, P	8
CO5	Perform numerical differentiation and identify maxima and minima from tabulated data using interpolation formulas.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, Ap	C, P	8
CO6	Apply numerical integration techniques like Trapezoidal, Simpson's 1/3, and 3/8 rules to approximate definite integrals.	PO1, PO2, PO3, PO4, PO6, PSO1, PSO2	U, Ap,	C, P	7
Total hours of instruction					60

KADI SARVA VISHWAVIDYALAYA

Mapping of COs with POs & PSOs

CO	PO										PSO	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3	0	0	0	3	0	0	0	0	3	3
CO2	3	3	3	0	0	3	0	0	0	0	3	3
CO3	3	0	3	0	0	3	0	0	0	0	3	0
CO4	3	0	3	2	0	3	0	0	0	0	3	3
CO5	3	3	3	0	0	3	0	0	0	0	3	3
CO6	3	3	3	2	0	3	0	0	0	0	3	3

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Mathematics Semester IV - Major Course

MTM243-2C Differential Equations

Course Outcomes:

- CO1: Solve linear differential equations with constant coefficients using complementary and particular integrals.
- CO2: Apply short methods to find particular integrals for special forms of input functions in differential equations.
- CO3: Use the method of undetermined coefficients and alternative techniques to solve homogeneous and reducible linear differential equations.
- CO4: Solve linear differential equations using the method of variation of parameters and known integrals from complementary functions.
- CO5: Define and classify first-order partial differential equations, including order, degree, linearity, and type.
- CO6: Derive partial differential equations by eliminating arbitrary constants and functions; solve Cauchy's first-order PDEs.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme	Credits	Examination Scheme			
				Hrs.	Max Marks		Total Marks
		Theory Per Week			CCE	SEE	
MTM243-2C	Differential Equations	4	4	2.5	50	50	100

Unit 1

Teaching Hours: 15

Linear differential equations with constant coefficients, Determination of complementary function of the given equation, The symbolic function $\frac{1}{f(D)}$, Determination of the particular integral (P.I.) of the given equation, General method of getting P.I., Short methods for finding P.I. of f(D)y = X, when X is of certain special form, Short method of finding P.I. of f(D)y = X when $X = e^{ax}$, Short method of finding P.I. of f(D)y = X when $X = \sin ax$ *or* $\cos ax$, Short method of finding P.I. of f(D)y = X when $X = x^m$, Short method of finding P.I. of f(D)y = X when $X = e^{ax}V$ where V is any function of x, Short method of finding P.I. of f(D)y = X when $X = xV$ where V is any function of x.

Unit 2

Teaching Hours: 15

Method of undetermined coefficients for solving linear equations with constant coefficients, Homogeneous linear equation, Method of solution of homogeneous linear differential equations, Definition of $\{1/f(D_1)\}X$, *where* $D_1 \equiv d/dz, x = e^z$ and X is any function of x, An alternative method of getting P.I. of homogeneous equations, Equations reducible to homogeneous linear form, Legendre's linear equations.

Unit 3

Teaching Hours: 15

Method of variation of parameters for solving $dy/dx + P(x)y = Q(x)$, Method of variation of parameters for solving $d^2y/dx^2 + P(x)(dy/dx) + Q(x) = R(x)$, Complete solution of $y'' + Py' + Qy = R$ in terms of one known integral belonging to the complementary function (C.F)

Unit 4

Teaching Hours: 15

Definition of partial differential equation (PDE). Order and degree of PDE, Linear and nonlinear PDE, Classification of first order PDE, origin of PDE, Derivation of PDE by elimination of arbitrary constants, Derivation of PDE by elimination of arbitrary functions ϕ from the equation, $\phi(u,v) = 0$ where u and v are function of x, y and z, Cauchy's problem for first order equations.

***CCE:** Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

***SEE:** Semester End Evaluation

Reference Books:

1. Ordinary and Partial Differential Equations, M. D. Raisinghania, S. Chand & Company Ltd.
2. Differential Equations with Applications and Historical Notes, Simmons G.F., Tata McGraw-Hill Publishing Co. Ltd.
3. Differential Equations, Rukumangadachari E. Pearson Education
4. Ordinary Differential Equations-A First course, Brauer R., Nohel J, Benjamin Inc.
5. Ordinary Differential Equations, G. Birkoff and G. C. Rota, Ginn and Co.
6. Introduction to Ordinary Differential Equations, E. A. Coddington,Prentice Hall of India.
7. Elements of Ordinary Differential Equations, M Golom and M. E. Shinks, McGraw- Hill Books Co., 1965.
8. Theory and Problems of Differential Equations, F. Ayers, McGraw Hill.
9. Advanced Engineering Mathematics, E. Kreyzig, John Willey and Sons.
10. Introductory Course in Differential Equations, Daniel A.Murray, New York Longmans, Green, and Co.

CO	Course outcome	POs / PSOs	Cognitive level	Knowledge category	Class session
CO1	Solve linear differential equations with constant coefficients using complementary and particular integrals.	PO1, PO2, PO3, PSO1. PSO2	U, Ap	C, P	8
CO2	Apply short methods to find particular integrals for special forms of input functions in differential equations.	PO1, PO3, PO6, PSO1, PSO2	R, Ap	C, P	7
CO3	Use the method of undetermined coefficients and alternative techniques to solve homogeneous and reducible linear differential equations.	PO1,PO2, PO3, PO6, PSO1, PSO2	U, Ap	C, P	15
CO4	Solve linear differential equations using the method of variation of parameters and known integrals from complementary functions.	PO1, PO2, PO3, PO4, PO6, PSO1,PSO2	U, Ap	C, P	15
CO5	Define and classify first-order partial differential equations, including order, degree, linearity, and type.	PO1, PO2, PSO1, PSO2	R, U, An	C	8
CO6	Derive partial differential equations by eliminating arbitrary constants and functions; solve Cauchy's first-order PDEs.	PO1, PO2, PO3, PO6, PSO1, PSO2	Ap, E	C, P	7
Total hours of instruction					60

Mapping of COs with POs & PSOs

CO	PO										PSO	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3	3	0	0	0	0	0	0	0	3	3
CO2	3	0	3	0	0	3	0	0	0	0	3	3
CO3	3	3	3	0	0	3	0	0	0	0	3	3
CO4	3	3	3	2	0	3	0	0	0	0	3	3
CO5	3	3	0	0	0	0	0	0	0	0	3	3
CO6	3	3	3	0	0	3	0	0	0	0	3	3

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Mathematics Semester IV – Major Course

MTM244-2C Application of Numerical Analysis and Differential Equations

Course Outcomes:

- CO1: Compute finite differences and apply interpolation techniques (Newton, Gauss, Sterling, Bessel, Lagrange) to estimate function values.
- CO2: Perform numerical differentiation using forward and backward difference methods on tabulated data.
- CO3: Apply numerical integration techniques including Trapezoidal, Simpson's 1/3rd and 3/8th rules to approximate definite integrals.
- CO4: Solve linear differential equations by determining complementary functions for different types of auxiliary equation roots (real, equal, complex, surd).
- CO5: Find particular integrals using standard and short methods for different forms of nonhomogeneous terms.
- CO6: Solve differential equations using undetermined coefficients, Legendre's form, variation of parameters, and derive partial differential equations from given functions or constants.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
		Practical Per Week		Hrs.	Max Marks		
					CCE	SEE	
MTM244-2C	Application of Numerical Analysis and Differential Equations	8	4	5	50	50	100

Unit 1 Application of Numerical Analysis

Teaching Hours: 60

1. Evaluation of finite differences of various functions.
2. Evaluation of differences of a polynomial.
3. Application of Newton's forward formula.
4. Application of Newton's backward formula.
5. Application of Gauss forward interpolation formula.
6. Application of Gauss backward interpolation formula.
7. Application of Sterling interpolation formula.
8. Application of Bessel's interpolation.
9. Applications of Newton's divided difference formula.
10. Application of Lagrange's interpolation formula for equal and unequal intervals.
11. Application of Numerical differentiation using Newton forward formula.
12. Application of Numerical differentiation using Newton backward formula
13. Application of Trapezoidal rule.
14. Application of Simpson's $1/3^{rd}$ rule & $3/8^{th}$ rule.

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Unit 2 Application of Differential Equations **Teaching Hours:60**

1. Examples to find C.F. when all the roots of the auxiliary equation are real and different.
2. Examples to find C.F. when auxiliary equation has equal roots.
3. Examples to find C.F. when auxiliary equation has complex roots.
4. Examples to find C.F. when auxiliary equation has surd roots.
5. Examples to find P.I. of f(D)y = X when $X = e^{ax}$.
6. Examples to find P.I. of f(D)y = X when $X = \sin ax$ *or* $\cos ax$.
7. Examples to find P.I. of f(D)y = X when $X = x^{\infty}$.
8. Examples to find P.I. of f(D)y = X when $X = e^{ax}V$ where V is any function of x.
9. Examples to find P.I. of f(D)y = X when $X = xV$ where V is any function of x.
10. Examples to solve linear equations with constant coefficients using method of undetermined coefficients.
11. Examples to find P.I. of homogeneous equations.
12. Examples based on Legendre's linear equations.
13. Solve examples of the form $dy/dx + P(x)y = Q(x)$ with the method of variation of parameters.
14. Solve examples of the form $d^2y/dx^2 + P(x)(dy/dx) + Q(x) = R(x)$ with the method of variation of parameters.
15. Examples to solve the problems of the form $y'' + Py' + Qy = R$.
16. To find order and degree of partial differential equations.
17. Examples to derive partial differential equation by elimination of arbitrary constants.
18. Examples to derive partial differential equation by elimination of arbitrary functions ϕ from the equation $\phi(u, v) = 0$, where u and v are function of x, y and z, Cauchy's problem for first order equations.

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

*SEE: Semester End Evaluation

Reference Books:

1. Numerical Methods in Engineering and Science, Dr B. S. Grewal, Grewal J. S., Khanna Publication.
2. Numerical Analysis and Computational Procedures, S. A. Mollah, Books & Allied Ltd.
3. Numerical Analysis,Kaiser S. Kunz, Mcgraw-hill Inc.
4. Methods in Numerical Analysis, K. L. Nielsen, Macmilllan Company.
5. Numerical Methods, V. N. Vedamurthy, N. Iyengar, Vikas Publishing, House Pvt. Ltd.
6. Numerical Mathematical Analysis, James B. Scarborough, Oxford University Press.
7. Numerical Analysis, Vithal A. Patel, Harcourt Brace College Publishers.
8. Introductory Methods of Numerical Analysis, S. S. Sastry, Prentice Hall of India Pvt. Ltd. New Delhi.
9. Ordinary and Partial Differential Equations, M.D. Raisinghania, S. Chand & Company Ltd.
10. Differential Equations with Applications and Historical Notes, Simmons G.F.,Tata McGraw-Hill Publishing Co. Ltd.
11. Differential Equations, Rukumangadachari E. Pearson Education
12. Ordinary Differential Equations-A First course, Brauer R., Nohel J,Benjamin Inc.
13. Ordinary Differential Equations, G. Birkoff and G. C. Rota, Ginn and Co.
14. Introduction to Ordinary Differential Equations, E. A. Coddington,Prentice Hall of India.
15. Elements of Ordinary Differential Equations, M. Golom and M. E. Shinks,McGraw- Hill Books Co., 1965.
16. Theory and Problems of Differential Equations, F. Ayers,McGraw Hill.
17. Advanced Engineering Mathematics, E. Kreyzig, John Willey and Sons.
18. Introductory Course in Differential Equations, Daniel A.Murray,New York Longmans, Green, and Co.

CO	Course outcome	POs / PSOs	Cognitive level	Knowledge category	Class session
CO1	Compute finite differences and apply interpolation techniques (Newton, Gauss, Sterling, Bessel, Lagrange) to estimate function values.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, Ap	C, P	20
CO2	Perform numerical differentiation using forward and backward difference methods on tabulated data.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, Ap, E	C, P	18
CO3	Apply numerical integration techniques including Trapezoidal, Simpson's 1/3rd and 3/8th rules to approximate definite integrals.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, Ap	C, P	22
CO4	Solve linear differential equations by determining complementary functions for different types of auxiliary equation roots (real, equal, complex, surd).	PO1, PO2, PO3, PSO1, PSO2	U, Ap	C, P	20
CO5	Find particular integrals using standard and short methods for different forms of nonhomogeneous terms.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, Ap	C, P	20
CO6	Solve differential equations using undetermined coefficients, Legendre's form, variation of parameters, and derive partial differential equations from given functions or constants.	PO1, PO2, PO3, PO4, PO6, PSO1, PSO2	U, Ap	C, P	20
Total hours of instruction					120

Mapping of COs with POs & PSOs

CO	PO										PSO	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3	3	0	0	3	0	0	0	0	3	3
CO2	3	3	3	0	0	3	0	0	0	0	3	3
CO3	3	3	3	0	0	3	0	0	0	0	3	3
CO4	3	3	3	0	0	0	0	0	0	0	3	3
CO5	3	3	3	0	0	3	0	0	0	0	3	3
CO6	3	3	3	1	0	3	0	0	0	0	3	3

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Microbiology Semester IV Minor Course

MBE221-2C - Analytical Techniques in Microbiology-I

COURSE OUTCOMES:

- CO1: Describe the properties of electromagnetic radiation, electromagnetic spectrum and their interaction with matter.
- CO2: Explain and describe the principle, instrumentation, and applications of UV-Visible spectrometer, AAS and flame photometers.
- CO3: Explain the principle, components and types of centrifuges and describe types of ultracentrifugation techniques with their applications.
- CO4: Apply absorption principle to select appropriate λmax for the quantification of biomolecules.
- CO5: Evaluate and compare methods of quantitative estimation of DNA, RNA, and potassium, based on their principle and procedure.
- CO6: Design an experimental procedure to isolate mitochondria and chloroplast with their detection.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Credit	Teaching Scheme (Hrs. Per Week)	
			Theory	Practical
MBE221-2C	Analytical techniques in Microbiology- I	4	2	4

Examination Scheme						Total Marks
Theory			Practical			
Hrs.	Max Marks		Hrs.	Max Marks		
	CCE	SEE		CCE	SEE	
2	25	25	2.5	25	25	100

Unit 1: Spectrophotometry **Teaching Hours: 15 (Weightage 25%)**

- Properties of EMR
- Electromagnetic spectrum
- Interaction of EMR with matter: absorption, emission, fluorescence
- UV-Visible Spectroscopy: Principle, Instrumentation and Application
- Atomic Absorption Spectroscopy: Principle, Instrumentation and Application
- Flame Photometry: Principle, Instrumentation and Application

Unit 2: Centrifugation **Teaching Hours: 15 (Weightage 25%)**

- Definition: Centrifugation, Basic Components of centrifuge, Types of rotors
- Basic Principles of Sedimentation, Sedimentation Coefficient and Factors affecting rate of sedimentation
- Types of Centrifuges: Benchtop, Clinical, High speed and Analytical
- Ultracentrifugation
  - Introduction
  - Analytical Centrifuge: Introduction, components and applications of Analytical Centrifuge
  - Preparative Centrifuge: Introduction, Types: Differential centrifugation and Density Gradient Centrifugation (Rate Zonal and Isopycnic) and applications of Preparative Centrifuge.

Practicals **Teaching Hours: 60 (Weightage 50%)**

1. Determination of λ (Absorption Maxima -wavelength selection)
2. Quantitative estimation of DNA by DPA method.
3. Quantitative estimation of RNA by Orcinol method.
4. Isolation and Detection of Mitochondria from Leaves.
5. Isolation and Detection of Chloroplast from Leaves.
6. Estimation of Potassium by Flame Photometry.

Reference Books:

1. Principles and Techniques of Biochemistry & Molecular Biology- Keith Wilson & John Walker, Cambridge University Press.
2. Instrumental Methods of Analysis- B. Sivasankar, Oxford University Press, India.
3. Biophysical Chemistry: Principle and Techniques- Upadhyay & Nath, Himalaya Publishing House, India.
4. Instrumental Methods of Analysis- Willard, Merritt, Dean and Settle, CBS Publishers.
5. Instrumental Analysis- D.A. Skoog, Holler & Crouch, Brooks/Cole Pub Company.

Suggested Reference Books:

1. Physical Biochemistry By David Freifelder, W.H. Freeman & Co
2. Instrumental Methods Of Chemical Analysis By Chatwal G And Anand, S., Himalaya Publishing House
3. Chemical Analysis And Instrumentation By B.K.Sharma , Krishna Prakashan Media

KADI SARVA VISHWAVIDYALAYA

	Course Outcomes	POs/PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Describe the properties of electromagnetic radiation, electromagnetic spectrum and their interaction with matter.	PO1, PO2, PSO1	U, R	C	7
CO2	Explain and describe the principle, instrumentation, and applications of UV-Visible Spectrometer, AAS and flame photometers.	PO1, PO2, PSO1, PSO2	U, R, Ap	C, P	8
CO3	Explain the principle, components and types of centrifuges and describe types of ultracentrifugation techniques with their applications.	PO1, PO2, PSO1, PSO2	U, R, Ap	C, P	15
CO4	Apply absorption principle to select appropriate λmax for the quantification of biomolecules.	PO2, PO3, PO6, PO7, PSO2	Ap, An, E	P	12
CO5	Evaluate and compare methods of quantitative estimation of DNA, RNA, and potassium, based on their principle and procedure.	PO1, PO2, PO3, PO6, PO7, PSO1, PSO2	Ap, An, E	C, P	30
CO6	Design an experimental procedure to isolate mitochondria and chloroplast with their detection.	PO2, PO3, PO6, PO7, PSO2	Ap, An, Cr	P	18
	Total hours of Instruction				**90**

Mapping of COs with POs & PSOs

CO	PO										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3										
CO2	3	3									3	
CO3	3	3									3	3
CO4		3	3			3	3				3	3
CO5	3	3	3			3	3					3
CO6		3	3			3	3				3	3
												3

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Chemistry Semester IV Minor Course

CHE222-2C CHEMISTRY IN DAILY LIFE- AGRICULTURECHEMISTRY

Course Outcomes:

- CO1:Describe the elemental composition of Earth's crust and soils, and explain concepts such as cation and anion exchange capacities, soil colloids, and point of zero charge (PZC).
- CO2: Classify plant nutrients into major, minor, and trace elements, and explain the classification, composition, and synthesis of key nitrogen- and phosphorus-containing fertilisers.
- CO3: Compare inorganic, organic, and natural insecticides, and demonstrate the synthesis and uses of common pesticides such as DDT and BHC.
- CO4: Analyse the structure–activity relationship (SAR) and evaluate the benefits and drawbacks of various pesticide classes, including organophosphates, carbamates, quinones, and anilides.
- CO5: Perform physical and chemical analysis of soil samples, including bulk density, moisture content, water holding capacity, humus content, and conductance, to evaluate soil quality.
- CO6: Determine the concentration of essential soil nutrients (N, P, K, Ca^{2+}, Mg^{2+}, S, Cl^-) using volumetric, gravimetric, and colourimetric techniques, and analyse the data to assess soil fertility.
-

Course Code	Course Title	Teaching Scheme Per Week		Credits
		Theory hrs Per Week	Practical hrs Per Week	
CHE222-2C	Chemistry in Daily Life- Agriculture Chemistry	2	4	4

Examination Scheme						
Theory			Practical			Total Marks
Hrs.	Max Marks		Hrs.	Max Marks		
	CCE	SEE		CCE	SEE	
2	25	25	2.5	25	25	100

Contents

Unit:1 SOIL CHEMISTRY & FERTILIZERS **Teaching Hours:15 (Weightage:50%)**

- Chemical (elemental) composition of the earth's crust and soils. Cation Exchange Capacity and Anion Exchange Capacity Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable- charge soil components
- Plant Nutrients, Major Nutrients, Minor Nutrients, Trace Nutrients
- Definition of Fertilizer • Classification of Fertilizer
- Synthesis of N Containing Fertilizer i.e.$(NH_4)_2SO_4$,$Ca(CN)_2$,andUrea
- SynthesisofPContainingFertilizeri.e.SuperPhosphate,TripalSuperPhosphateMix

KADI SARVA VISHWAVIDYALAYA

Unit 2 INSECTICIDE & PESTICIDES **TeachingHours:15 (Weightage:50%)**

- Introduction • Inorganic Insecticide • Organic Insecticide, Natural or Plant Insecticide • Synthesis of DDT, BHC
- General Introduction to Pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture, and uses of representative pesticides in the following classes:
    - Oragnophophates (Malathion, Parathion)
    - Carbamates (Carbofuranandcarbaryl)
    - Quinones (Chloranil)
    - Anilides (alachlorand Butachlor).

UNIT3: Practical (Minimum Ten) **Teaching Hours:60**

- To determine Physical and chemical analysis of soil
- Volumetric estimation of fertilizers.(N,P,K)
- To determine bulk density of different samples of soil.
- To determine moisture of different samples of soil.
- To determine water holding capacity of different samples of soil.
- To determine humus analysis of different samples of soil.
- TodetermineCa^{+2}andMg^{+2}amountinthesoilsamples.
- Colorimetric analysis of Sulphur (gravimetrically) and phosphorous in the given soil sample.
- Colorimetric analysis of N,P,K in the given soil sample.
- To determine conductance of different samples of soil.
- To determine conductance chloride ion of different samples of soil. (by $AgNO_3$,Mohr's method)

***CCE:** Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

***SEE:** Semester End Evaluation

REFERENCES BOOK:

- Researchmethodsinplantsciences:AllelopathyVolI,soilanalysisbyS.S.Narwal,S. S. Dahiyaand J.P.Singh.
- PracticalmanualchemicalanalysisofsoilandplantsamplesbyUmmedSinghCS Praharaj, ICAR-Indian institute of pulses research Kanpur, Uttar Pradesh
- Practical Manual, Introductory Agro Meterology and Climate change by Dr. R. R. Pisal, Dr. A. P. Patel, Dr. V. M. Patel, Prof. S SSonawane, Prof. H. P. Dholariya
- Industrial Chemistry by B.K. Sharma.
- A source book of Agricultural chemistry by Charles Albert Browne
- MethodsinAgriculturalchemicalanalysis–ApracticalHandbookbyN.T.Faithfull.
- BearRE.1964.Chemistryof the Soil. Oxford and IBH.
- BoltGH&BruggenwertMGM.1978.SoilChemistry.Elsevier.
- Greenland DJ & Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons.
- Greenland DJ & Hayes MHB. Chemistry of Soil Constituents. John Wiley & Sons.

SUGGESTED BOOKS:

- McBrideMB.1994.EnvironmentalChemistryofSoils.OxfordUniv.Press.
- Sposito G. 1981. The Thermodynamics of Soil Solutions. Oxford Univ. Press.

- SpositoG.1984.TheSurfaceChemistryofSoils.OxfordUniv.Press.
- SpositoG.1989.TheChemistryofSoils.OxfordUniv.Press.nd
- StevensonFJ.1994.HumusChemistry.2Ed.JohnWiley&Sons.
- Van Olphan H. 1977. Introduction to Clay Colloid Chemistry. John Wiley & Sons.
- Cremlyn, R. Pesticides, Preparation and Modes of Action, John Wiley & Sons, New York, 1978.

	Course Outcomes	POs/ PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Describe the elemental composition of Earth's crust and soils, and explain concepts such as cation and anion exchange capacities, soil colloids, and point of zero charge (PZC).	PO1, PO2, PSO1	U	C	15
CO2	Classify plant nutrients into major, minor, and trace elements, and explain the classification, composition, and synthesis of key nitrogen- and phosphorus-containing fertilisers.	PO1, PSO1, PSO2	U	C	8
CO3	Compare inorganic, organic, and natural insecticides, and demonstrate the synthesis and uses of common pesticides such as DDT and BHC.	PO1, PO3, PSO1	An, Ap	C, P	6
CO4	Analyse the structure–activity relationship (SAR) and evaluate the benefits and drawbacks of various pesticide classes, including organophosphates, carbamates, quinones, and anilides.	PO1, PO3, PO6 PSO2	An, E	C, P	20
CO5	Perform physical and chemical analysis of soil samples, including bulk density, moisture content, water holding capacity, humus content, and conductance, to evaluate soil quality.	PO1, PO9 PSO2	An, E	P	20
CO6	Determine the concentration of essential soil nutrients (N, P, K, Ca^{2+}, Mg^{2+}, S, Cl^-) using volumetric, gravimetric, and colourimetric techniques, and analyse the data to assess soil fertility.	PO1, PO9 PSO2	An, Ap	C, P	20
	Total hours of Instruction				**90**

KADI SARVA VISHWAVIDYALAYA

Mapping of COs with POs and PSOs

CO	PO										PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	1									2	
CO2	3										2	3
CO3	3		2								2	
CO4	3		2			1						3
CO5	3								3			3
CO6	3								3			3

3: High, 2: Medium, 1: Low

Patel

KADI SARVA VISHWAVIDYALAYA

Physics Semester IV - Minor Course

PHE223-2C Introduction to Computational Physics with Python

COURSEOUTCOMES (COs):

- **CO1:** Understand Python syntax, variables, operators, and basic data structures.
- **CO2:** Apply conditional logic, loops, and functions to solve physical problems.
- **CO3:** Implement physics simulations (e.g., projectile motion, SHM) in Python.
- **CO4:** Use libraries like NumPy, SciPy, and Matplotlib for numerical analysis.
- **CO5:** Visualize physical data using plots and graphical tools for better interpretation.
- **CO6:** Debug and improve code efficiency for real-world physics applications

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme		Credits
		Theory Per Week	Practical Per week	
PHE223-2C	Introduction to Computational Physics with Python	2	4	4

Examination Scheme						
Theory			Practical			Total Marks
Hrs.	Max Marks		Hrs.	Max Marks		
	CCE	SEE		CCE	SEE	
2	25	25	2.5	25	25	100

Unit 1: Python: Overview & Basic Syntax **Teaching Hours: 15 (Weightage :25%)**

Introduction, Short History, Types of Python, Python environment setup, Identifiers, Keywords, Lines and indentation, Multi-line statements. Quotation, Comments, Blank lines, Types of Variables – Assigning values to variable, multiple assignments, data types, numbers, strings, lists, tuples, dictionary, data type conversion, Basic Operators- Types of Operators, Arithmetic operators, Comparison Operators, Assignment, Bitwise, Logical, Membership, Identity & operator precedence

Unit-2 :Decision making, loops, classes & objects, and data visulization

Teaching Hours: 15 (Weightage :25%)

Decision Making - *If* statement, *If....else* statement, The*elif*statement, Single statement suite, Loops- While, the Infinite loop, *else* with loops, For loops, Iterations, Nested loop, Loop control, Break, Continue, Introduction to Numpy&Scipy, Data Visualization with Matplotlib – Simple Plot, Figures, Subplots, Axes & Ticks, Examples and exercise

List of Practical **Teaching Hours: 30 (Weightage :50%)**

1) Projectile Motion: Calculate the trajectory of a projectile launched at an angle with a given initial velocity, assuming no air resistance.
2) Gravitational Force: Calculate the gravitational force between two objects given their masses and the distance between them using Newton's law of universal gravitation.
3) Simple Pendulum: Calculate the period and frequency of a simple pendulum given its length and the acceleration due to gravity.
4) Circular Motion: Calculate the centripetal force required to keep an object moving in a circle given its mass, velocity, and radius of the circle.

5) Work and Energy: Calculate the work done on an object by a force and its change in kinetic energy.
6) Simple Harmonic Motion: Simulate the motion of a mass-spring system or a pendulum undergoing simple harmonic motion.
7) Temperature Conversion: Convert temperature between Celsius, Fahrenheit, and Kelvin scales using appropriate conversion formulas.
8) Density and Buoyancy: Calculate the buoyant force acting on an object submerged in a fluid given its volume and density.
9) Ohm's Law: Calculate the current, voltage, or resistance in an electrical circuit using Ohm's law.
10) Motion with Constant Acceleration: Calculate the final velocity, displacement, or time taken for an object moving with constant acceleration.

Note:

- New Experiments can be introduced AND / OR replaced as per need by the permission of the Head / Principal of the institute.
- Hands-on / Project /Model etc. will carried out additionally for the enhancement of related skills.

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

*SEE: Semester End Evaluation

Reference Books

1) Essential Python for the Physicist by Giovanni Moruzzi, Springer
2) www.python.org
3) Python Essential Reference by David M. Beazley, Pearson Education

CO No.	Course Outcomes (COs)	Mapped POs/PSOs	CL Cognitive level	KC Knowledge Category	Class Session
CO1	Understand Python syntax, variables, operators, and basic data structures.	PO1, PO3 PSO1	U	C	12
CO2	Apply conditional logic, loops, and functions to solve physical problems.	PO2, PO6 PSO2	Ap	C	8
CO3	Implement physics simulations (e.g., projectile motion, SHM) in Python.	PO1, PO3, PO6 PSO2	Ap, E	C	10
CO4	Use libraries like NumPy, SciPy, and Matplotlib for numerical analysis.	PO4, PO6, PO7 PSO2	Ap	P	20
CO5	Visualize physical data using plots and graphical tools for better interpretation.	PO5, PO7 PSO2	Ap	P	20
CO6	Debug and improve code efficiency for real-world physics applications.	PO3, PO6 PSO2	An, C	P	20
				Total hour of Instruction	**90**

Mapping of Cos with Pos & PSOs

COs	POs										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3		3								1	
CO2		1				3						3
CO3	3		3			3						3
CO4				1		3	2					3
CO5					1		2					3
CO6			3			3						3

3:High,2:Medium,1:Low

KADI SARVA VISHWAVIDYALAYA

Mathematics Semester IV – Minor Course

MTE224-2C Python Programming

Course Outcomes:

- CO1:Explain Python basics including variables, expressions, control structures, and user-defined functions, and implement them using interactive environments like IDEs and Jupyter.
- CO2:Apply string handling and list, tuple, and set operations to develop programs involving collection manipulations and data traversal.
- CO3:Use dictionaries, nested data structures, and anonymous functions (lambda, map, filter, reduce) for data processing and transformation tasks.
- CO4:Develop Python programs that demonstrate recursion, scope of variables, decorators, and generators with accurate application of concepts.
- CO5:Handle errors and exceptions effectively in Python programs, and demonstrate structured exception handling with appropriate use of try-except blocks.
- CO6:Implement object-oriented programming concepts including classes, inheritance, and encapsulation, and perform file operations (text and binary) for persistent data storage and manipulation.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme		Credits
		Theory Per Week	Practical Per week	
MTE224-2C	Python Programming	2	4	4

Examination Scheme						Total Marks
Theory			Practical			
Hrs.	Max Marks		Hrs.	Max Marks		
	CCE	SEE		CCE	SEE	
2	25	25	2.5	25	25	100

Unit 1

Teaching Hours:15

Introduction and Basics of Python: Python IDE, interacting with Python programs, Elements of Python, variables, Immutability, Expressions, Operators and Boolean expressions, Operator precedence, Conditional statements and Control loop, Break and Continue, range (), User defined functions, Types of arguments in function, Local and Global variables, Recursive functions.

String Handling: Lists-Creating Lists, Accessing the elements of a list, List slicing, Python in-built functions for lists, List comprehension, List methods, passing list to a function, Returning a list to function.

Tuples: Creating tuples, tuple () function, Inbuilt functions for tuples, Indexing and Slicing, Operations on tuples, Passing variable length arguments to tuples, Sort tuples, Traverse tuples from a list

Sets: Creating sets, the set in and not in operator, The Python set class, Set operations.

Unit 2

Teaching Hours:15

Dictionaries : Basics of dictionaries, creating a Dictionary, Adding and replacing values, retrieving values, formatting dictionaries, deleting items, comparing two dictionaries, Methods of dictionary class, traversing dictionaries, Nested dictionaries, Traversing nested dictionaries

Anonymous Functions: Lambda (), filter(), map (), reduce (), zip (), Inverse zip (*), Function Decorators, Generators.

Error and Exceptions : Errors in a Python Program (Compile-Time Errors, Runtime Errors, Logical Errors), NameError, Index Error, Type Error, Import Error, Value Error, Exception Handling, Types of Exceptions, Classes and object-Oriented Programming, Abstract data type and classes, Inheritance, Encapsulation and Information Hiding, File handling, Basic file operations of text and binary files.

Practicals

Teaching Hours:60

1. Introduction to Python Editors like IDE, Jupyter, Google Colab etc.
2. Introduction to basic operations in python.
3. Develop programs to understand the control structures of python.
4. Develop programs to understand the string handling operations.
5. Develop programs to understand the User-Defined functions with different types of arguments.
6. Develop programs to learn concept of functions scoping, recursion and list mutability.
7. Develop programs to learn different types of structures (sets, list, dictionary, tuples) in python.
8. Develop programs to understand working of exception handling and assertions.
9. Develop programs to learn different Files operations in python.

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.
*SEE: Semester End Evaluation

Reference Books:

1. Introduction to Computation and Programming Using Python, John V. Guttag, Prentice Hall of India.
2. Core Python Programming, R. Nageswara Rao, Dreamtech Press, Wiley India.
3. Core Python Programming, Wesley J. Chun, Prentice Hall.
4. Fundamentals of Python – First Programs, Kenneth A. Lambert, CENGAGE Publication.

CO	Course outcome	POs / PSOs	Cognitive level	Knowledge category	Class session
CO1	Explain Python basics including variables, expressions, control structures, and user-defined functions, and implement them using interactive environments like IDEs and Jupyter.	PO1, PO2, PO7, PSO1, PSO2	R, U, Ap	C, P	13
CO2	Apply string handling and list, tuple, and set operations to develop programs involving collection manipulations and data traversal.	PO1, PO2, PO3, PO7, PSO1, PSO2	U, Ap	C, P	15
CO3	Use dictionaries, nested data structures, and anonymous functions (lambda, map, filter, reduce) for data processing and transformation tasks.	PO1, PO2, PO3, PO6, PO7, PSO1	U, Ap	C, P	15
CO4	Develop Python programs that demonstrate recursion, scope of variables, decorators, and generators with accurate application of concepts.	PO1, PO2, PO3, PO4, PO7, PSO2	Ap, An, C	C, P	15
CO5	Handle errors and exceptions effectively in Python programs, and demonstrate structured exception handling with appropriate use of try-except blocks.	PO1, PO2, PO3, PO6, PO7, PSO2	U, Ap	C, P	13
CO6	Implement object-oriented programming concepts including classes, inheritance, and encapsulation, and perform file operations (text and binary) for persistent data storage and manipulation.	PO1, PO2, PO3, PO4, PO6, PO7, PSO1, PSO2	U, Ap	C, P	19
Total hours of instruction					90

Mapping of COs with POs & PSOs

CO	PO										PSO	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3	0	0	0	0	3	0	0	0	3	3
CO2	3	3	3	0	0	0	3	0	0	0	3	3
CO3	3	3	3	0	0	3	3	0	0	0	3	0
CO4	3	3	3	2	0	0	3	0	0	0	0	3
CO5	3	3	3	0	0	3	3	0	0	0	0	3
CO6	3	3	3	2	0	3	3	0	0	0	3	3

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Ability Enhancement Course – Semester 4

AEC-213-2C –Personality Development

Course Outcomes:

CO 1: Describe personal attributes through selected self-assessment tools to determine specific areas for self-development.

CO 2: Illustrate the concept of Interpersonal skills through the selected case studies focusing the personality traits essential to successful teamwork and cross-cultural communication.

CO 3: Examine the personal effectiveness in professional set-up considering time and change management, goal setting and creative thinking.

Teaching and Evaluation Scheme:

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
				Hrs.	Max Marks		
		Theory Per Week			*CCE	*SEE	
AEC-213-2C	Personality Development	2	2	2	25	25	50

Unit 1: Basic of Personality Development **Teaching Hours: 09 (Weightage30%)**

- Concept of personality [Introduction, Definitions and general meaning(2 hr)
- Personality Analysis Method-Types, self-assessment and implications for working on limitations (3 hr)
- SWOT analysis [Introduction, Meaning, Benefits of SWOT analysis, Grid (Framework) of SWOT] (2 hr)
- Johari window (2 hr)

Unit 2: Interpersonal Skills **Teaching Hours: 09 (Weightage 30%)**

- Forms of Communication (1 hr)
- Interpersonal communication-definition and three unique attributes (1 hr)
  - Personality traits to develop for good interpersonal skills (7 traits)
- Teamwork
  - Importance of team work, collaboration VS silo building, five points of importance of team work, diverse and dispersed teams (1 hr)
  - Features of a good team worker/leader (1 hr)
  - Adaptability- Culture and communication: defining culture and understanding cultural communication. some related terms-globalization, culture, intercultural communication, co-culture, cultural shock, cultural context, high-context and low context culture (2 hr)
  - Five categories of cultural values (1 hr)
  - Barriers to bridging differences and adapting to others, and strategies to deal with them (2 hr)

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Unit 3:Personal Attributes Teaching Hours: 12(Weightage40%)

- Change management- a case study and test (1 hr)
  - Physical-emotional reactions to change, attitudes that hinder change, the change implementation model (2 hr)
- Motivation, Goal setting and self-esteem (4 hr)
  case study, questionnaire, Impact of values and attitudes, how one gets motivated step by step, characteristics of attainable goals, worksheets, ten ways to increase self-motivation, case study discussion.
- Time management:
  - Case study, definition, symptoms of problems in time management, (1 hr)
  - steps-planning prioritizing, estimating, documenting, tracking (1 hr)
  - Barriers in time management (1 hr)
  - Creative thinking: what it is, components, strategies and case study(2 hr)

***CCE:** Continuous and Comprehensive Evaluation :It consists of Assignments /Seminars/Presentations/Quizzes/ Surprise Tests.

***SEE:** Semester End Evaluation

Reference books:

Alex, K. *Soft Skills: Know Yourself and Know the World*. S. Chand and Company, 2015.

Beebe, Steven A., et al. *Communication: Principles for a Lifetime*. Pearson, 2010.

Gearson, Scott, and Philip Gearson. *Technical Communication: Process and Product*. Pearson, 2013.

Kumar, Sanjay, and Pushpa Lata. *Communication Skills*. Oxford University Press, 2013.

Matthews, Gerald, et al. *Personality Traits*. Cambridge University Press, 2009.

Mitra, Barun. *Personality Development and Soft Skills*. Oxford University Press, 2011.

Ramesh, G. *The Ace of Soft Skills: Attitude, Communication and Etiquettes for Success*. Pearson, 2013.

Sherfield, Robert, et al. *Cornerstone Book of Developing Soft Skills*. Pearson, 2008.

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	Course Outcome	Pos/PSOs	CL Cognitive level	Knowledge Category	Class Session
CO 1	Describe personal attributes through selected self-assessment tools to determine specific areas for self-development.	PO1,PO4, PO5	U, Ap	C, M	09
CO 2	Illustrate the concept of Interpersonal skills through the selected case studies focusing the personality traits essential to successful teamwork and cross-cultural communication.	PO1, PO2, PO3, PO4, PO5,PO10	U, Ap, An	C, P, M	09
CO 3	Examine the personal effectiveness in professional set-up considering time and change management, goal setting and creative thinking.	PO1, PO2, PO3, PO4, PO5	U, Ap, An	C, P, M	12
Total hour of instruction					**30**

Mapping of Cos with Pos & PSOs

Co	PO															PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2
CO1	3			3	3													
CO2	3	3	3	3	3					2								
CO3	3	3	3	3	3													

3:High,2:Medium,1:Low

CO		POs												PSOs	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	1	2
CO1	09	Y			Y	Y									
CO2	09	Y	Y	Y	Y	Y					Y				
CO3	12	Y	Y	Y	Y	Y									
CO4															
	30	30	21	21	30	30					09				
		3	3	3	3	3					2				

Note: less than 5 %=0; 5-25%=1; 25-40%=2; Greater than 40%=3

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Semester IV – ValueAddedC ourse

VAC207-2C Disaster Management

Course Outcomes:

- **CO1:**Understand the types and causes of natural and man-made disasters
- **CO2:**Analyze the impact of disasters on society, environment, and economy
- **CO3:**Develop communication and coordination skills for disaster situations

TeachingandEvaluation Scheme:

Course Code	CourseTitle	TeachingScheme		Credits	ExaminationScheme			Total Marks
		Theory hrs PerWeek	Practical hrs PerWeek		Hrs.	MaxMarks CCE	MaxMarks SEE	
VAC207-2C	Disaster Management	2	0	2	2	25	25	50

CONTENT:

Unit ITeachingHours:15(Weightage:50%)

- Introduction disaster: Understanding the concepts and definitions of Disaster-3hrs
- General concepts of disaster: Hazard, Vulnerability, Risk-4hrs
- Introduction, Primary concept, approaches to disaster risk reduction for disaster management-4hrs
- Various steps during pre-disaster management: Risk Assessment and Analysis-4hrs

Unit IITeachingHours:15(Weightage:50%)

- Management during disaster and post disaster: Types, Trends, Causes, Consequences and Control of Geological Disasters (earthquakes, landslides, tsunami); Hydro Disasters (floods); biological disaster(forest fire); technical disaster (chemical, nuclear); global disasters trends (climate change and urban disasters)

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations/Quizzes/Surprise Tests.

*SEE: Semester End Evaluation

ReferenceBook:

1. ModiCD&others(2006)ParyavaranandAapattiVyavasthapan[Gujarati],Swami prakashan, Patan- 384265
2. Patel J C (2006) Paryavaran and disaster management [Gujarati], Parshwa publication, Ahmedabad-380001
3. ErachsBharucha(2008, firstedition)ParyavaranAdhyayan[Gujarati],OrientLongmanPvt.Ltd., Hyderabad.

Suggested Books:

1. Distributor: M/S Himanshu book company, 06-07 ShriJayendrapuriBhavan, Ellisbridge, New Sanyas Ashram, Ahmedabad – 380 006.
2. K RamanaMurthi, 2004 Disaster Management, Dominant Publishersand Di stributors, New Delhi -110002

	Course Outcome	POs/ PSOs	CL Cognitive Level	Knowledge Category	Class Session
CO1	Understand the types and causes of natural and man-made disasters	PO1,PO2,PO9 , PO10,PSO1, PSO2	U ,R, An	C,P	07
CO2	Analyze the impact of disasters on society, environment, and economy	PO1,PO2,PO9 , PO10,PSO1, PSO2	U ,An, E	C,P	08
CO3	Develop communication and coordination skills for disaster situations	PO1,PO2,PO4 , PO5, PO9, PO10,PSO1, PSO2	Ap, An, C	C,P	15
Total Hours of Instructions					30

Mapping of COs with POs and PSOs

CO	PO										PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3	3							3	3	3	3
CO2	3	3							3	3	3	3
CO3	3	3		3	3				3	3	3	3

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Microbiology Semester IV Skill Enhancement Course

SEC225-2C- Food Microbiology

COURSE OUTCOMES:

- CO1: Explain the scope, historical development, and fundamental concepts of food microbiology, including fermented foods and probiotics.
- CO2: Analyze the types and causes of microbial food spoilage, food borne infections, and intoxications, and identify their causative agents.
- CO3: Describe types of preservation and preservative agent and compare methods of preservation.

TEACHING AND EVALUATION SCHEME:

Course code	Course Title	Credit	Teaching Scheme (Hrs. Per Week)	Examination Scheme			Total Marks
			Theory	Hrs.	Max Marks		
					CCE	SEE	
SEC225-2C	Food Microbiology	2	2	2	25	25	50

Unit 1: Introduction to food microbiology and Fermented foods

Teaching Hours: 15 (Weightage 50%)

- Introduction to food microbiology, Scope of food microbiology
- Historical development of food science and technology.
- Classification of food in relation to shelf life.
- Food as substrate for microorganisms
- Microbiology of fermented milk - Starter lactic cultures,
- Fermented milk products: Curd, Yogurt, Butter and Cheese, other fermented foods: Idli, Bread.
- Nutritional value of fermented foods.
- Microorganisms as food: Single Cell Protein, Edible Mushrooms.
- Probiotics: definition and uses.

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Unit 2 Microbial Food Spoilage, food poisoning and Preservation

Teaching Hours: 15(Weightage 50%)

- Significance of Microorganisms in Foods.
- **Microbial food spoilage**
  - Importance of food spoilage
  - Factors affecting growth and survival of microorganisms in food,
  - Natural sources of microbial contamination of food, different types of spoilages,
  - Microbes involved in food spoilage: meat, poultry, vegetables, canned foods and dairy products;
  - Methods for detection of microorganisms in food: Meat, Diary, Sea foods, Vegetables: Physical, Chemical, Immunological and Biochemical assays.
- **Food poisoning**
  - Definition of food poisoning, food infections and toxications.
  - Causative agents, foods involved symptoms and preventive measures.
  - Food intoxications: *Staphylococcus aureus, Clostridium botulinum*
  - Important microbes secreting toxins, chemical nature of important toxins; Mycotoxins.
  - Food borne infections: *Bacillus cereus, Escherichia coli, Shigella, Listeria monocytogenes.*
- **Food preservation**
  - Introduction to preservation, types of preservation, natural and artificial preservative agent, class I, II and III preservative agents,
  - Methods of preservation:
    - Physical methods of food preservation: High and Low temperature, Pasteurization, types (canning, drying); High pressure and Irradiation.
    - Chemical methods of food preservation: salt, sugar, organic acids, SO_2 and antibiotics

Reference Books:

1. Essentials of Food Microbiology, edited by John Garbutt, Arnold International Students Edition, London, UK.
2. Microbiology- Pelczar, M.J., Chan, E.C.S., and Krieg, N.R., McGraw-Hill Education, USA.
3. Microbiology of Foods- John C. Ayres, J. Orwin Mundt, and William E. Sandine, W. H. Freeman and Company, San Francisco, USA.
4. Bacterial Pathogenesis: A Molecular Approach - Abigail A. Salyers and Dixie D. Whitt, 2nd Edition, ASM Press, Washington, D.C., USA
5. Food Microbiology- W.C. Frazier, Tata McGraw-Hill Publishing Company Ltd, India.

Suggested reference Books:

1. Food Microbiology- M.R. Adams and M.O. Moss, The Royal Society of Chemistry, Cambridge, UK.
2. Biotechnology- R.C. Dubey, S. Chand Publishing, New Delhi, India.

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	Course Outcomes	POs/PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Explain the scope, historical development, and fundamental concepts of food microbiology, including fermented foods and probiotics.	PO1, PO2, PSO1	U, R	C	5
CO2	Analyze the types and causes of microbial food spoilage, food borne infections, and intoxications, and identify their causative agents.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, R	C, P	10
CO3	Describe types of preservation and preservative agent and compare methods of preservation.	PO1, PO2, PO3, PO6, PSO1, PSO2	U, R, Ap, An, E	C, P	15
	Total hours of Instruction				30

Mapping of COs with POs & PSOs

CO	PO										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3									3	
CO2	3	3	3			3					3	3
CO3	3	3	3			3					3	3

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Chemistry Semester IV Skill Enhancement Course

SEC266-2C INDUSTRIAL CHEMISTRY - II

Course Outcomes:

- CO1:Explain the principles of surface chemistry and interfacial phenomena, including adsorption isotherms, micelles, emulsions, and the effect of surfactants and hydrotropes.
- CO2:Apply the concepts of catalysis and analyse the mechanism, rate models, and industrial relevance of catalytic and enzyme-catalysed reactions, including phase transfer catalysis.
- CO3:Perform basic chemical calculations and construct and solve material balance problems for unit operations like distillation, extraction, and evaporation; describe the role of fuels, water, air, and industrial heat/mass transfer equipment.

Course Code	Course Title	Teaching Scheme Per Week		Credits	Examination Scheme			Total Marks
					Hrs.	Max Marks		
		Theory hrs Per Week	Practical hrs Per Week			CCE	SEE	
SEC266-2C	Industrial Chemistry-II	2	0	2	2	25	25	50

Content

Unit: 1 Industrial Aspects of Physical and Material Chemistry Teaching Hours : 15 (Weightage:50%)

- Surface chemistry and Interfacial phenomena: Adsorption isotherm, Sols, Gels, Emulsions, Microemulsions, Micelles, Aerosols, Effect of surfactants, Hydrotropes.
- Catalysis: Introduction, Types, Basic principles, mechanisms, factors affecting the performance, introduction to phase transfer catalysis, Enzymes catalysed reactions- rate model, industrially important reactions.
- Dimensions and Units: Basic chemical calculations – atomic weight, molecular weight, equivalent weight, Mole concept, composition of liquid and gaseous mixtures.
- Material Balance without chemical reactions: Flow diagram for material balance, simple material balance with or without recycle or bypass for chemical engineering operations such as distillation, absorption, crystallisation, evaporation, extraction, etc.

Unit2: Utilities in Industry Teaching Hours :15 (Weightage:50%)

- Fuel: Types of fuels– advantage sand disadvantages. Boilers: Types of boilers and their functioning.
- Water: Specifications for Industrial use, various water treatments. Steam: Generation and use.
- Air: Specifications for Industrial use, processing of air.
- Fluid Flow: Fans, Blowers, Compressors, vacuum pumps, Ejectors. Pumps: Reciprocating pumps, Gear pumps, Centrifugal pumps.
- HeatTransfer:Heatexchangers-shellandtubetype,finnedtubeheatexchangers,plate heat exchangers, refrigeration cycles.

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

*SEE: Semester End Evaluation

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REFERENCES BOOK

- E.Stocchi: Industrial Chemistry,Vol-I,EllisHorwoodLtd.UK.
- R.M. Felder,R.W. Rousseau: Elementary Principles of Chemical Processes,Wiley Publishers, New Delhi.

SUGGESTED BOOKS:

- J.A.Kent:Riegel'sHandbookofIndustrialChemistry,CBSPublishers,NewDelhi.
- S.S.Dara:ATextbookofEngineeringChemistry,S.Chand&CompanyLtd.NewDelhi

	Course Outcomes	POs/ PSOs	CL Cognitive level	Knowledge Category	Class Session
CO1	Explain the principles of surface chemistry and interfacial phenomena, including adsorption isotherms, micelles, emulsions, and the effect of surfactants and hydrotropes.	PO1,PSO1	U	C	9
CO2	Apply the concepts of catalysis and analyse the mechanism, rate models, and industrial relevance of catalytic and enzyme-catalysed reactions, including phase transfer catalysis.	PO1,PO2, PO6, PSO1, PSO2	Ap, An	C, P	6
CO3	Perform basic chemical calculations and construct and solve material balance problems for unit operations like distillation, extraction, and evaporation; describe the role of fuels, water, air, and industrial heat/mass transfer equipment.	PO1,PO2, PSO1, PSO2	U, Ap	C, P	15
	Total hours of Instruction				**30**

Mapping of COs with POs and PSOs

CO	PO										PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	3										3	
CO2	3	3				1					3	3
CO3	3	3									3	3

3: High, 2: Medium, 1: Low

KADI SARVA VISHWAVIDYALAYA

Physics Semester IV - Skill Enhancement Course

SEC267-2C Physics in Biology and Medicine-II

COURSEOUTCOMES (COs):

- **CO1:**Explain elastic response of human tissues under physical stress.
- **CO2:**Evaluate scenarios of bone fracture, impulse forces, and injury mechanisms.
- **CO3:**Analyse fluid mechanics in body processes including buoyancy, pressure, etc.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
						Max Marks		
		Theory Per Week	Practical Per week		Hrs.	CCE	SEE	
SEC267-2C	Physics in Biology and Medicine-II	2	0	2	2	25	25	50

Unit-1: Elasticity and strength of material

Teaching Hours: 15 (Weightage 50%)

Longitud in alstretch and compression, A Spring, Bone Fracture: Energy considerations,Impulsive forces, Fracture due to fall : Impulsive force considerations, Air bags : Inflating collision protection devices, Whiplash injury, Falling from great height, Osteoarthritis and exercise.

Unit-2: Fluids

Teaching Hours: 15 (Weightage 50%)

Force and pressure in a fluid, Pascal's principle, Hydro static Skeleton, Archimedes Principle, Power requirement to remain A float, Buoyancy of Fish, Surface tension, Soil water, Insect Locomotionon water, contraction of muscles, Surfactant.

Reference Books

1) Physics in Biology and Medicine by Paul Davidovits; 5th edition, Academic Press.

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CO No.	Course Outcomes (COs)	Mapped POs/PSOs	CL Cognitive level	KC Knowledge Category	Class Session
CO1	Explain elastic response of human tissues under physical stress.	PO1, PO3 PSO1	U, An	C	10
CO2	Evaluate scenarios of bone fracture, impulse forces, and injury mechanisms.	PO2, PO4 PSO2	An, E	C	10
CO3	Analyse fluid mechanics in body processes including buoyancy, pressure, etc.	PO1, PO3, PO6 PSO2	Ap, E	C	10
				Total hour of Instruction	**30**

Mapping of Cos with Pos & PSOs

COs	POs										PSOs	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3		3								2	
CO2		2		2								3
CO3	3		3			2						3

3:High,2:Medium,1:Low

KADI SARVA VISHWAVIDYALAYA

Mathematics Semester IV - Skill Enhancement Course

SEC268-2C Quantitative Aptitude-II

Course Outcomes:

- **CO1:** Apply arithmetic reasoning to solve real-life problems involving trains, boats and streams, mixtures, interests, and logarithms.
- **CO2:** Analyze and solve geometric and mensuration-based problems related to area, volume, and surface area using standard formulas.
- **CO3:** Demonstrate logical and analytical thinking by solving problems on calendars, clocks, permutations and combinations, heights and distances, and numerical series.

TEACHING AND EVALUATION SCHEME:

Course Code	Course Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
					Hrs.	Max Marks		
		Theory Per Week	Practical Per week			CCE	SEE	
SEC268-2C	Quantitative Aptitude-II	2	0	2	2	25	25	50

Unit 1 **Teaching Hours: 15**

Examples related to trains, Examples on boats and streams, Problem solving on mixture, Examples on simple interest and compound interest, Examples on logarithms, Problem solving on area, volume and surface area.

Unit 2 **Teaching Hours: 15**

Examples related to calendar, Problems related to clock, Problem solving on permutations and combinations, Examples on heights and distances, Examples on series.

*CCE: Continuous and Comprehensive Evaluation: It consists of Assignments /Seminars/ Presentations /Quizzes/Surprise Tests.

*SEE: Semester End Evaluation

ReferenceBooks:

1. Quantitative Aptitude for Competitive Examinations, Dr. R. S. Aggarwal, S. Chand Publishing
2. The Pearson Guide to Quantitative Aptitude for Competitive Examinations, Dinesh Khattar, Pearson
3. CSIR-NET General Aptitude - A New Outlook, Christy Varghese, Lilly Publishing House

CO	Course outcome	POs / PSOs	Cognitive level	Knowledge category	Class session
CO1	Apply arithmetic reasoning to solve real-life problems involving trains, boats and streams, mixtures, interests, and logarithms.	PO1, PO2, PO3, PSO1, PSO2	U, Ap	C, P	8
CO2	Analyze and solve geometric and mensuration-based problems related to area, volume, and surface area using standard formulas.	PO1, PO2, PO3, PSO1	U, Ap, An	C, P	7
CO3	Demonstrate logical and analytical thinking by solving problems on calendars, clocks, permutations and combinations, heights and distances, and numerical series.	PO1, PO2, PO3, PO6, PSO1, PSO2	Ap, An	C, P	15
Total hours of instruction					30

Mapping of COs with POs & PSOs

CO	PO										PSO	
	1	2	3	4	5	6	7	8	9	10	1	2
CO1	3	3	3	0	0	0	0	0	0	0	3	3
CO2	3	3	3	0	0	0	0	0	0	0	3	0
CO3	3	3	3	0	0	1	0	0	0	0	3	3

3: High, 2: Medium, 1: Low