ST. TERESA'S COLLEGE, ERNAKULAM

(AUTONOMOUS)

Affiliated to Mahatma Gandhi University, Kottayam

CURRICULUM FOR
BACHELOR'S PROGRAMME
IN CHEMISTRY

Under Choice Based Credit & Semester System
& Outcome Based Education

(2018 Admissions)

BCHE - B.Sc. CHEMISTRY

PROGRAMME SPECIFIC OUTCOMES

PSO1: Describe the major concepts and theoretical principles in Chemistry

PSO2: Solve problems using basic understandings in chemistry, physics and mathematics

PSO3: Apply scientific knowledge to design, perform, record and analyze experiments

PSO4: Develop communication skills to identify, investigate, formulate and transmit new ideas and concepts

PSO5: Develop analytical, creative, cognitive skills with social responsibility and environmental consciousness

SEMESTER I

Course Code	Course Title	Credits	Course Type
EN1A01B18	FINE-TUNE YOUR ENGLISH	4	Common Course I
EN1A02B18	PEARLS FROM THE DEEP	3	
MA1A01B18	KATHASAHITHYAM	4	Common Course II
HN1A01B18	KAHAANI AUR UPANYAS	4	
FR1A01B18	FRENCH LANGUAGE AND COMMUNICATIVE SKILLS -I	4	
MT1C01B18	DIFFERENTIAL AND INTEGRALCALCULUS	3	Complementary Course I
PH1C02B18	PROPERTIES OF MATTER & THERMODYNAMICS	2	Complementary Course II
CH1B01B18	GENERAL AND ANALYTICAL CHEMISTRY	2	Core course

SEMESTER I

COMMON COURSE I

EN1A01B18– FINE TUNE YOUR ENGLISH

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: Recognize the basics of English grammar

CO2: Choose the appropriate word classes

CO3: Identify common errors in the use of English language in various contexts

CO4: Apply the rules of grammar to comprehend, speak, and write grammatically correct English

CO5: Compose materials for business communication

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	3	2
CO3	1	1	1	2	2
CO4	1	1	1	3	2
CO5	1	1	1	2	2

Syllabus Content:

Module 1 **(18 Hours)**

The Sentence and its Structure

How to Write Effective Sentences – Phrases:What are They? – The Noun Clauses – The Adverb Clause – "If All the Trees Were Bread and Cheese" – The Relative Clause – How Clauses are Conjoined

Module 2 **(18 Hours)**

Word-Classes and Related Topics

Understanding the Verb – Understanding Auxiliary Verbs – Understanding Adverbs – Understanding Pronouns – The Reflexive Pronoun – The Articles I – The Articles II – The Adjective – Phrasal Verbs – Mind your Prepositions

Module 3 **(18 Hours)**

To Err is Human

Concord – Errors – Common and Uncommon

Spelling and Pronounciation

Pronunciation: Some Tips – More Tips on Pronunciation – An awesome Mess? – Spelling Part II

Module 4 **(18 Hours)**

Tense and Related Topics

'Presentness' and Present Tenses – The 'Presentness' of a Past Action – Futurity in English – Passivisation

Interrogatives and Negatives

Negatives – How to Frame Questions – What's What? – The Question Tag

Module 5 **(18 Hours)**

Conversational English

Some time expressions – Is John There Please?

Miscellaneous and General Topics

Reading

Letter Writing

In addition there will be an essay question on a general topic.

Learning Resources

Core Text : *Fine-tune Your English* by Dr. Mathew Joseph. Orient Blackswan and Mahatma Gandhi University

SEMESTER I

COMMON COURSE I

EN1A02B18– PEARLS FROM THE DEEP

Credits: 3

Total Lecture Hours: 72

Course Outcomes:

CO1: Name prominent literary figures and recognize various literary devices

CO2: Analyze inherent themes and motives

CO3: Identify the nuances of the age in which the literary work was written

CO4: Examine the different aspects of theatre

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	3	2
CO3	1	1	1	3	2
CO4	1	1	1	3	2

Syllabus Content:

Module 1 (Fiction) **(18hours)**

Ernest Hemingway: The Old Man and the Sea

Module 2 (One Act Plays) **(18hours)**

Susan Glaspell: Trifles

Asif Currimbhoy: The Refugee

A.A Milne: The Boy Comes Home

Module 3 (Short Stories) **(18hours)**

Guy De Maupassant: Two Friends

O. Henry: The Gift of Magi

K.A Abbas: Sparrows

Flora Annie Steel: Valiant Vicky, the Brave Weaver

Module 4 (Poems) (18hours)

Rumi: The Chance of Humming

Walter Scott: Lochinvar

John Keats: La Belle Dame Sans Mercy

Robert Frost: After Apple Picking

Chinua Achebe: Refugee Mother and Child

Kamala Das: My Grandmother's House

Ted Hughes: Jaguar

Pablo Neruda: Tonight I can Write the Saddest Lines

P.P Ramachandran: How Simple It Is!

Learning Resources

Core Text: *Pearls from the Deep*. Cambridge University Press and Mahatma Gandhi University

SEMESTER I

COMMON COURSE II

MA1A01B18 – കഥാസാഹിത്യം

Credits: 4

Total Lecture Hours: 72

Course Outcomes:

CO1: ചെറുകഥ, നോവൽ പഠനത്തിലൂടെ വായനാശേഷിയും ആസ്വാദനപ്രാപ്തിയും കൈവരിക്കൽ.

CO2:ചെറുകഥയുടെയും നോവലിന്റെയും കാലാനുസൃതമായ ഭാവുകത്വപരിണാമം തിരിച്ചറിയൽ.

CO3: നിലവിലുള്ളസാമൂഹ്യജീവിത യാഥാർഥ്യങ്ങളെ അഭിമുഖീകരിക്കാൻ പ്രാപ്തരാക്കൽ.

CO4: ആശയവിനിമയം, ഭാഷാവിഷ്കരണം എന്നീ ശേഷികൾ കൈവരിക്കുന്നു

CO5: കഥ,നോവൽ എന്നിവയുടെ വ്യതിരിക്ത സവിശേഷതകൾ തിരിച്ചറിയുന്നു.

CO6:പുതുകാലജീവിതാനുഭവങ്ങൾ വിലയിരുത്താൻ പര്യാപ്തരാകുന്നു

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	2	2
CO3	1	1	1	3	3
CO4	1	1	1	3	2
CO5	1	1	1	2	2
CO6	1	1	1	2	2

Syllabus Content:

ഖണ്ഡംഒന്ന്– 10 മണിക്കൂർ

1.പൂവമ്പഴം -കാരൂർ

2.ഭൂമിയുടെഅവകാശികൾ -വൈക്കംമുഹമ്മദ്ബഷീർ

ഖണ്ഡംരണ്ട് - 15മണിക്കൂർ

1.കടൽ -ടി .പദ്മനാഭൻ

2.പെരുമഴയുടെപിറ്റേന്ന് -എം. ടി. വാസുദേവൻനായർ

3.മാനാഞ്ചിറടെസ്റ്റ് -വി .കെ.എൻ

4.തരിശുനിലം -മാധവിക്കുട്ടി

ഖണ്ഡംമൂന്ന് - 15മണിക്കൂർ

1.ആർക്കറിയാം -സക്കറിയ

2.ഓരോഎഴുത്തുകാരിയുടെഉള്ളിലും -സാറാജോസഫ്

3.തിരുത്ത് -എൻ .എസ് .മാധവൻ

4.മോഹമഞ്ഞ -കെ .ആർ .മീര

ഖണ്ഡംനാല്-10 മണിക്കൂർ

1.അഗ്നി -സിതാര.എസ്

2.ബിരിയാണി -സന്തോഷ്എച്ചിക്കാനം

3.മോദസ്ഥിരനായി അങ്ങ് വസിപ്പൂമലപോലെ -എസ്. ഹരീഷ്

4.സ്നേഹബഹുമാനപെട്ടഅന്നാമ്മയ്ക്ക്ഗീതാലക്ഷ്മിഎഴുതുന്നകത്ത് -പ്രിയഎ .എസ്

5.ചിലസ്വപ്നങ്ങളിൽ .....സീതാലക്ഷ്മിയുടെകറുത്തമുടിയിഴ -ഇന്ദുമേനോൻ

ഖണ്ഡംഅഞ്ച് - 22മണിക്കൂർ

ആടുജീവിതം -ബന്യാമിൻ

സഹായകഗ്രന്ഥങ്ങൾ

1.ചെറുകഥഇന്നലെഇന്ന് -എം .അച്യുതൻ

2.ചെറുകഥാപ്രസ്ഥാനം -എം.പി. പോൾ

3.ചെറുകഥ വാക്കുംവഴിയും -ഡോ .കെ.എസ്.രവികുമാർ

4.നോവൽസാഹിത്യചരിത്രം -പ്രൊഫ.കെ.എം .തരകൻ

SEMESTER I

COMMON COURSE II

HN1A01B18- KAHAANI AUR UPANYAS

Credits: 4

Total Lecture Hours: 72

Course Outcomes:

CO1: Discuss story content and structure in depth.

CO2: Analyse characterisation and comment on the development of the characters as the story/ novel unfolds.

CO3: Analyse short stories and novels on the basis of literary elements like plot, theme, metaphor, and image.

CO4: Compare treatments of theme, character and subject matter of different short stories.

CO5: Illustrate greater reading fluency and improved vocabulary in Hindi.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	2	2
CO3	1	1	1	2	2
CO4	1	1	1	2	2
CO5	1	1	1	3	2

Syllabus Content:

Module I: (18 Hrs)

ANTHIM SAAKSHYA –CHANDRAKAANTA CHAPTERS 1 ,2

EIDGAAH- PREMCHAND

Module II: (20 hrs)

ANTHIM SAAKSHYA –CHANDRAKAANTA CHAPTERS 3, 4, 5 JANGAL KA DAAH- SWAYAM PRAKASH CHCHUTTI KA DIN- USHA PRIYAMVADA

Module III: (20 hrs)

ANTHIM SAAKSHYA –CHANDRAKAANTA CHAPTERS 6,7,8 MAA RASOI MEI REHTI HAI – KUMAR AMBUJ KHEER – MADHAVI KUTTY

Module IV: (16 hrs)

ANTHIM SAAKSHYA –CHANDRAKAANTA CHAPTERS 9, 10 HEELIBON KI BATHTHAKHE- AGYEY

SEMESTER I

COMMON COURSE II

FR1A01B18- FRENCH LANGUAGE AND COMMUNICATIVE SKILLS -I

Credits: 4

Total Lecture Hours: 72

Course Outcomes:

CO1: Describe topics such as family, professions, time, place, likes and dislikes, daily life situations.

CO2: Develop language, vocabulary and grammar skills.

CO3: Articulate various speech sounds and their determined combinations.

CO4: Prepare conversations based on scenarios which helps while traveling

CO5: Articulate the concepts to express one's opinion in a specific situation.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	3	2
CO3	1	1	1	3	2
CO4	1	1	1	2	2
CO5	1	1	1	3	2

Syllabus Content:

Module I : (25 hours)

La population L"alphabet – Les chiffres – Identité – Se présenter – Poser des questions – Les professions – Les nationalités

Module II : (23 hours)

La banlieue Demander une information, un prix – l"heure – la ville

Module III : (24 hours)

Quartier de Paris Décrire un lieu – Indiquer un prix, un itinéraire.

SEMESTER I

COMPLEMENTARY COURSE I

MT1C01B18– DIFFERENTIAL AND INTEGRAL CALCULUS

Credits: 3

Total Lecture Hours: 72

CO1: Evaluate the rate of change of functions using the definition of limit and the differentiation rules.

CO2: Apply the concept of differentiation to find the extreme values of a function and interpret the consequences of Rolle's theorem and Mean value theorem for differentiable functions.

CO3: Interpret the area under the curve as a definite integral and find the area between curves.

CO4: Apply integration to calculate lengths of plane curves, areas of surfaces of revolution and volumes by slicing and rotation about an axis.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	1	1	2
CO2	1	3	1	1	2
CO3	1	3	2	1	2
CO4	1	3	1	1	2

Syllabus Content:

Module 1 :Differential Calculus: (22 Hrs)

Rates of change and limits, calculating limits using the limit laws, the precise definition of a limit, one sided limits and limits at infinity, derivative of a function, differentiation rules, the derivative as a rate of change, derivatives of trigonometric functions, the chain rule and parametric equations, implicit differentiation.

Module 2: Applications of Derivatives: (15 Hrs)

Extreme values of functions, The Mean Value Theorem, Monotonic functions and the first derivative test.

Module 3 : Integral Calculus: (15 Hrs)

A quick review of indefinite integral as anti-derivative,The Definite integral, The fundamental theorem of Calculus

Module 4: Application of Integrals: (20Hrs)

Substitution and area between curves, Volumes by slicing and rotation about an axis (disc method only), Lengths of plane curves, Areas of surfaces of revolution and the theorem of Pappus (excluding theorem of Pappus).

SEMESTER I

COMPLEMENTARY COURSE I

PH1C02B18: PROPERTIES OF MATTER & THERMODYNAMICS

Credits: 2

Total Lecture Hours: 36

CO1: Apply static and dynamic methods to determine rigidity modulus and bending of beams to Young's modulus

CO2: Discuss the theory for the dynamics of fluid systems

CO3: Examine Carnot engine and refrigerator by applying second law of thermodynamics

CO4: Deduce Maxwell's thermodynamic relations from thermodynamic potentials

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	1	2
CO2	1	3	2	1	2
CO3	2	3	2	1	2
CO4	2	3	1	1	2

Syllabus Content:

Module I: Elasticity (13 hours)

Stress- strain- Hooke's law- Elastic moduli- Poisson's ratio- twisting couple determination of rigidity modulus- static and dynamic methods- static torsion- torsion pendulum, bending of beams- cantilever, uniform and non-uniform bending, I section girder.

Text Book :*Mechanics - D. S. Mathur- Revised by P. S. Hemne, S. Chand & Co., Chapters 13 & 14.*

Module II: Surface tension (3 hours)

Molecular theory of surface tension - surface energy - excess pressure in a liquid drop, factors affecting surface tension – applications

Text book:*Mechanics– Prof. D.S Mathur Revised by: Dr. P.S Hemne. , S Chand & Company Pvt. Ltd, chapter 15*

Hydrodynamics (7 hours)

Streamline and turbulent flow - critical velocity - Coefficient of viscosity - Derivation of Poiseuille's equation, Stokes equation-Determination of viscosity by Poiseuille's method-Brownian motion – Viscosity of gases – Bernoulli's theorem.

Text book: ***Properties of Matter- Brijlal and N. Subrahmaniam, S. Chand &Company Pvt. Ltd,1989, Chapter 8***

Module III: Thermodynamics (13 hours)

Thermodynamic systems- thermodynamic equilibrium- thermodynamic processes isothermal process- adiabatic process- zeroth law of thermodynamics, first law of thermodynamics- heat engine- the Carnot engine- refrigerator, concept of entropy second law of thermodynamics- third law of thermodynamics- Maxwell's thermodynamic relations.

Text Book ***: Heat and Thermodynamics, Brijlal and Subrahmanyam and P. S. Hemne, S. Chand & Co., Chapter 5 & 6***

SEMESTER I

CORE COURSE

CH1B01B18: GENERAL AND ANALYTICAL CHEMISTRY

Credits: 2

Total Lecture Hours: 36

Course Outcomes:

CO1: Compute the number of significant digits, mean and standard deviation, percentage and distribution of errors from a set of analytical data and the molecular mass, molarity, oxidation and reduction numbers, equivalent mass.

CO2: Explain the methodology of chemistry and the periodic properties of elements

CO3: Illustrate the principles of analytical chemistry in the intergroup separation of cations, methods of expressing concentration, quantification of analytes by titrimetry, gravimetry and separation of organic compounds

CO4: Differentiate between column chromatography, TLC, GC, Ion exchange chromatography and HPLC

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	2
CO2	3	2	2	1	1
CO3	3	2	3	1	2
CO4	3	2	2	1	1

Syllabus Content:

Module 1: Methodology of Chemistry and Evaluation of Analytical Data(12Hrs)

Definition of Science. Scientific methods - observation-posing a question - formulation of hypothesis- experiment – theory - law. Falsification of hypothesis - inductive and deductive reasoning- revision of scientific theories and laws.

Evolution of Chemistry-ancient speculation on the nature of matter. Early form of chemistry-alchemy, origin of modern chemistry. Structure of chemical science: Scope, theory and experiment - branches of chemistry. Role of chemistry as a central science connecting physics, biology and other branches of science. Interdisciplinary areas involving chemistry: Nanotechnology and biotechnology.

Evaluation of Analytical Data: Units, significant digits, rounding, scientific and prefix notation, graphing of data. Precision and accuracy-types of errors – ways of expressing precision – ways to reduce systematic errors - reporting analytical data. Statistical treatment of analytical data – population and samples –Mean and standard deviation – distribution of random errors.

Module II: Periodic Table and Properties (6 Hrs)

Modern periodic law – Long form periodic table. Diagonal relationship and anomalous behavior of first element in a group. Periodicity in properties: Atomic and ionic radii - ionization enthalpy - electron affinity (electron gain enthalpy) – electronegativity. Electronegativity scales: Pauling and Mullikan scales. Effective nuclear charge – Slater rule and its applications – polarising power.

Molecular mass - mole concept – molar volume. Oxidation and reduction – oxidation number and valency – variable valency - equivalent mass of oxidizing agent and reducing agent using oxidation number concept.

Module III : Analytical Methods in Chemistry (18 Hrs)

Qualitative analysis: Applications of solubility product and common ion effect in the precipitation of cations. Principle of intergroup separation of cations. Interfering acid radicals and their elimination (oxalate, fluoride, borate and phosphate).

Titrimetric analysis - fundamental concepts. Methods of expressing concentration: Weight percentage, molality, molarity, normality, mole fraction, ppm. and ppb. Primary and secondary standards, quantitative dilution – problems. Acid base titrations- titration curves – pH indicators. Redox titrations – titration curve –titrations involving MnO_4^- and $Cr_2O_7^{2-}$ - redox indicators. Complexometric titrations – EDTA titrations - titration curves – metal ion indicators. Gravimetric analysis: Unit operations in gravimetric analysis - illustrations using iron and barium estimation.

Separation and purification techniques – filtration, crystallization and precipitation – fractional distillation, solvent extraction.

Chromatographic Methods: Column Chromatography: Principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications. Thin Layer Chromatography: Principle, choice of adsorbent and solvent, preparation of Chromatoplates, Rf-values, significance of Rf values. Ion exchange chromatography: Principle and experimental techniques. Gas Chromatography: Principle and experimental techniques. High Performance Liquid Chromatography (HPLC): Principle and experimental techniques.

SEMESTER II

Course Code	Course Title	Credits	Course Type
EN2A03B18	ISSUES THAT MATTER	4	Common Course I
EN2A04B18	SAVOURING THE CLASSICS	3	
MA2A03B18	KAVITHA	4	Common Course II
HN2A03B18	KAVITHA VYAKARAN AUR ANUVAD	4	
FR2A03B18	FRENCH LANGUAGE AND COMMUNICATIVE SKILLS -II	4	
MT2C01B18	PARTIAL DERIVATIVES, MULTIPLE INTEGRALS TRIGONOMETRY AND MATRICES	3	Complementary Course I
PH2C02B18	MECHANICS AND CRYSTALLOGRAPHY	2	Complementary Course II
PH2CP02B18	PRACTICAL	2	Complementary Practical
CH2B02B18	THEORETICAL AND INORGANIC CHEMISTRY	2	Core course
CH2BP01B18	VOLUMETRIC ANALYSIS	2	Core Practical

SEMESTER II

COMMON COURSE I

EN2A03B18 - ISSUES THAT MATTER

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1. Identify the major issues of contemporary significance

CO2. Discuss the consequences of war and refugee crisis with respect to the psychological dimension

CO3. Employ theoretical learning in classrooms to current developments in the world

CO4. Critique the diverse experiences both historical and contemporary to create a more informed vision of the future

CO5. Develop oneself as a conscious, concerned, conscientious human being

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	3	2
CO3	1	1	1	1	2
CO4	1	1	1	2	2
CO5	1	1	1	1	2

Syllabus Content

Module 1 **(18 hours)**

"The Unsurrendered People" – Kenzaburo Oe

"The Old Prison" – Judith Wright

"War" – Luigi Pirandello

Module 2 **(18 hours)**

Persuasions on the Power of the Word:

"On Censorship" – Salman Rushdie

"Peril" – Toni Morrison

"The Burning of the Books" – Bertolt Brecht

"The Censors" – Luisa Valenzuela

Module 3 **(18 hours)**

"The Poisoned Bread" – Bandhu Madhav

"A Trip Westward" – Zitkala-Sa

"The Pot Maker" – Temsula Ao

Module 4 **(18 hours)**

"Does it Matter?" – Richard Leakey

"On Killing a Tree" – Gieve Patel

"Hagar: A Story of a Woman and Water" (Gift in Green (chapter 2)) – Sarah Joseph

Module 5 **(18 hours)**

"Understanding Refugeeism: An Introduction to Tibetan Refugees in India" – Mallica Mishra

"Refugee Blues" – W.H Auden

"The Child Goes to the Camp" (from Palestine's Children) – Ghassan Kanafani

SEMESTER II

COMMON COURSE I

EN2A04B18 – SAVOURING THE CLASSICS

Credits: 3

Total Lecture Hours: 72

Course Outcomes:

CO1: Recognise the time-tested literary masterpieces from diverse cultures

CO2: Identify the representative authors from various genres (poetry, drama, novel, short fiction)

CO3: Recite celebrated lines from Classic works

CO4: Discuss the 'universals' of human condition

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	1	2
CO3	1	1	1	3	2
CO4	1	1	1	3	2

Syllabus Content

Module 1 (Poems) **(18hours)**

Homer: "Father and Son" (Odyssey Book 16: 113-189) (Translated by Robert Fagles)

Kalidasa: "Lovely is Youth" (Translated by J.G Jennings)

Omar Khayyam: Rubaiyat (quatrains: 25-28) (Translated by Edward Fitzgerald)

Dante: Dante meets Virgil (Inferno Canto 1: 49-102) (Translated by J.G Nichols)

John Milton: "On his Blindness"

Module 2 (Shakespeare Excerpts) (18hours)

Romeo and Juliet: Act II, Scene ii

The Merchant of Venice: Act IV, Scene i

Module 3 (Novel Excerpts) (18hours)

Miguel de Cervantes: Don Quixote (Chapter 8) (Translated by Edith Grossman)

Jane Austen: Pride and Prejudice (Chapters 1-6)

Victor Hugo: Les Miserables (Part 1- Fantine, Book II, Chapters 9-13) (Translated by Christine Donougher)

Module 4 (Short Fiction) (18hours)

Charles Dickens: The Black Veil

Leo Tolstoy: How Much Land Does a Man Need? (Translated by Louise & Aulmer Maude)

Rabindranath Tagore: Kabuliwala (Translated by Mohammad A Quayum)

Jorge Louis Borges: The Shape of the Sword (Translated by Andrew Hurley)

സെമസ്റ്റർ രണ്ട്

കോമൺ കോഴ്സ് II- മലയാളം

MA2A03B18-കവിത

ക്രെഡിറ്റ് : 4

പഠനസമയം : 72 മണിക്കൂർ

കോഴ്സ് ഔട്ട്കം (Course Outcome)

CO1:പത്തൊൻപത് കവിതകളുടെ പഠനത്തിലൂടെ വായനാശേഷിയും ആസ്വാദന പ്രാപ്തിയും കൈവരിക്കൽ.

CO2:മലയാളകവിതകളിലെ കാലാനുസൃതമായ ഭാവുകത്വപരിണാമം തിരിച്ചറിയ.

CO3:നിലവിലുള്ള സാമൂഹ്യജീവിതയാഥാർഥ്യങ്ങളെ അഭിമുഖീകരിക്കാൻ പ്രാപ്തരാക്കൽ.

CO4:പരിസ്ഥിതികസൗന്ദര്യശാസ്ത്രത്തെയും ചില സാമൂഹ്യചരിത്ര പശ്ചാത്തലങ്ങളെയും കുറിച്ച് ഗ്രഹിക്കൽ.

CO5:വിദ്യാർത്ഥികളുടെ സർഗ്ഗാത്മകശേഷി വികസിക്കൽ .

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	3
CO2	1	1	1	2	3
CO3	1	1	1	1	3
CO4	1	1	1	1	3
CO5A	1	1	1	2	3

ഖണ്ഡം ഒന്ന്- 20 മണിക്കൂർ

1. **മാംസനിബദ്ധമല്ല രാഗം -കുമാരനാശാൻ (ലീലയിലെ 47 മുതൽ 74 വരെയുള്ള 28 ശ്ലോകങ്ങൾ)**

2.**സ്നേഹസുന്ദരപാതയിലൂടെ -വൈലോപ്പിള്ളി ('കുടിയൊഴിക്കലി'ലെ അവസാന ഖണ്ഡം)**

ഖണ്ഡം രണ്ട് **15 മണിക്കൂർ**

1 .ഒറ്റയ്ക്കിരിക്കാൻ പഠിച്ചുകഴിഞ്ഞു ഞാൻ -സുഗതകുമാരി

2 .കോഴി -കടമ്മനിട്ടരാമകൃഷ്ണപിള്ള

3 .പഴഞ്ചൊല്ലുകൾ -സച്ചിദാനന്ദൻ

4 .മുള്ളൻപന്നി -കെ.ജി.ശങ്കരപ്പിള്ള

ഖണ്ഡം മൂന്ന് **15 മണിക്കൂർ**

1.തിരുത്ത്-പി .പി.രാമചന്ദ്രൻ

2.പിറക്കാത്ത മകന് -ബാലചന്ദ്രൻ ചുള്ളിക്കാട്

3.മൃഗശിക്ഷകൻ -വിജയലക്ഷ്മി

4.കുന്നിമണികൾ-കുഞ്ഞുണ്ണി

ഖണ്ഡം നാല് **22 മണിക്കൂർ**

1 .ആടിയാടില അലഞ്ഞ മരങ്ങളേ -അൻവർ അലി

2 .കൽവീട് -വി.എം.ഗിരിജ

3 . ആഴങ്ങൾ അടച്ചിട്ട പുഴ -എസ് .ജോസഫ്

4 .സ്മാരകം -വീരാൻകുട്ടി

5 .കുട്ടമ്മാൻ -എം.ർ.രേണുകുമാർ

6 .നാഷണൽ ജ്യോഗ്രഫി -എസ് .കണ്ണൻ

7 .വാഴക്കുല -കെ .ആർ.ടോണി

8 .പഴയ ചിലത് -പി.രാമൻ

9 .ഗോതമ്പുശില്പം -കവിത ബാലകൃഷ്ണൻ

SEMESTER II

COMMON COURSE II

HN2AO3B18 - KAVITA, VYAKARAN AUR ANUVAD

Credits – 4

Total Hours- 72

Course Outcomes:

CO1: Contextualize and summarise the poems of different genres in Hindi

CO2: Evaluate the Poets contribution to Hindi literature

CO3: Demonstrate linguistic ability for translation of texts between Hindi & English

CO4: Classify Parts of Speech

CO5: Illustrate greater fluency in Hindi by applying theoretical knowledge of Grammar

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	3	3
CO2	1	1	1	2	3
CO3	1	1	1	3	2
CO4	1	1	1	3	3
CO5	1	1	1	3	2

Syllabus Contents

Module I **(18 Hours)**

Vyaakaran

Module II **(20 Hours)**

Tulasidas

Kabir

Ve Muskathe Phool Nahi- Mahadevi Verma

Cheenane Aaye Hain Ve – Sarweshvar Dayal Saxena

Dilli Darwaaza – Kumar Vimal

Jungle Ke Ujaad Mei – Vinod Kumar Shukla

Aazadi Urf Gulaami – Gyanendrapathi

Module III **(20 Hours)**

Meera

Bazaar- Mangalesh Dabraal

Beesvi Sadi Ke Antim Dino Ka Aashcharya- Rajesh Joshi

Do Haathiyon Ki Ladaai- Uda Pakash

Thande Paani Ki Machine – Ekant Srivastav

Saboot – Arun Kamal

Tumhe Kuch Karna Chahiye – Chanrakanth Devthale

Module IV **(14 Hours)**

Anuvaad

SEMESTER II

COMMON COURSE II

FR2A03B18- FRENCH LANGUAGE AND COMMUNICATIVE SKILLS -II

Credits: 4

Total Lecture Hours: 72

Course Outcomes:

CO1: Identify familiar everyday expressions and basic phrases.

CO2: Ask questions to get meaningful responses in effective communication.

CO3: Develop language, vocabulary and grammar skills.

CO4: Prepare conversations based on various situations

CO5: Articulate the concepts to express one's opinion in a specific situation.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	3	3
CO2	1	1	1	3	3
CO3	1	1	1	3	3
CO4	1	1	1	3	3
CO5	1	1	1	3	3

Syllabus Content:

Module I **(25 hours)**

Chambre pour étudiants Localiser des objets – l'habitat – les meubles – l'appréciation

Module II **(23 hours)**

Petits boulots Téléphoner – Raconter – l'emploi

Module III **(24 hours)**

Le resto U Exprimer une opinion – Poser des questions – la nourriture

SEMESTER II

COMPLEMENTARY COURSE I

MT2C01B18 - PARTIAL DERIVATIVES, MULTIPLE INTEGRALS, TRIGONOMETRY AND MATRICES

Credits: 2

Total Lecture Hours: 72

Course Outcomes

CO1 : Apply the multiple integrals to calculate quantities that vary over two and three dimensions.

CO2 : Illustrate the separation of Circular and hyperbolic functions of a complex variable function into real and imaginary parts and expansions of some trigonometric functions and employ C + iS method for the summation of an infinite series

CO3 : Calculate the Partial derivatives using the rules of differentiation. .

CO4 : Explain the properties of Matrices and employ the Matrix Algebra to solve a system of linear equations , determine the characteristic roots and characteristic vectors of a Matrix and illustrate the Cayley Hamilton theorem.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	1	2
CO2	1	3	1	1	2
CO3	1	3	1	1	2
CO4	1	3	1	1	2

Syllabus Content:

Module 1 Multiple Integrals: (17 Hours)

Double Integrals, area of bounded region in plane only, Double Integrals in Polar form, Triple integrals in rectangular co-ordinates, Volume of a region in space (As in Sections 15.1, 15.2, 15.3, 15.4 of Text 1)

Module 2 Trigonometry: (20Hours)

Expansions of functions like $\sin n\theta$, $\cos n\theta$, $\tan n\theta$, $\cos^n\theta$, hyperbolic functions, inverse circular and hyperbolic function. Separation into real and imaginary parts. Summation of infinite series based on C+iS method. (Geometric, Binomial, Exponential, Logarithmic and Trigonometric series)

(Relevant Sections in Chapter 3 to 5 and Chapter 8of Text 3)

Module 3 Partial Derivatives: (15 Hours)

Functions of several variables (Definition only), Partial derivatives, The Chain Rule (Sections 14.3 - 14.4 of Text 1)

Module 4 Matrices: (20Hours)

Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices, Row Canonical form, Normal form, Elementary matrices only.

Systems of Linear equations: System of non-homogeneous, solution using matrices, Cramer's rule, system of homogeneous equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton theorem (statement only) and simple applications

(Chapters – 5, 10, 19, 23 of text 2).

SEMESTER II

COMPLEMENTARY COURSE II

PH2C02B18- MECHANICS AND CRYSTALLOGRAPHY

Credits - 2

Total lecture hours - 36 hrs

Course Outcomes:

CO1: Articulate the motion under gravity and determine the acceleration due to gravity

CO2: Apply relevant theorems and strategies to determine the physical parameters related to rotational motion of bodies

CO3: Represent and solve equations of oscillatory motion of particles

CO4: Summarize different crystal systems and X-ray diffraction in crystals

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	3	1	2
CO2	1	3	1	1	2
CO3	1	3	1	1	2
CO4	1	3	3	1	2

Syllabus Content

Module I Motion under gravity (5 hours)

Velocity- acceleration- force – acceleration due to gravity - compound pendulum (symmetric and asymmetric) radius of gyration –centripetal acceleration and force - centrifugal force

Rotational dynamics (10 hours)

Angular velocity- angular momentum- torque- conservation of angular momentum angular acceleration- moment of inertia- parallel and perpendicular axes theorems moment of inertia of rod, ring, disc, cylinder and sphere- flywheel

Module II

Oscillations **(9 hours)**

Periodic and oscillatory motion- simple harmonic motion- differential equation, expression for displacement, velocity and acceleration- graphical representation- energy of a particle executing simple harmonic motion damped oscillation- forced oscillation and resonance.

Waves **(4 hours)**

Waves-classifications- progressive wave- energy of progressive wave- superposition of waves- theory of beats- Doppler effect.

Module III

Crystalline Solids **(8 hours)**

Crystalline and amorphous solids – crystal lattice and translation vectors – basis– unit cell – lattice parameters – crystal systems – crystal planes and directions –Miller indices – inter planar spacing – hcp, fcc, bcc, sc crystal structures –Bragg's law of X ray diffraction.

SEMESTER II

COMPLEMENTARY PRACTICAL

PH2CP02B18 - MECHANICS AND CRYSTALLOGRAPHY

Credit - 2

No. of hours: 72

Course Outcomes:

CO1: Apply the knowledge of basic concepts in Physics to identify and select appropriate measuring instruments.

CO2: Analyse basics experiments in Properties of Matter, Mechanics and construct diode circuits.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	3	1	2
CO2	1	3	3	1	2

Syllabus Content

1. Vernier Calipers - Volume of a cylinder- sphere and a beaker
2. Screw gauge - Volume of a sphere and a glass plate
3. Beam balance - Mass of a solid (sensibility method)
4. Radius of a capillary tube- Using (1) travelling microscope
5. Density of a liquid - U-Tube and Hare's apparatus
6. Viscosity of a liquid - Variable pressure head
7. Surface Tension – Capillary rise method.
8. Cantilever - Pin & Microscope – Determination of Young's Modulus
9. Symmetric Compound Pendulum-Determination of radius of gyration(K) and Acceleration due to gravity (g)

10. Spectrometer – Angle of the Prism.
11. Cantilever – Scale and Telescope-Determination of Young's modulus
12. Asymmetric Compound Pendulum-Determination of K and g
13. Coefficient of Viscosity – Constant pressure head
14. Spectrometer - Refractive Index of material of prism.
15. Liquid lens - Refractive Index of glass using liquid of known refractive index
16. Potentiometer-Calibration of low range voltmeter
17. Characteristics of Zener diode
18. Construction of half wave rectifier with and without filter – Ripple factor and Load regulation
19. Characteristics of p-n junction diode
20. Torsion pendulum - Rigidity modulus

SEMESTER - II

CORE COURSE

CH2B02B18: THEORETICAL AND INORGANIC CHEMISTRY

Credits - 2

Total Lecture Hours : 36

Course Outcomes

CO1: Apply the knowledge of atomic theories in recognizing the atomic spectra, wave particle dualities, Heisenberg's uncertainty principle and quantum numbers.

CO2: Explain the properties of s and p block elements, transition metals and lanthanides.

CO3: Explain the properties of ionic bond and ionic solids, calculation of lattice energy of ionic solids from Born-Lande equation and Born-Haber cycle, features of intermolecular forces and theories of metallic bond.

CO4: Illustrate the covalent bonding in molecules using Valence Bond Theory, Resonance concept, Hybridization, VSEPR theory and Molecular Orbital theory.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	1
CO2	3	2	2	1	1
CO3	3	2	2	1	1
CO4	3	3	2	1	1

Syllabus Content

Module 1: Atomic Structure **(6 Hrs)**

Introduction based on historical development (Dalton's atomic theory, Thomson's atom model Rutherford's atom model) - failure of classical physics – black body radiation - Planck's quantum hypothesis - photoelectric effect - generalization of quantum theory . Atomic spectra of hydrogen

and hydrogen like atoms– Bohr theory of atom – Calculation of Bohr radius, velocity and energy of an electron - explanation of atomic spectra - limitations of Bohr theory. Louis de Broglie's matter waves – wave-particle duality - electron diffraction - Heisenberg's uncertainty principle. Schrödinger wave equation (derivation not expected), wave functions – significance of ψ and ψ2 – atomic orbitals and concept of quantum numbers - shapes of orbitals (s, p and d) - Pauli's Exclusion principle - Hund's rule of maximum multiplicity - Aufbau principle – electronic configuration of atoms.

Module II : Chemistry of s, p, d & f Block Elements (10 Hrs)

s and p block: Periodicity in s-and p- block elements with respect to electronic configuration, atomic and ionic size, ionization energy and electro negativity. Inert pair effect.

Transition Metals: General characteristics: Metallic character, oxidation states, size, density, melting points, boiling points, ionization energy, colour, magnetic properties, reducing properties, catalytic properties, non-stoichiometric compounds, complex formation and alloy formation. Difference between first row and other two rows. Preparation, properties, structure and uses of KMnO4 and K2Cr2O7.

Lanthanides: Electronic configuration and general characteristics – Occurrence of lanthanides. Isolation of lanthanides from monazite sand - Separation by ion exchange method. Lanthanide contraction: Causes and consequences. Industrial importance of lanthanides.

Module III : Chemical Bonding (20 Hrs)

Introduction – Octet rule and its limitations. Types of bonds: Ionic bond - factors favouring the formation of ionic bonds - lattice energy of ionic compounds - Born- Lande equation with derivation - solvation enthalpy and solubility of ionic compounds – Born-Haber cycle and its applications – properties of ionic compounds - polarisation of ions – Fajan's rule and its applications.

Covalent Bond: Valence Bond Theory and its limitations. Concept of resonance - resonance

structures of borate, carbonate and nitrate ions. Hybridization: Definition and characteristics

– shape of molecules (BeCl2, C2H2, BF3, C2H4, CH4, PCl5, SF6 and IF7). VSEPR theory: Postulates - applications - shapes of molecules NH3, H2O, XeF2, IF5, and XeF6.

Properties of covalent compounds - polarity of bonds – percentage of ionic character – dipole moment and molecular structure.

Covalent Bond: Molecular Orbital Theory – LCAO - bonding and anti-bonding molecular orbitals – bond order and its significance. MO diagrams of homonuclear and heteronuclear diatomic molecules: H2, He2, Li2, Be2, B2, C2, N2, O2, F2, CO and NO – comparison of bond length, magnetic behavior and bond energy of O2, O2+, O22+, O2- and O22- . Metallic

Bond: free electron theory, valence bond theory and band theory (qualitative treatment only) - explanation of metallic properties based on these theories.

Intermolecular forces: Hydrogen bond - intra and inter molecular hydrogen bonds – effect on physical properties. Van der Waals forces, ion-dipole, dipole-dipole, ion-induced dipole, dipole-induced dipole and induced dipole-induced dipole interactions

SEMESTER I AND II
CORE CHEMISTRY PRACTICAL

CH2BP01B18 - VOLUMETRIC ANALYSIS

Credits: 2

Total Hours: 72

Course Outcomes:

CO1: Prepare standard solutions for microscale volumetric analysis.

CO2: Record the molarity of the given intermediate solution by standardizing it.

CO3: Calculate the mass of the analyte in a given solution by microscale volumetric analysis.

CO4: Administer microscale analysis of solutions by different types of volumetry like acidimetry, alkalimetry, complexometry, permanganometry, dichrometry, iodometry and iodimetry.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	1	2
CO2	2	3	3	1	2
CO3	2	3	3	1	2
CO4	2	3	3	1	2

Syllabus Content:

Micro Analysis

A. Acidimetry and Alkalimetry

1. Strong acid-Strong base
2. Strong acid – Weak base
3. Strong base – Weak acid
4. Estimation of $Na_2CO_3$and $NaHCO_3$ in a mixture
5. Estimation of NaOH and Na_2CO_3 in a mixture
6. Estimation of ammonia in ammonium salts by direct and indirect methods

B. Complexometric Titrations Using EDTA

1. Estimation of Zn
2. Estimation of Mg
3. Estimation of Mg and Ca in a mixture
4. Estimation of Ni
5. Determination of hardness of water

C. Oxidation – Reduction Titrations

(i) Permanganometry

1. Estimation of ferrous iron
2. Estimation of oxalic acid
3. Estimation of sodium oxalate
4. Estimation of calcium

(ii) Dichrometry

1. Estimation of ferrous iron using internal indicator
2. Estimation of ferrous iron using external indicator
3. Estimation of ferric iron using internal indicator
4. Estimation of ferric iron using external indicator

(iii) Iodimetry and Iodometry

1. Estimation of copper
2. Estimation of arsenious oxide

SEMESTER III

Course Code	Course Title	Credits	Course Type
EN3A05B18	LITERATURE AND/AS IDENTITY	4	Common Course I
MA3A05B18	DRISYAKALASAHITHYAM	4	Common Course II
HN3A05B18	NAATAK AUR LAMBI KAVITA	4	
FR3A05B18	AN ADVANCED COURSE IN FRENCH –I	4	
MT3C01B18	VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND ANALYTIC GEOMETRY	4	Complementary Course I
PH3C02B18	MODERN PHYSICS AND BASIC ELECTRONICS	3	Complementary Course II
CH3B03B18	ORGANIC CHEMISTRY – I	3	Core course

SEMESTER III

COMMON COURSE I

EN3A05B18 – LITERATURE AND/AS IDENTITY

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1. Explain how literature problematizes identity.

CO2. Analyze the quest for identity in the Indian diaspora.

CO3. Illustrate the effects of partition and communal violence in South Asian Literature.

CO4. Critique the social construction of identity.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	3
CO2	1	1	1	2	3
CO3	1	1	1	2	3
CO4	1	1	1	2	3

Syllabus Content

Module 1 (Diasporic Identities) **(18 hours)**

Agha Shahid Ali: Postcard from Kashmir

Amy Tan: Mother Tongue

Imtiaz Dharker: At the Lahore Karhai

Chitra Banerjee Divakaruni: Indian Movie, New Jersey

Module 2 (South Asian Identities) **(18 hours)**

Sadat Hassan Manto: The Dog of Tetwal

Intizar Hussain: A Chronicle of Peacocks

Selina Hossain: Fugitive Colours

Punakante Wijenaike: That Deep Silence

Module 3 (Life Writings) **(18 hours)**

Malcolm X: ―Nightmare, excerpt from *The Autobiography of Malcolm X*.

Sashi Deshpande: Learning to be a Mother in *Janani– Mothers, Daughters, Motherhood*, (Ed.) Rinki Bhattacharya.

Module 4 (Indigenous Identities **(18 hours)**

Leslie Marmon Silko: Lullaby

Garhwali Songs in *Painted Words- An Anthology of Tribal Literature* – Edited by G.N. Devy

Mamang Dai: Pinyar the Widow (Excerpt from Legends of Pensam)

Module 5 (Alter Identities) **(18 hours)**

Nathaniel Hawthorne: The Birth Mark

Girish Karnad: Hayavadana (Excerpt)

Ruskin Bond: The Girl on the Train

സെമസ്റ്റർ : മൂന്ന്

കോമൺ കോഴ്സ് II മലയാളം
MA3A05B18- ദൃശ്യകലാസാഹിത്യം

Credits: 4

Total Lecture hours: 90

പഠനനേട്ടങ്ങൾ (Course Outcomes)

CO1:കേരളീയരംഗകലാപാരമ്പര്യവും സംസ്കാരപരിണാമവും ചർച്ചചെയ്യുക

CO2:ദൃശ്യകലാപഠനത്തിലൂടെ കേരളീയസംസ്കാരപരിണാമം, ചരിത്രം എന്നിവ അപഗ്രഥിക്കുക

CO3:കഥാപാത്രപഠനത്തിലൂടെ സമകാലികവിഷയങ്ങളെ വിലയിരുത്തുക

CO4: ഇതിവൃത്ത പഠനത്തിലൂടെ കഥാപാത്രങ്ങളെ വിമർശനാത്മകമായി നിരൂപണം ചെയ്യുക

CO5:സമകാലികസംഭവങ്ങളെ അടിസ്ഥാനമാക്കി നാടകം, ഹ്രസ്വചിത്രം എന്നിവ തയാറാക്കുക.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	3
CO2	1	1	1	2	3
CO3	1	1	1	2	3
CO4	1	1	1	2	3
CO5	1	1	1	2	3

പാഠഭാഗങ്ങൾ

ഖണ്ഡം ഒന്ന് - സംസ്കൃത നാടകം **20 മണിക്കൂർ.**

മലയാളശാകുന്തളം നാലാമങ്കം - എ. ആർ രാജ രാജ വർമ

ഖണ്ഡം രണ്ട് - ആട്ടക്കഥ **15 മണിക്കൂർ**

നളചരിതം (ഒന്നാം ദിവസം) - ഉണ്ണായി വാര്യർ (തുടക്കം മുതൽ ഹംസം നളനിലുള്ള പ്രണയം ഉറപ്പിക്കുന്നത് വരെ)

ഖണ്ഡം മൂന്ന് - തുള്ളൽ **15 മണിക്കൂർ**

കല്യാണസൗഗന്ധികം (ശീതങ്കൻ തുള്ളൽ) - കുഞ്ചൻ നമ്പ്യാർ - (ഭീമൻറെ കദളീവന പ്രവേശം മുതൽ ശ്രീരാമ ദാസൻറെ വംശേ ജനിക്കയാൽ പാരം നിനക്കു മഹംഭാവമിങ്ങനെ' വരെ ഭാഗങ്ങൾ

ഖണ്ഡം നാല് - മലയാള നാടകം **20 മണിക്കൂർ**

1128 ൽ ക്രൈം 27 - സി. ജെ. തോമസ്

ഖണ്ഡം അഞ്ച്- സിനിമ **20 മണിക്കൂർ**

നിർമാല്യം തിരക്കഥ - എം. ടി . വാസുദേവൻ നായർ

SEMESTER III
COMMON COURSE II– HINDI
HN3AO5B18 - NAATAK AUR LAMBI KAVITHA

Credits – 4

Total Lecturer Hours - 90

Course Outcomes:

CO1: Summarise the poems and illustrate the socio-political and cultural concerns of the Author

CO2: Discuss the Authors contribution to Hindi Literature

CO3: Analyse the characterisation of the Drama Konark

CO4: Critique excerpts of the poems and Drama

CO5: Communicate in oral and written form of Hindi with competence.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	3	3
CO2	1	1	1	3	3
CO3	1	1	1	2	3
CO4	1	1	1	2	3
CO5	1	1	1	3	3

Syllabus Content

Module- I **22 Hours**

Syllabus- Konark Introduction & Act 1 (Jagdishchandra Mathur)

Module- II **24 Hours**

Syllabus- - Konark Act 2 & 3(Jagdishchandra Mathur)

Module- III **22 Hours**

Syllabus- Nagayi Mahura (Thrilochan)

Shahenshah Ki Neend (Umashankar Chaudhary)

Dhaaba- Nilesh Raghuvanshi

Module- IV **22 Hours**

Syllabus- Ithni Door Mat Bhyahna Baba- Nirmala Putul

Jawahar Tunnel – Agnishekhar

SEMESTER III

COMMON COURSE II

FR3A05B18- AN ADVANCED COURSE IN FRENCH - I

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: Describe topics such as physical appearance of a person, sports and entertainments.

CO2: Articulate the concepts to express one's opinion in a specific situation.

CO3: Compose conversations based on scenarios which help while shopping.

CO4: Articulate the concepts to give advice and instructions and to invite a person in a specific situation.

CO5: Construct conversations based on scenarios which help during medical and health consultations.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	3	2
CO2	1	1	1	3	2
CO3	1	1	1	3	2
CO4	1	1	1	2	3
CO5	1	1	1	3	2

Syllabus Content:

Module I **(30 hours)**

Jeunes artistes: Décrire une personne - Exprimer une opinion - La description physique - Les spectacles

Module II **(30 hours)**

Tenue de soirée : Inviter - Les vêtements - Les chaussures - Les couleurs - Les matières

Module III **(30 hours)**

Faites du sport ! : Donner des conseils - Les parties du corps - Les mouvements - Les sports

SEMESTER III

COMPLEMENTARY COURSE I

MT3C01B18-VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND ANALYTIC GEOMETRY

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: Analyze the path, velocity and acceleration of moving bodies using Vector Calculus

CO2: Apply line and surface integrals to calculate Circulation, flux and work done by vector fields and potential function of conservative fields.

CO3: Apply Green's, Stokes and Divergence theorems to calculate multiple integrals.

CO4: Explain different types of differential equations and solve first order differential equations.

CO5: Classify conic sections and deduce their equations and geometric properties

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	1	2
CO2	1	3	1	1	2
CO3	1	3	1	1	2
CO4	1	3	1	1	2
CO5	1	3	1	1	2

Syllabus Content:

Module 1

Vector valued Functions: **(15 Hrs)**

Vector Functions, Arc length and unit Tangent vector **T**, Curvature and unit Normal Vector **N**, Torsion and unit Binormal vector **B,** Directional Derivatives and Gradient Vectors**. (Sections** 13.1, 13.3, 13.4, 13.5 and 14.5 of text 2)

Module 2

Integration in Vector Fields: (25 Hrs)

Line Integrals, Vector fields and Work, Circulation and Flux, Path independence, Potential Function and Conservation Fields, Green's theorem in Plane (Statement and problems only), Surface area and Surface integral, Parameterised Surface, Stoke'stheorem(Statement and Problems only), the Divergence theorem and a Unified theory (Statement and simple problems only). (Sections 16.1 to 16.8 of text 2)

Module 3

Ordinary differential equations: (25Hrs)

Exact Differential Equation, Linear Equations , Solutions by Substitutions, Equations of first order and not of first degree , First order equations of higher Degree solvable for p , Equations solvable for y , Equations solvable for x, Equations of first degree in x and y , Lagrange's and Clairaut's Equation (sections 2.1 , 2.2 , 2.3 , 2.4 , 3.1 , 3.2 , 3.3 , 3.4 , 3.5 of text 1)

Module 4

Analytic Geometry: (25Hrs)

Conic sections and Quadratic equations, Classifying Conic Sections by Eccentricity, Conics and Parametric equations, The Cycloid, polar co-ordinates, Conic Sections in Polar coordinates. (Sections 10.1, 10.2, 10.4, 10.5, 10.8 of Text 2) (exclude the pedal Method and Newtonian Method)

SEMESTER III

COMPLEMENTARY COURSE II

PH3C02B18 - MODERN PHYSICS AND BASIC ELECTRONICS

Credits: 3

Total lecture hours - 54 hrs

Course Outcomes:

CO1: Discuss different atom models used to study spectroscopy and estimate the spectral characteristics

CO2: Discuss emergence of quantum mechanics and solve photoelectric equation, energy and uncertainties in position/momentum of a particle in a box

CO3: Construct rectifiers, voltage regulators and explain the characteristics of transistors

CO4: Explain the ground state properties of the nucleus and demonstrate different types of nuclear disintegrations and combination

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	2
CO2	3	3	2	1	2
CO3	2	3	3	1	2
CO4	2	3	1	1	2

Syllabus Content:

Module I **(16 hours)**

Atom models & Spectroscopy

Thomson's model - Rutherford's nuclear atom model (qualitative) - Bohr atom model – Bohr radius – total energy of the electron – Bohr's interpretation of Hydrogen atom- Sommerfeld's

relativistic atom model – elliptical orbits of Hydrogen (qualitative) – Sommerfeld's relativistic theory – fine structure of Hα line - Vector atom model – quantum numbers associated with vector atom model – coupling scheme (qualitative) - optical spectra – spectral terms – spectral notation – selection rules.

Molecular spectra – theory of origin of pure rotational spectra of rigid diatomic molecule - Raman effect – experimental study of Raman effect – quantum theory of Raman effect-- fluorescence and phosphorescence.

Module II **(12 hours)**

Quantum mechanics

Introduction – breakdown of classical physics – black body radiation and Planck's quantum hypothesis (qualitative) – photoelectric effect – Einstein's explanation of photoelectric effect – de Broglie hypothesis – matter wave – Davisson Germer experiment – uncertainty principle (derivation and application not required) - wave packet – wave function – properties of wave function – probabilistic interpretation of wave function – normalisation condition – time independent Schrödinger equation – particle in a box problem.

Module III **(11 hours)**

Basic Electronics

Energy bands in solids - conduction in solids – semiconductors - majority and minority charge carriers - intrinsic conduction. PN junction diodes – biasing - diode equation (derivation not required), diode parameters, diode ratings - diode characteristics – junction break down. Rectifiers - half wave, full wave and bridge rectifiers. Zener diode characteristics – voltage regulation. Bipolar junction transistors – biasing - transistor currents - transistor circuit configurations - common emitter configurations.

Module IV **(15 hours)**

Nuclear Physics

Classification of nuclei - general properties of nucleus - binding energy - nuclear stability - theories of nuclear composition - nuclear forces - magic numbers - natural radioactivity - alpha- beta & gamma rays - properties of alpha rays - properties of beta rays - properties of gamma rays-

fundamental laws of radioactivity – Soddy Fajan's displacement law - law of radioactive disintegration – half life - mean life - units of radioactivity - law of successive disintegration - radioactive dating.

Nuclear Fission & Fusion **(7 hrs)**

Nuclear fission- Energy released in fission- Chain reaction- Atom bomb- Nuclear reactors - Nuclear Fusion- Source of stellar energy- Thermonuclear reactions- Transuranic elements

SEMESTER III

CORE COURSE

CH3B03B18: ORGANIC CHEMISTRY – I

Credits – 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Summarize the types of reagents and reactive intermediates, electronic displacement effects and reaction mechanisms in organic chemistry.

CO2: Apply the knowledge of isomerism in predicting the nomenclature and stability of organic molecules.

CO3: Generalize the preparation, properties and uses of alkanes, alkenes, alkynes, alkyl halides and aryl halides.

CO4: Predict the aromaticity and reactivity of aromatic compounds towards Electrophilic substitution reactions.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	1	1
CO2	3	3	2	1	2
CO3	3	2	2	1	1
CO4	3	3	2	1	2

Syllabus Content:

Module 1: Fundamentals of Organic Chemistry **(12 Hrs)**

Classification and IUPAC system of nomenclature of common organic compounds (both aliphatic and aromatic). Line diagram drawing. Factors affecting reaction mechanism. Polarity of bonds.

Electronic displacements: Inductive effect, electromeric effect, mesomeric effect, resonance and hyperconjugation. steric effects.

Cleavage of bonds: Homolysis and heterolysis with suitable examples. curly arrow rules, formal charges. *Types of reagents*: Nucleophiles and electrophiles. *Reactive intermediates*: Carbocations, carbanions, free radicals and carbenes – types, shape and relative stability. *Types of organic reactions*: Addition, elimination, substitution, rearrangement and redox reactions (definition and one example each). *Pericyclic Reactions*: Classification – electrocyclic reactions, cycloadditions - Diels-Alder reaction and Sigmatropic rearrangements - Claisen rearrangement (with mechanism).

Module II : Stereochemistry (15 Hrs)

Stereoisomerism – definition, classification.

Optical isomerism: Optical activity, specific rotation, concept of chirality (upto two carbon atoms). Configuration. Enantiomerism, diastereomerism and meso compounds. Racemic mixture and methods of resolution. Asymmetric synthesis (partial and absolute). Threo and erythro; *d* and *l* designations; Cahn-Ingold-Prelog rules: R/ S notation (for upto 2 chiral carbon atoms).

Geometrical isomerism: cis–trans, *syn-anti* and E/Z nomenclature (for upto two C=C systems) with C.I.P rules. Methods of distinguishing geometrical isomers.

Conformational analysis: Conformational analysis with respect to ethane, butane and cyclohexane. Relative stability and energy diagrams. Interconversion of Wedge formula, Newman, Sawhorse and Fischer projection formulae. Chair, boat and twist boat forms of cyclohexane with energy diagrams. Conformation of methyl cyclohexane. Origin of ring strain in cyclic systems. Baeyer's strain theory.

Module III: Aliphatic Hydrocarbons and Alkyl Halides (12 Hrs)

Alkanes: Preparation - catalytic hydrogenation, Wurtz reaction, Wurtz-Fittig reaction, from Grignard reagent. Reactions - free radical substitution - halogenation. *Alkenes:* Preparation - Elimination reactions - mechanism of E1 and E2 reactions. Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's and Hofmann's rules). Reactions - *cis*-addition

(alkaline $KMnO_4$) and *trans*-addition (bromine). Addition of HX (Markownikoff's and anti-Markownikoff's addition with mechanisms), Hydration, Ozonolysis.

Alkynes: Preparation - Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides. Reactions - Acidity of alkynes, formation of metal acetylides, alkylation of terminal alkynes and conversion into higher alkynes, addition of bromine and alkaline $KMnO_4$.

Alkyl Halides: Preparation - From alkenes and alcohols. Reactions - Types of aliphatic nucleophilic substitution reactions - $S_N^1$and S_N^2 mechanisms with stereochemical aspects and effects of substrate structure, solvent, nucleophile and leaving group.

Organometallic compounds of Mg (*Grignard reagents*) – Formation, structure and important reactions/synthetic applications.

Module IV: Aromatic Hydrocarbons and Aryl Halides (15 Hrs)

Aromaticity : Definition, Hückel's rule - application to benzenoid (benzene, naphthalene and anthracene) and non-benzenoid (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation) compounds.

Benzene: Molecular orbital picture and resonance energy. Preparation - from phenol, by decarboxylation, from acetylene, from aromatic acids. Reactions - Electrophilic aromatic substitution: nitration, halogenation, sulphonation and Friedel-Craft's reaction (alkylation and acylation) with their mechanism.

Orientation of aromatic substitution. *ortho, para* and *meta* directing effects of groups. Ring activating and deactivating groups with examples.

Naphthalene and Anthracene: Molecular orbital picture and resonance energy. Preparation (of Naphthalene): Haworth synthesis, Reactions - Electrophilic substitutions (halogenation, nitration and sulphonation) of naphthalene.

Aryl Halides: Preparation - chloro, bromo and iodo-benzene from phenol, Sandmeyer and Gattermann reactions. Reactions - aromatic nucleophilic substitutions – bimolecular displacement mechanism, elimination-addition (benzyne intermediate) mechanism.

SEMESTER IV

Course Code	Course Title	Credits	Course Type
EN4A06B18	ILLUMINATIONS	4	Common Course I
MA4A06B18	MALAYALA GADHYARACHANAKAL	4	Common Course II
HN4A06B18	GADYA AUR EKANKI	4	
FR4A06B18	AN ADVANCED COURSE IN FRENCH –II	4	
MT4C01B18	FOURIER SERIES , PARTIAL DIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS AND ABSTRACT ALGEBRA	4	Complementary Course I
PH4C02B18	PHYSICAL OPTICS , LASER PHYSICS AND SUPERCONDUCTIVITY	3	Complementary Course II
PH4CP02B18	PRACTICAL	2	Complementary Practical
CH4B04B18	ORGANIC CHEMISTRY – II	3	Core course
CH4BP02B18	QUALITATIVE ORGANIC ANALYSIS	2	Core Practical

SEMESTER IV

COMMON COURSE VI

EN4A06B18 – ILLUMINATIONS

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: Discover life lessons through the study of life sketches

CO2: Explain multiple perspectives of life from the viewpoint of great minds

CO3: Apply the language skills acquired in academic and non-academic contexts

CO4: Analyze creative texts with a special focus on human emotions and the spirit of survival

CO5: Critique the conventional notions of happiness, courage and failure

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	2	1
CO3	1	1	1	3	3
CO4	1	1	1	3	3
CO5	1	1	1	3	3

Syllabus Content

Module 1- Life Sketches (18 hours)

Helen Keller: Three Days to See

Jesse Owens: My Greatest Olympic Prize

Thus Spoke Sudarshan: An Interview with God's Own Physicist Compiled from E C G Sudarshan's interviews

Module 2- Essays (18 hours)

Stephen Leacock: Are the Rich Happy?

A.G. Gardiner: On Courage

Module 3- Speeches (18 hours)

Lafcadio Hearn: On Reading

J.K. Rowling: The fringe benefits of failure and the importance of imagination

Chimamanda Ngozi Adichie: An Ode to Makeup

Module 4- Short Stories (18 hours)

Oscar Wilde: The Nightingale and the Rose

George Orwell: Roucolle, the Miser

John Galsworthy: Quality

Alice Walker: Everyday Use

Module 5- Poems (18 hours)

William Ernest Henley: Invictus

Robert Frost: The Road Not Taken

Kahlil Gibran: Of Good and Evil

Maya Angelou: Still I Rise

SEMESTER IV

COMMON COURSE II

MA4A06B18 - മലയാള ഗദ്യരചനകൾ

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: മലയാള ഗദ്യസാഹിത്യത്തിലെ സമകാലിക വിഷയങ്ങൾ ചർച്ച ചെയ്യുക

CO2: കേരളീയസംസ്കാര - കലാപരിണാമം , ചരിത്രം, ആത്മകഥ എന്നിവ അപഗ്രഥിക്കുക

CO3: ഗദ്യപാഠങ്ങളിലൂടെ സമകാലികവിഷയങ്ങളെ വിലയിരുത്തുക

CO4: സമകാലിക സാമൂഹിക വിഷയങ്ങളെ വിമർശനാത്മകമായി നിരൂപണംചെയ്യുക

CO5: വിവിധ വിഷയങ്ങളെ ആസ്പദമാക്കി ലേഖനങ്ങൾ തയാറാക്കുക. സ്വാനുഭവങ്ങൾ വിവിധ ആഖ്യാന രൂപങ്ങളിലൂടെ ആവിഷ്കരിക്കുക

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	2
CO2	1	1	1	3	2
CO3	1	1	1	3	3
CO4	1	1	1	3	3
CO5	1	1	1	3	3

പാഠഭാഗങ്ങൾ

പുസ്തകങ്ങൾ : ഗദ്യാരാമം , ഓർമ്മകൾ ചന്ദനഗന്ധം പോലെ

ഖണ്ഡം ഒന്ന് **15 മണിക്കൂർ**

1. കാളിദാസനും കാലത്തിൻറെ ദാസൻ - ജോസഫ് മുണ്ടശ്ശേരി
2. മേഘസന്ദേശവിവർത്തനങ്ങൾ - ഡോ. എൻ .അജയകുമാർ

3. മാതൃഭാഷയിലേക്കു വീണ്ടും - എൻ .വി . കൃഷ്ണവാര്യർ

ഖണ്ഡം രണ്ട് **20 മണിക്കൂർ**

1. വാക്കുകളുടെ വിസ്മയം - എം .ടി.വാസുദേവൻനായർ
2. മാറുന്ന മലയാള സംസാരഭാഷ - ടി .ബി .വേണുഗോപാലപ്പണിക്കർ
3. നമ്മുടെ അടുക്കള തിരിച്ചുപിടിക്കുക - സാറാ ജോസഫ്
4. കലയും കലാദർശനവും - ഡോ. ജെ . ഉണ്ണികൃഷ്ണപിള്ള

ഖണ്ഡം മൂന്ന് **15 മണിക്കൂർ**

1. ചെമ്പൈ വൈദ്യനാഥ ഭാഗവതർ സംഗീതത്തിലെ സിംഹനാദം - ഇന്ദിരാമേനോൻ
2. ഈശ്വരപിള്ളയെ ആരോർക്കുന്നു - പി. കെ . രാജശേഖരൻ
3. രവിവർമ്മ - വിജയകുമാർ മേനോൻ

ഖണ്ഡം നാല് **15 മണിക്കൂർ**

1. പ്രകാശത്തിൻറെ ആയിരം തടവറകൾ - ജീവൻ ജോബ് തോമസ്
2. ജനാധിപത്യ വിദ്യാഭാസം ചില ചിന്തകൾ - ഡോ. കെ .എൻ. പണിക്കർ
3. ഞങ്ങൾ നിങ്ങൾക്ക് ഭൂമി വിറ്റാൽ - സിയാറ്റിൽ മൂപ്പൻ

ഖണ്ഡം അഞ്ച് **25 മണിക്കൂർ**

1. ഓർമ്മകൾ ചന്ദനഗന്ധം പോലെ - ബി. സരസ്വതിയമ്മ

SEMESTER IV

COMMON COURSE II

HN4AO6B18 - GADYA AUR EKAANKI

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: Discuss the authors contribution to Hindi Literature

CO2: Summarise the central theme and other relevant details of all literary works

CO3: Illustrate the socio-political and cultural concerns of the Author

CO4: Critique excerpts of the Prose and One Act Plays

CO5: Communicate in oral and written form of Hindi with competence

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	2	1
CO2	1	1	1	2	2
CO3	1	1	1	3	3
CO4	1	1	1	3	2
CO5	1	1	1	3	2

Syllabus Content:

Module- I **(22hrs)**

1. Aaiye hum vriksh devta ki aaradhana karen- Dr. Kishorilal vyas
2. Raajniti ka batvaara- Harishankar parsai
3. Deep daan – Ramkumar verma

Module- II **(24hrs)**

4. Himachadit uttung shikhar aur dhuli hariyali – Vijay kumar sandesh
5. Kaphan chor ka beta – Ushabaala
6. Bahu ki vida- Vinod rastogi

Module- III **(22hr)**

7. Jab mai fail hua- Ramkumar Verma
8. Jaan se pyare – Mamta Kaaliya
9. Sati – G.K. Harjeeth

Module- IV **(22hrs)**

10. Jab intizar hussain apni janmabhoomi laute – Azhar vajahat
11. Hari ghaas par ghante bhar – Surendra verma

SEMESTER IV

COMMON COURSE II

FR4A06B18 AN ADVANCED COURSE IN FRENCH II

Credits: 4

Total Lecture Hours: 90 hours

Course Outcomes:

CO1: Develop language, vocabulary and grammar skills

CO2: Prepare conversations based on various situations and speak about them

CO3: Articulate the concepts to express one's opinion in a specific situation

CO4: Ask questions to get meaningful responses in effective communication

CO5: Describe events or topics based on various daily life situations such as persons, family, time schedules, visiting countries

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	3	2
CO2	1	1	1	3	3
CO3	1	1	1	3	3
CO4	1	1	1	2	2
CO5	1	1	1	2	2

Syllabus Content:

Module I : En voiture Proposer – Accepter – Refuser – Faire des projets- Les routes – La voiture **(30 Hours)**

Module II : Sur la route Exprimer l'obligation/ L'interdiction – La météo– Le temps **(30 Hours)**

Module III : Raconter un emploi du temps Se justifier – Le tourisme - Les pays et les continents **(30 Hours)**

SEMESTER IV

COMPLEMENTARY COURSE

MT4C01B18- FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS AND ABSTRACT ALGEBRA

Credits: 4

Total Lecture Hours: 90

Course Outcomes:

CO1: Compute the Fourier Series of a periodic function

CO2 : Estimate the solutions of Legendre and Bessel's differential equations using the power series method

CO3: Distinguish between ordinary & partial differential equations and calculate their solutions using different methods

CO4 : Determine the roots of algebraic and transcendental equations using various numerical methods

CO5: Explain the properties of algebraic structures - groups, rings, fields and vector spaces

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	1	2
CO2	2	3	2	1	2
CO3	2	3	2	1	2
CO4	2	3	2	1	2
CO5	2	3	3	1	2

Syllabus Content:

Module 1

Special Functions: (25 Hours)

Fourier Series : Periodic Functions, Trigonometric Series, Functions of any period p = 2L Fourier Series, Even and Odd functions, Half-range Expansions.

Legendre Polynomials –A brief introduction to power series and power series method solving Differential equations. Legendre equation and Legendre Polynomials , Rodrigues' Formula, Bessel's Equation .Bessel's Functions

Module 2 **(15 Hours)**

Partial Differential Equations: Surfaces and Curves in three dimensions, solution of equation of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$

Origin of first order and second order partial differential equations, Linear equations of the first order, Lagrange's method.

Module 3 **(25 Hours)**

Numerical Analysis: (Use of Non-Programmable Scientific Calculator is Permitted) Bisection Method, Methods of false position, Iteration Method, Acceleration of convergence: Aitken's Δ^2 Process, Newton Raphson Method, the quotient – Difference method.

Module 4 **(25 Hours)**

Abstract algebra: Groups, Subgroups, Cyclic groups, Groups of Permutations and Homomorphisms, Rings and Fields , Vector Spaces. (Theorems Statement only. Omit Proofs)

SEMESTER IV

COMPLEMENTARY COURSE

PH4C01B18: PHYSICAL OPTICS, LASER PHYSICS AND SUPERCONDUCTIVITY

Credits: 3

Total lecture hours - 54

Course Outcomes:

CO1: Interpret interference of light in thin film, diffraction at straight edge and in grating

CO2: Explain different types of polarised light and compute thickness of retardation plates

CO3: Examine basic principles of lasers, holography and Fiber Optic communication

CO4: Examine the behaviour of dielectrics in the presence of electric field

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	1	2
CO2	2	3	3	1	2
CO3	2	3	3	1	2
CO4	2	3	3	1	2

Syllabus Content:

Module I **(20 hours)**

Interference (12 hrs)

Interference of light - Principle of superposition - conditions for maximum and minimum intensities - coherent sources - Interference by division of wave front and division of amplitude - Young's double slit experiment (division of wave front) – Expression for fringe width - Newton's

rings by reflected light (division of amplitude) - measurement of wavelength of sodium light by Newton's rings - interference in thin films.

Diffraction (8 hrs)

Introduction – Difference between Interference and diffraction - Fresnel and Fraunhofer diffraction - Fresnel Diffraction at a straight edge - Theory of plane transmission grating - Determination of wavelength (normal incidence) – resolving power - dispersive power.

Module II (10 hours)

Polarization (12 hrs)

Polarization - preferential direction in a wave - polarized light - natural light - production of linearly polarized light – polarization by reflection – Brewster's law - polarization by double refraction – calcite crystal – optic axis – principal section – positive and negative crystals – Huygen's explanation of double refraction - phase difference between O and E rays – types of polarization – retardation plates (only half wave plate and quarter wave – Nicol prism – Malus's law.

Module III (22 hours)

Lasers (10 hours)

Interaction of light and matter - quantum behavior of light - energy levels – population - thermal equilibrium - absorption and emission of light - the three processes - Einstein relation - condition for large stimulated emissions - condition for light amplification - population inversion – pumping - active medium - metastable state - pumping schemes - solid state lasers – ruby laser &yag laser - gas laser – helium-neon laser - applications (basic ideas).

Holography (2 hours)

Holography –introduction – principle- method-advantages and applications

Fibre optics(5 hours)

Introduction-optical fibre-critical angle of propogation-acceptance angle-types of optical fibres-single mode –multimode-graded index fibre-fibre optic communication system.

Superconductivity (5 hours)

Super conducting phenomenon- Occurrence- BCS theory (qualitative) Meissner Effect- Type I and Type II superconductors- Josephson effects (qualitative) - High temperature superconductors- Applications of Superconductivity.

SEMESTER IV

COMPLEMENTARY COURSE - PHYSICS PRACTICAL

PH4CP02B18: PHYSICAL OPTICS, LASER PHYSICS AND SUPERCONDUCTIVITY

Credit: 2

Total lecture hours - 72

Course Outcomes:

CO1: Interpret general experiments in elasticity and magnetism

CO2: Construct rectifiers, logic gates, amplifiers and analyse transistor characteristics, Potentiometer and Carey Foster's Bridge

CO3: Determine wavelength of light source, refractive index of material and dispersive power

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	1	2
CO2	2	3	3	1	2
CO3	2	3	3	1	2

Syllabus Content

1. Non-uniform bending-Young's modulus-Pin and Microscope method
2. Field along the axis of circular coil- Variation of magnetic field and determination of B_H
3. Carey Foster's Bridge - Measurement of resistivity
4. Liquid lens - Refractive index of liquid
5. Searle's vibration Magnetometer-magnetic moment
6. Tangent Galvanometer – Ammeter calibration
7. Spectrometer – Prism – Dispersive power

8. Potentiometer-Calibration of low range ammeter
9. Construction of full wave rectifier with and without filter – Ripple factor and Load regulation
10. Construction of regulated power supply using Zener diode
11. Uniform bending – Young's modulus-Optic lever method
12. Torsion pendulum (Equal mass method) - Rigidity modulus and Moment of Inertia
13. Fly wheel - Moment of Inertia
14. Static Torsion - Rigidity modulus
15. Spectrometer - Grating Dispersive power
16. Newton's rings - Wave length
17. Deflection and Vibration Magnetometer- m & Bh
18. Conversion of Galvanometer into voltmeter
19. Transistor characteristics- CE configuration
20. Gates – AND - OR- NOT- verification of truth table
21. Construction of CE amplifier – gain

SEMESTER IV

CORE COURSE

CH4B04B18: ORGANIC CHEMISTRY – II

Credits – 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Illustrate the preparation, properties and reactions with mechanism of alcohols, phenols, ethers and epoxides

CO2: Summarize the preparation, properties and reactions with mechanism of aldehydes and ketones

CO3: Generalize the preparation, reactions and uses of carboxylic acids, sulphonic acids and their derivatives

CO4: Apply the knowledge of functional group chemistry in intergroup conversion and identification of products with mechanism

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2
CO2	3	2	2	1	2
CO3	3	2	2	1	2
CO4	3	3	3	1	2

Syllabus Content:

Module I : Alcohols, Phenols and Ethers **(16 Hours)**

Alcohols: Preparation - 1 , 2 and 3 alcohols using Grignard reagent, ester hydrolysis, reduction of aldehydes, ketones, carboxylic acids and esters (Bouveault-Blanc reduction). Reactions - with sodium, HX (Lucas test), esterification, oxidation (with PCC, alkaline $KMnO_4$, OsO_4, acidic dichromate, conc. HNO_3). Oppenauer oxidation (with mechanism).

Ascent and descent of alcohol series.

Diols: Preparation - hydroxylation of alkenes, hydrolysis of epoxides. Reactions - oxidative cleavage of diols using lead tetraacetate and periodic acid. Pinacol - Pinacolone rearrangement (with mechanism).

Phenols: Preparation -cumene hydroperoxide method, from diazonium salts. Reactions - Electrophilic substitution - nitration, halogenation and sulphonation. Reimer- Tiemann reaction and Fries rearrangement (with mechanisms). Preparation and uses of nitrophenols, picric acid, resorcinol and quinol.

Ethers and Epoxides: Preparation - ethers and epoxides - Williamson's ether synthesis.

Reactions of ethers - cleavage with HI. Zeisel's method of estimation of alkoxy groups.

Reactions of epoxides - with alcohols, ammonia derivatives and $LiAlH_4$.

Module II : Aldehydes and Ketones (20 Hours)

Preparation, properties and reactions of formaldehye, acetaldehyde, acetone, benzaldehyde and benzophenone.

Preparation - from alcohols, acid chlorides, esters and nitriles. Reactions - Structure of the carbonyl group and acidity of α-hydrogen.

(i) Additions reactions - with HCN, ROH, $NaHSO_3$, Grignard reagents and ammonia derivatives.

Aldol, Claisen, Claisen-Schmidt, Knoevenagel and Benzoin condensations (with mechanisms). Cannizzaro reaction, Wittig reaction and Mannich reaction (with mechanisms). Michael addition (with mechanism) (ii) Oxidation reactions - Tollen's and Fehling's tests, Iodoform test, Baeyer-Villiger oxidation (with mechanism) (iii) Reduction reactions - Clemmensen, Wolff-Kishner, Meerwein-Pondorff-Verley, $LiAlH_4$, and $NaBH_4$ reductions (with mechanisms) (iv) Rearrangement reactions - Beckmann, and benzil-benzilic acid rearrangements (with mechanisms).

Module III : Carboxylic Acids, Sulphonic Acids and their Derivatives (12 Hours)

Carboxylic acids (aliphatic and aromatic): Preparation - Oxidation of alcohols and aldehydes, hydrolysis of nitriles, side chain oxidation and carbonylation of grignard reagents. Acidic and

alkaline hydrolysis of esters. Reactions - structure of carboxylate ion, effect of substituents on acid strength. Ascent and descent of acid series. Reduction and decarboxylation reactions. Reactions with PCl_5, PCl_3 and $SOCl_2$. Reaction with ammonia, esterification and halogentaion. Hell – Volhard - Zelinsky reaction (with mechanism).

Carboxylic acid derivatives (aliphatic): Preparation - acid chlorides, anhydrides, esters and amides from acids. Reactions - comparative study of nucleophilicity of acyl derivatives. Perkin condensation and Reformatsky reaction (with mechanisms).

Sulphonic acids and their derivatives: Preparation, reactions and uses of benzene sulphonic acid, benzene sulphonyl chloride and *ortho*- and *para*- toluene sulphonyl chlorides.

Module IV : Dicarboxylic acids and unsaturated acids (6 Hours)

Methods of formation, important reactions and uses of dicarboxylic acids, hydroxy acids and unsaturated acids like oxalic acid, phthalic acid, citric acid, salicylic acid, cinnamic acid, maleic acid and fumaric acid.

SEMESTER III AND IV

CORE CHEMISTRY PRACTICAL

CH4BP02B18: QUALITATIVE ORGANIC ANALYSIS (micro)

Credits: 2

Total Lecture Hours: 72

Course Outcomes:

CO1: Record the physical constants of solid and liquid organic compounds

CO2: Determine the heteroatoms present in an organic compound

CO3: Determine the functional groups present in an organic compound

CO4: Prepare a solid derivative of the analyzed organic compound

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2
CO2	3	3	3	1	1
CO3	3	3	3	1	1
CO4	3	3	3	1	1

Syllabus Content:

1. Determination of physical constants of solids and liquids – melting and boiling points.
2. Tests for elements: Nitrogen, Halogens and Sulphur
3. Tests for unsaturation.
4. Tests for aromatic character.
5. Study of the reactions of the following functional groups: carboxylic acid, 1,2-dicarboxylic acid, phenol, aldehyde, ketone, ester, reducing and nonreducing sugars, polynuclear hydrocarbon, primary, secondary and tertiary amines, amides, diamide, nitro and halogen compounds.
6. Systematic analysis and preparation of solid derivative of the following organic compounds: carboxylic acid, 1,2-dicarboxylic acid, unsaturated acids, phenol, hydroxy

acids, aldehyde, ketone, ester, reducing and nonreducing sugars, polynuclear hydrocarbon, primary, secondary and tertiary amines, amide, diamide, nitro and halogen compounds.

(Minimum twelve compounds to be analysed)

SEMESTER – V

Course Code	Course Title	Credits	Course Type
CH5BO5B18	ENVIRONMENTAL STUDIES AND HUMAN RIGHTS	4	Core course
CH5BO6B18	ORGANIC CHEMISTRY - III	3	
CH5BO7B18	PHYSICAL CHEMISTRY - I	2	
CH5BO8B18	PHYSICAL CHEMISTRY – II	3	
CH5D01aB18	CHEMISTRY IN EVERYDAY LIFE	3	Open Course
CH5D01aB18	NANOSCIENCE AND NANATECHNOLOGY	3	Open Course
CH5D01aB18	FORENSIC SCIENCE	3	Open Course

SEMESTER V

CORE COURSE

CH5BO5B18: ENVIRONMENTAL STUDIES AND HUMAN RIGHTS

CREDITS- 4

TOTAL LECTURE HOURS: 72

CO1: Explain the principles of ecosystem and the use and overexploitation of natural resources.

CO2: Explain various environmental acts in India and the need for public awareness.

CO3: Identify and interpret the concept of Human Rights and its relevance for women, children and environment.

CO4: Illustrate the causes, effects and control measures of industrial waste and environmental pollution with special reference to air, water, soil, nuclear, noise and thermal pollution.

CO5: Apply the twelve principles of green chemistry in reducing the impact of pollution and toxic chemicals in the environment.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	1	3
CO2	3	2	1	1	3
CO3	2	2	1	1	2
CO4	2	2	1	2	3
CO5	2	2	3	2	3

Syllabus content:

Module I: Multidisciplinary Nature of Environmental Studies and Ecosystem (20 Hrs)

Definition, scope and importance. Need for public awareness. Natural resources: Renewable and non-renewable resources, forest resources - use and over-exploitation, deforestation. Water resources - use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources - use and exploitation, environmental effects of extracting and using mineral resources. Food resources - World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems. Energy resources -growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources - land as a resource, land degradation, man induced landslides, soil erosion and desertification

Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem.

Module II: Social Issues, Human Rights and Environment (20 Hrs)

Urban problems related to energy. Water conservation, rain water harvesting, water shed management. Resettlement and rehabilitation of people: its problems and concerns. Environmental ethics: Issues and possible solutions. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act,

Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

An Introduction to Human Rights, meaning, concept and development. Three generations of human rights (civil and political rights; economic, social and cultural rights).Human Rights and

United Nations – contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights. Human Rights in India: Fundamental rights and Indian Constitution,

Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities. Environment and Human Rights - right to clean environment and public safety. Issues of industrial pollution, prevention, rehabilitation and safety aspect of new technologies such as chemical and nuclear technologies, protection of environment.

Module III: Environmental Pollution (24 Hrs)

Air pollution: Causes, effects and control measures. Acid rain, smog, green house effect, Global warming, ozone depletion – causes and consequences.

Water pollution: Water pollution- Eutrophication, Biomagnification, water quality parameters- DO, BOD, COD

Cause, effects and control measures of :- Soil Pollution, Nuclear Pollution, Noise Pollution and Thermal pollution.

Solid Waste Management : Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies.

Introduction to green chemistry: twelve principles of green chemistry, atom economy – examples.

Module IV: Toxicology and Toxicological Effects (8 Hrs)

Toxic chemicals in the environment, impact of toxic chemicals on enzymes, biochemical effects of As, Cd, Pb, Hg, CO, Oxides of Nitrogen and Sulphur.

SEMESTER V

CORE COURSE

CH5B06B18: ORGANIC CHEMISTRY - III

Credits – 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Illustrate the preparation, properties and reactions of Nitrogen containing compounds like Nitro, Amino, Diazonium salts and heterocyclics

CO2: Summarize the preparation, properties and applications of active methylene compounds

CO3: Demonstrate the principles and applications of spectroscopic methods used for the structure elucidation of organic molecules.

CO4: Generalize the preparation, properties and applications of Drugs, Dyes and Polymers.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2
CO2	3	2	2	1	2
CO3	3	3	3	1	2
CO4	3	2	2	1	2

Syllabus Content:

Module I: Nitrogen Containing Compounds (23 hrs)

Nitro compounds (aliphatic and aromatic): Preparation: Methods of preparation of nitroalkanes and aromatic nitro compounds**.** Reactions: Tautomerism of nitromethane. Reduction products of nitrobenzene in acidic, neutral and alkaline media. Electrolytic reduction and selective reduction of polynitro compounds. Formation of charge transfer complexes.

Amines (aliphatic and aromatic): Preparation: From alkyl halides, Reduction of nitro compounds and nitriles, Reductive amination of aldehydes and ketones, Gabriel's phthalimide synthesis, Hofmann bromamide reaction (with mechanism).Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2. Separation of a mixture of 1°, 2° and 3° amines using Hinsberg reagent. Stereochemistry of amines. Structural features affecting basicity of aliphatic and aromatic amines. Comparative study of aliphatic and aromatic amines. Schotten – Baumann Reaction (with mechanism). Electrophilic substitution reactions of aniline: Halogenation, nitration and sulphonation. Quaternary amine salts as phase-transfer catalysts.

Diazonium salts: Preparation: From aromatic amines. Reactions: Structure and stability of benzene diazonium salts. Conversion to benzene, phenol, chloro, bromo, iodo and fluoro benzenes, nitro benzene and azo dyes. Mechanisms of Sandmeyer and Gatterman reactions. Schiemann and Gomberg reactions.

Heterocyclic Compounds: Classification and nomenclature. Structure and aromaticity of 5-numbered and 6-membered rings containing N as heteroatom. Synthesis and reactions of: Pyrrole (Paal-Knorr synthesis and Knorr pyrrole synthesis), Pyridine (Hantzsch synthesis), Indole (Fischer's indole synthesis), Quinoline (Skraup synthesis and Friedlander's synthesis) and Isoquinoline (Bischler-Napieralski reaction).

Module II: Active Methylene Compounds (5 Hrs)

Preparation: Ethyl acetoacetate by Claisen ester condensation.

Reactions: Keto-enol tautomerism. Synthetic uses of ethylacetoacetate, diethyl malonate and ethyl cyanoacetate (preparation of non-heteromolecules only). Alkylation of carbonyl compounds *via* enamines.

Module III: Organic Spectroscopy (11 Hrs)

UV Spectroscopy: Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λ_{max} for the following systems: α,β-unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O and N containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds.

Applications of IR, UV and NMR for identification of simple organic molecules.

Mass Spectrometry: Introduction. EI ionisation. Determination of molecular mass by MS (elementary idea only – fragmentation study not required).

Module IV: Drugs, Dyes and Polymers (15 Hrs)

Drugs: Classification of drugs. Structure, therapeutic uses and mode of action (synthesis not required) of Antibiotics: Ampicillin and Chloramphenicaol, Sulpha drugs: Sulphanilamide, Antipyretics: Paracetamol, Analgesics: Aspirin, Antimalarials: Chloroquine, Antacids: Ranitidine, Anti- cancer drugs: Chlorambucil and Anti-HIV agents: Azidothymidine (Zidovudine). Psychotropic drugs: Tranquilizers, antidepressants and stimulants with examples. Drug addiction and abuse. Prevention and treatment.

Dyes: Theories of colour and chemical constitution. Classification of dyes – according to chemical constitution and method of application. Natural and synthetic dyes.

Synthesis and applications of: Azo dyes – Methyl orange; Triphenyl methane dyes - Malachite green and Rosaniline; Phthalein dyes – Phenolphthalein and Fluorescein; Indigoid dyes - Indigotin; Anthraquinoid dyes – Alizarin.

Polymers: Introduction and classification. Polymerisation reactions - Addition and condensation - Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisationof alkenes. Preparation and applications of plastics–thermosetting (Phenol-formaldehyde, Urea-formaldehyde) and thermosoftening (Polythene) Fibres (Polyamide, Polyester). Synthetic rubbers – SBR and

Neoprene. Introduction to conducting polymers with examples. Environmental hazards and biodegradability of polymers. Recycling of plastics.

SEMESTER V

CORE COURSE

CH5B07B18: PHYSICAL CHEMISTRY- I

Credits- 2

Total lecture hours: 36

CO1: Apply the laws and properties of gaseous state in explaining Kinetic gas equation, van der Waals equation, Virial equation of state and the relation between critical constants and van der Waals constants.

CO2: Apply the laws of crystallography and the theory of X-ray diffraction technique to identify the lattice type and the interplanar spacing and hence predict the crystal structure of sodium chloride and potassium chloride.

CO3: Differentiate the different types of adsorption, adsorption isotherms and liquid crystals.

CO4: Explain the properties of colloids and determination of Surface tension and Viscosity of liquids.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	2	1	2
CO2	2	3	2	1	2
CO3	3	3	2	1	2
CO4	3	2	3	1	2

Syllabus content:

Module I: Gaseous State **(12 Hrs)**

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of

state for real gases. Boyle temperature (derivation not required). Critical phenomena and Andrews isotherms of CO_2, critical constants and their calculation from van der Waals equation.Virial equation of state, van der Waals equation expressed in virial form.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphical representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation).

Collision properties: Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Relation between mean free path and coefficient of viscosity.

Module II: Solid State and Surface Chemistry (18 Hrs)

Solid State: The nature of the solid state – anisotropy –Forms of solids. Unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography – Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Bragg's X-ray diffractometer method and powder pattern method. Analysis of powder diffraction patterns of NaCl and KCl, density of cubic crystals.

Structure of ionic compounds of the type AX (NaCl, CsCl, ZnS) and AX2 (CaF2, Na2O) Defects in crystals – stoichiometric and non-stoichiometric defects, extrinsic and intrinsic defects. Electrical conductivity, semiconductors, n-type, p-type, Superconductivity – An introduction.

Liquid Crystals: Liquid crystals and its thermographic behaviour. Classification, structure of nematic and cholestric phases.

Surface Chemistry: Adsorption – types, adsorption of gases by solids – factors influencing adsorption – Freundlich adsorption isotherm – Langmuir adsorption isotherm –derivation of Langmuir adsorption isotherm. The BET theory (no derivation) – use of BET equation for the determination of surface area.

Module III: Liquid State and Colloids (6 Hrs)

Liquid State: Intermolecular forces in liquids (qualitative idea only). Surface tension and its measurement by stalagmometer method, factors affecting Surface tension, Viscosity, Poisuelle's equation, Determination of viscosity by Ostwald's viscometer.

Colloidal State: Types of solutions – true, colloid and suspensions, Purification of colloids – Ultra filtration and electrodialysis, optical and electrical properties of colloids. Electrical double layer. Coagulation of colloids, Hardy-Schulz rule. Micelles and critical micelle concentration (elementary idea).

SEMESTER V

CORE COURSE

CH5BO8B18: PHYSICAL CHEMISTRY – II

Credits - 3

Total Lecture Hours: 36

Course Outcomes:

CO1: Compare the classical mechanical and quantum mechanical concepts.

CO2: Apply the quantum mechanical principles to one electron systems.

CO3: Explain the principles and applications of Rotational, Vibrational, Electronic and Raman spectroscopy.

CO4: Explain the principles and applications of NMR and ESR spectroscopy.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	1	2
CO2	3	3	3	1	2
CO3	3	3	3	1	2
CO4	3	3	3	1	2

Syllabus content:

Module I: Quantum Mechanics - I **(6 Hrs)**

Classical mechanics: Concepts, Radiation phenomena –Blackbody radiation, Photoelectric effect, Compton effect and Atomic spectra. Plank's quantum theory and explanation of the radiation phenomena.de Broglie hypothesis, dual nature of electrons – Davisson and Germer's experiment. Heisensberg's uncertainty principle and its significance.

Quantum Mechanics: Postulates of quantum mechanics: Schrodinger wave equation – significance of Ψ, well behaved wave functions, Concept of operators- Operator algebra – Linear

and Hermitian operators - Laplacian and Hamiltonian operators – Eigen functions and Eigen values of an operator.

Module II: Quantum Mechanics - II (8 Hrs)

Application of quantum mechanics to simple systems – Particle in 1-D box, normalization of wave function, application to linear conjugated polyene (butadiene). Introductory treatment of Schrödinger equation for hydrogen atom.– The wave equation in spherical polar coordinates (derivation not required) - Separation of wave equation - Radial and angular functions (derivation not required) – Orbitals. Quantum numbers and their importance, hydrogen like wave functions – radial and angular wave functions, radial distribution curves.

Molecular orbital theory: basic ideas – criteria for forming MO from AOs, construction of molecular orbital by LCAO method for H_2^+ion (elementary idea only), physical picture of bonding and anti bonding wave functions, concept of σ, σ*, π, π* orbitals and their characteristics.

Module III: Molecular Spectroscopy-I (12 Hrs)

Introduction: electromagnetic radiation, regions of the spectrum, interaction of electromagnetic radiation with molecules, various types of molecular spectroscopic techniques, Born-Oppenheimer approximation.

Rotation spectroscopy: Introduction to rotational spectroscopy, Rotational energy levels, Selection rules.

Vibrational spectroscopy: Introduction, Selection Rules, Classical equation of vibration, calculation of force constant, concept of anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands. Degrees of freedom for polyatomic molecules, modes of vibration (H_2O and CO_2 as examples), finger print region, Fermi resonance.

Raman spectroscopy: Introduction, Classical and quantum treatment of Raman effect, Qualitative treatment of Rotational Raman effect; Vibrational Raman spectra, Stokes and anti-Stokes lines: their intensity difference, rule of mutual exclusion.

Module IV: Molecular Spectroscopy-II (10 Hrs)

Electronic spectroscopy: Introduction, selection rule, Franck-Condon principle, electronic transitions, singlet and triplet states, dissociation and predissociation. Polyatomic molecules – qualitative description of σ, π and n- molecular orbitals, their energy levels and the respective transitions. Lambert-Beer's law.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low-resolution spectra, different scales, spin-spin coupling.

Electron Spin Resonance (ESR) spectroscopy: Principle, hyperfine structure, ESR of simple radical - methyl radical.

SEMESTER V

OPEN COURSE

CH5D01aB18: CHEMISTRY IN EVERYDAY LIFE

Credits – 3

Total Lecture Hours: 72

Course Outcomes:

CO1: Illustrate the different types of food additives, their importance, toxicity and health effects.

CO2: Discuss the different types of fertilizers, plant growth hormones, pesticides and their impact on the environment.

CO3: Describe the preparation, classification and environmental aspects of soaps, detergents and cosmetics.

CO4: Summarise the classification, uses and environmental impact of plastics, papers, dyes and drugs with examples.

CO5: Explain the types of nanoparticles, toxicity and their application in biology and medicine

Syllabus content:

Module I: Food Additives and Agricultural Chemistry (24 Hrs)

Food additives: Definition. Preservatives, Food colours - permitted and non-permitted, Toxicology. Flavours - natural and synthetic. Artificial sweeteners, Emulsifying agents, Antioxidants, Leavening agents and Flavour enhancers. Importance of food additives. Soft drinks - formulation and health effects. Health drinks. Fast foods and junk foods and their health effects. Food adulteration. Food laws and standards. Food Safety and Standards Act, 2006. Chemistry and Agriculture: Fertilizers – Introduction. Types of fertilizers - Natural, synthetic, mixed, NPK fertilizers. Excessive use of fertilizers and its impact on the environment. Bio-fertilizers. Plant

growth hormones. Pesticides - Introduction. Classification - Insecticides, Fungicides, Herbicides. Excessive use of pesticides - Environmental hazards. Bio pesticides.

Module II: Soaps, Detergents and Cosmetics (18 Hrs)

Soaps: Introduction. Types of soaps - Toilet soaps, washing soaps. Liquid soap. TFM and grades of soaps. Bathing bars. Cleansing action of soap. Detergents: Introduction. Types of detergents - anionic, cationic, non-ionic and amphoteric detergents. Common detergent additives. Enzymes used in commercial detergents. Comparison between soaps and detergents. Environmental aspects. Cosmetics: Introduction. General formulation of different types of cosmetics - Dental cosmetics, Shampoos, Hair dyes, Skin products (lipstick, perfumes and deodorants), Shaving cream and Talcum powder. Toxicology of cosmetics.

Module III: Plastics, Paper, Dyes and Drugs (18 Hrs)

Plastics: Plastics in everyday life. Plastics and Polymers. Classification of polymers. Brief idea of polymerization. Use of LDPE, HDPE, PP, PVC and PS. Environmental hazards of plastics. Biodegradable plastics. Recycling of plastics. Paper: Introduction. Paper manufacture (basic idea only). Weight and size of paper. Types of paper - News print paper, writing paper, paperboards, cardboards. Environmental impact of paper. International recycling codes, and symbols for identification of plastics. Dyes: Natural and synthetic dyes with examples (elementary idea only). Drugs: Classification of drugs - Analgesics, Antipyretics, Antihistamines, Antacids, Antibiotics and Antifertility drugs with examples. Psychotropic drugs - Tranquilizers, Antidepressants and Stimulants with examples. Drug addiction and abuse. Prevention and treatment.

Module IV : Nanomaterials (12 Hrs)

Terminology. Scales of nanosystems. Different types of nanoparticles. Applications of nanoparticles in biology and medicine – biological labels, drug and gene delivery, tissue engineering, tumour destruction (elementary idea). Other applications of nanoparticles – electronics, paints, food packaging. Toxicology of nanoparticles.

SEMESTER V

OPEN COURSE

CH5D01bB18: NANOSCIENCE AND NANOTECHNOLOGY

Credits – 3

Total Lecture Hours: 72

Course Outcomes:

CO1: Summarize the synthesis, properties and applications of nanomaterials with special reference to carbon nanotubes and fullerenes.

CO2: Review the social, economic and ethical perspectives of nanoscience.

CO3: Describe the spectroscopic techniques used for the characterization of nano systems.

CO4: Extend the knowledge of nanotechnology to nanobiology and medical diagnosis.

Syllabus content:

Module I: History of Nanotechnology (18 Hrs)

Historical landmarks- terminology-scales. Top-down and bottom-up paths in nanoscience. Feynman's hypothesis-Moore's law -Types of nanomaterials: fullerene- its discovery production-contribution to nanotechnology-unusual properties of fullerene. Nanotubes:carbon nanotubes-synthesis- properties and applications.

Module II: Nanoscience: Its Social, Economic and Ethical Perspectives (18 Hrs)

Existing laws and regulations of nanotechnology- regulatory agencies- intellectual property policy of nanotechnology. Energy challenges-environmental impacts of nanotechnology - green nanotechnology- technology business: nano economics- entrepreneurs in the technological ecosystem- nanoethics - future of nanotechnology.

Module III: Seeing the Nanoworld (18 Hrs)

Fundamental particles-electromagnetic radiation- its components- impact on matter-the Planck's equation- de Broglie relation- matter-wave concept of radiation- concept of colour and vision- Auxochromes and chromophores- spectroscopic methods and radiation elementary ideas of UV-visible, XPES and UPES techniques, SEM, TEM, SPL, and SIMS - their use in the studies of nanosystems (theory is not expected).

Module IV: Applications of Nanotechnology (18 Hrs)

Nanobiology and its applications- Nanomedicines- immuno targeted drug delivery-- nanoparticle drug systems for oral, nasal, and ocular administration- nanomaterials in medical diagnosis - therapeutic applications. Nanosensors- smart dusts. Destructive applications of nanotechnology.

SEMESTER V

OPEN COURSE

CH5D01cB18: FORENSIC SCIENCE

Credits – 3

Total Lecture Hours: 72

Course Outcomes:

CO1: Identify the type of poisons, their clinical symptoms and treatment.

CO2: Interpret the evidence involved in crimes associated with explosives.

CO3: Identify the different types of forgery and counterfeiting.

CO4: Interpret the biological forensic evidence from the crime scene.

CO5: Discuss the chemistry involved in metabolite analysis, arson and powder residue.

Syllabus content:

Module I: Poisons **(12 Hrs)**

Poisons-types and classification-diagnosis of poisons in the living and the dead – clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of sea foods use of neutron activation analysis in detecting Arsenic in human hair. Treatment in cases of poisoning - use of antidotes for common poisons.

Module II: Crime Detection **(12 Hrs)**

Accidental explosion during manufacture of matches and fireworks. Human bombs- possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for

VVIP- composition of bullets and detecting powder burn. Analysis of incendiary and timed bombs - spill of toxic and corrosive chemicals from tankers.

Module III: Forgery and Counterfeiting (12 Hrs)

Documents - different types of forged signatures-simulated and traced forgeries - inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays - comparison of type written letters - checking silver line watermark in currency notes - alloy analysis using AAS to detect counterfeit coins - detection of gold purity in 22 carat ornaments - detecting gold plated jewels - authenticity of diamond.

Module IV: Tracks and Traces (18 Hrs)

Tracks and traces - small tracks and police dogs-foot prints - casting of foot prints - residue prints, walking pattern or tyre marks - miscellaneous traces and tracks - glass fracture - tool markpaints – fibres. Analysis of biological substances - blood, saliva, urine and hair- Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies -Detecting steroid consumption in athletes and race horses.

Module V: Medical Aspects (18 Hrs)

Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum – gas chromatography. Arson Natural fires and arson - burning characteristics and chemistry of combustible materials - nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms - laboratory examination of barrel washing and detection of powder residue by chemical tests.

SEMESTER – VI

Course Code	Course Title	Credits	Course Type
CH6B09B18	INORGANIC CHEMISTRY	3	Core course
CH6B10B18	ORGANIC CHEMISTRY - IV	3	
CH6B11B18	PHYSICAL CHEMISTRY - III	3	
CH6128B18	PHYSICAL CHEMISTRY – IV	3	
CH6B13aB18	NANOCHEMISTRY AND NANOTECHNOLOGY	3	Choice Based Core Course
CH6B13bB18	POLYMER CHEMISTRY	3	
CH6B13cB18	SOIL AND AGRICULTURAL CHEMISTRY	3	
CH6BP03B18	QUALITATIVE INORGANIC MICRO ANALYSIS	2	Core Practical
CH6BP04B18	ORGANIC PREPARATIONS AND LABORATORY TECHNIQUES	2	
CH6BP05B18	PHYSICAL CHEMISTRY PRACTICALS	2	
CH6BP06B18	GRAVIMETRIC ANALYSIS	2	
CH6BPRB18	PROJECT	2	Project

SEMESTER VI

CORE COURSE

CH6B09B18: INORGANIC CHEMISTRY

Credits - 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Explain structure, nomenclature, theories, isomerism, spectral, magnetic properties and applications of coordination compounds

CO2: Discuss the nomenclature, classification, structure, bonding and catalytic activity of organometallic compounds

CO3: Describe the structure and functions of biologically important compounds and toxicity of essential and trace elements.

CO4: Explain the structure, preparation and properties of interhalogen, boron and noble gas compounds

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	1	2
CO2	3	2	2	1	2
CO3	3	1	2	1	2
CO4	3	1	2	1	2

Syllabus Content:

Module I: Coordination Chemistry **(27 Hrs)**

Introduction of coordination compounds, Types of ligands – Anionic, cationic and neutral – IUPAC Nomenclature, Isomerism in coordination compounds –Structural isomerism and stereo isomerism. Chelates, chelate effect-Stability of complexes: Inert and labile complexes

Factors influencing stability. Review of Werner's theory and Sidgwick's concept of coordination – EAN rule.

Bonding theories: Valence bond theory - Geometries of coordination numbers 4 and 6 – Inner orbital and outer orbital complexes- Limitations of VBT. Crystal filed theory - Splitting of *d*-orbitals in octahedral, tetrahedral, tetragonal and square planar complexes - Jahn Teller Effect– Jahn –Teller distortion in Cu(II) complexes. Factors affecting crystal field splitting - CFSE of low spin and high spin octahedral complexes. Spectrochemical series - Explanation of geometry, magnetism and spectral properties - Merits and demerits of Crystal field theory. Molecular orbital theory – evidence for metal ligand covalency- MO diagram for octahedral complexes (with sigma bonds only).

Spectral and magnetic properties of complexes – electronic absorption spectrum of $[Ti(H_2O)_6]^{3+}$, Calculation of magnetic moments – spin only formula. Reactivity of complexes – Ligand substitution reactions- SN_1 and SN_2 substitution reactions of square planar complexes- Trans effect and its applications. Application of coordination chemistry in qualitative and quantitative analysis of metal ions such as Cu^{2+}, Zn^{2+}, Ni^{2+} and Mg^{2+}.

Module II: Organometallic Compounds (12 Hrs)

Definition – Classification based on the nature of metal-carbon bond and on the basis of hapticity. Naming of organometallic compounds. The 18- electron rule and stability – Ferrocene: Preparation, properties and bonding (VBT only). Metal-alkene complexes- – Zeise's salt. Catalytic properties of organometallic compounds - Zeigler Natta catalyst in the polymerization of alkene and Wilkinson catalyst in the hydrogenation of alkene (mechanism not expected). Preparation and properties of mononuclear carbonyls - Structures of $Mo(CO)_6$, $Fe(CO)_5$ and $Ni(CO)_4$. Polynuclear carbonyls, bridged carbonyls and bonding in carbonyls –

$Mn_2(CO)_{10}$ and $Fe_2(CO)_9$. EAN of metals in metal carbonys – indication of metal-metal bonding. - Quadruple bond – structure of $Re_2CI_8^{2-}$.

Module III : Bioinorganic Chemistry (6 Hrs)

Essential and trace elements in biological systems – Structure and functions of haemoglobin and myoglobin, Vitamin B12 (structure not expected). Electron carriers – cytochromes. Chlorophyll and photosynthesis (mechanism not expected).

Role of alkali and alkaline earth metals in biological systems, Na/K pump. Importance of Ca and Mg. Biological functions and toxicity of metals – Fe, Cu, Zn, Cr, Mn, Ni, Co, Cd, Hg and Pb. Metalloenzymes of zinc and copper, nitrogenase. Treatment of metal toxicity by chelation therapy. Anti cancer drugs – cis platin and carboplatin– Structure and significance.

Module IV: Boron, Inter-halogen and Noble Gas Compounds (9 Hrs)

Boron: Preparation, properties and structure of diborane, borazine, boric acid, boron nitride.

Interhalogens: Classification- general preparation- structures of AB,AB_3, AB_5 and AB_7 types. Reactivity (ClF, ICl_3, ClF_3, IF_5 and IF_7). Comparison of pseudohalogens with halogens. Electropositive character of iodine.

Noble Gas: Separation of noble gases (charcoal adsorption method). Compounds of noble gases.

SEMESTER VI

CORE COURSE

CH6B10B18: ORGANIC CHEMISTRY - IV

Credits - 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Illustrate the preparation, properties and reactions of Natural products like Terpenes, Alkaloids, Lipids, Vitamins, Steroids and Hormones.

CO2: Explain the preparation, properties and applications of Carbohydrates, Amino acids, Peptides and Enzymes.

CO3: Explain the structure, properties and functions of Nucleic acids.

CO4: Generalize the principles and applications of Supramolecular Chemistry and Organic Photochemistry.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2
CO2	3	3	2	1	2
CO3	3	3	2	1	2
CO4	3	2	2	1	2

Syllabus Content:

Module I : Natural Products - I (18 Hrs)

*Terpenoids:*Classification. Isoprene rule. Structure elucidation and uses of citral and geraniol. Natural rubber - structure, latex processing methods, vulcanisation, rubber compounding, mastication and uses.

Alkaloids: General methods of isolation. Classification. Physiological action and medicinal importance. Structure elucidation and synthesis of coniine, nicotine and piperine.

*Lipids:*Introduction to lipids. Classification: Oils and fats: Biological functions. Extraction and refining. Common fatty acids present in oils and fats. Omega fatty acids. Trans fats and their effect. Hydrogenation, Rancidity. Acid value, Saponification value, Iodine value and RM value. Biological functions of waxes, phospholipids and glycolipids. Soaps - Types of soaps. Cleansing action of soaps. Synthetic detergents - Classification. Detergent additives. Comparison between soaps and detergents. Environmental aspects. ABS and LAS detergents.

Vitamins: Classification. Structure, biological functions and deficiency diseases of vitamins A, B_1, B_2, B_3, B_5, B_6, C and D.

Steroids: Introduction. Diels' hydrocarbon. Structure and functions ofcholesterol. Elementary idea of HDL and LDL.

Hormones: Introduction. Examples and biological functions of steroid hormones, peptide hormones and amine hormones (structure not required). Artificial hormones.

Module II : Natural Products - II (23 Hrs)

*Carbohydrates:*Classification of carbohydrates. Reducing and non-reducing sugars. General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections.

Cyclic structure of fructose. Chain lengthening and chain shortening of aldoses - Kiliani-Fischer synthesis and Wohl degradation. Interconversion of aldoses and ketoses.Linkage between monosaccharides. Structure of the disaccharides sucrose, maltose and cellobiose (excluding their structure elucidation). Reactions and uses of sucrose. Artificial sugars (sweeteners) – sucralose. Structure of the polysaccharides starch and cellulose (excluding their structure elucidation). Industrial applications of cellulose.

Amino Acids, Peptides and Proteins: Classification of amino acids. Synthesis, ionic properties and reactions of α-amino acids. Zwitterion structure and Isoelectric point. Polypeptides. Synthesis of simple peptides (upto tripeptides) by N-protecting (benzyloxycarbonyl and*t*-

butyloxycarbonyl) & C-activating groups. DCCmethod. Merrifield's solid phase peptide synthesis. Classification of proteins. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of proteins. Determination of N-terminal amino acid (by FDNB and Edman method) and C–terminal amino acid (by hydrazinolysis and with carboxypeptidase enzyme). Helical and sheet structures. Denaturation of proteins.

*Enzymes:*Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action (Including stereospecificity). Enzyme inhibitors and their importance. Uses of enzymes.

Module III : Nucleic Acids (6 Hrs)

Components of Nucleic acids: Adenine, guanine, cytosine, thymine and uracil (structure only), other components of nucleic acids. Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson - Crick Model) and RNA. Biological functions of DNA and RNA - Replication and protein biosynthesis. Transcription and Translation. Genetic code.

Module IV : Supramolecular Chemistry and Organic Photochemistry (7 Hrs)

*Supramolecular Chemistry:*Introduction. Molecular recognition. Host-guest interactions. Types of non-covalent interactions and molecular receptors. Role of molecular recognition in biopolymer (DNA and protein) structure organisation (elementary idea only).

Organic Photochemistry: Introduction. Photochemical versus Thermal reactions. Electronic excitation and fate of excited molecules. Jablonski diagram. Fluorescence and phosphorescence. Photosensitisation. Photochemical reactions: Norrish type I and II reactions of acyclic ketones, Paterno-Buchi reaction and Photo-Fries reaction (with mechanisms).

SEMESTER – VI

CORE COURSE

CH6B11B18: PHYSICAL CHEMISTRY- III

Credits - 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Illustrate the basic concepts, laws and significance of thermodynamics, thermochemistry and chemical equilibria in solving problems

CO2: Explain ionic equilibria using the concepts of acids and bases and hydrolysis of salts.

CO3: Explain the phase rule and phase diagrams of one component and two component systems.

CO4: Explain the kinetics of first order, second order, zero order, complex reactions and catalysis, collision theory, transition state theory, Lindemann theory and the effect of temperature on the rate of reaction

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	2
CO2	3	3	2	1	2
CO3	3	2	2	1	2
CO4	3	3	2	1	2

Syllabus content:

Module I: Thermodynamics (27 Hrs)

Basic concepts- system, surroundings, types of systems. Extensive and intensive properties, macroscopic properties. State functions and path functions. Types of Processes, Zeroth law of

thermodynamics. Definition of internal energy and enthalpy. Heat capacities at constant volume (C_v) and at constant pressure (C_p), relationship between C_p and C_v.

First law of thermodynamics –Mathematical statement of first law. Reversible process and maximum work. Calculation of work, heat, internal energy change and enthalpy change for the expansion of an ideal gas under reversible isothermal and adiabatic condition.

The Joule-Thomson effect – derivation of the expression for Joule-Thomson coefficient. Sign and magnitude of Joule-Thomson coefficient, inversion temperature. Liquefaction of gases.

Thermochemistry – standard states. Enthalpies of formation, combustion and neutralization. Integral and differential enthalpies of solution. Hess's law and its applications. Kirchoff's equation.

Second law: Limitations of first law – Different statements of IInd law, Thermodynamic scale of temperature. Carnot cycle and its efficiency, Carnot theorem.

Concept of entropy – Definition and physical significance. Entropy as a function of volume and temperature, Entropy as a function of pressure and temperature. Entropy as a criteria of spontaneity and equilibrium.

Gibbs and Helmholtz free energies and their significances- criteria of equilibrium and spontaneity. Gibbs-Helmholtz equation, dependence of Gibbs free energy change on temperature, volume and pressure. Third law of thermodynamics-statement and determination of absolute entropies of substances.

Module II : Equilibria – Chemical and Ionic (11 Hrs)

Chemical Equilibria: Law of mass action-equilibrium constant – Relation between Kp, Kc and Kx – Thermodynamic treatment of the law of mass action – Vant Hoff reaction isotherm

– Temperature dependence of the equilibrium constant – The Van'tHoffs equation –Pressure dependence of the equilibrium constant Kp.

Ionic Equilibria: Introduction – Concepts of acids and bases, relative strength of acid-base pairs, influence of solvents, Dissociation constants – acids, bases, and polyprotic acids. Ostwald's dilution law.Degree of ionization, factors affecting degree of ionization, ionization

constant and ionic product of water-pH. Effects of solvents on ionic strength. Buffer solutions – Mechanism of buffer action, Henderson equation. Hydrolysis of salts – degree of hydrolysis and hydrolysis constant, determination of degree of hydrolysis, pH of salt solutions.

Module III : Phase equilibria (6 Hrs)

The phase rule-derivation, equilibrium between phases – conditions. One component system – watersystem, sulphur system. Two component systems – solid-liquid equilibrium – Simple Eutectic, Lead- Silver system, Formation of compounds with Congruent Melting Point; Ferric chloride–Water system, Formation of compounds with Incongruent Melting Point Sodium sulphate–Water system.

Module IV: Chemical Kinetics (10 Hrs)

Rate of reaction, rate equation, order and molecularity of reactions, determination of order of a reaction. Integrated rate expressions for first and second order reactions ($2A \rightarrow P$ and $A + B \rightarrow P$). Zero order reactions, pseudo order reactions, half life.

Theories of chemical kinetics: Effect of temperature on the rate of reaction: Arrhenius equation, concept of activation energy, Collision theory, Transition state theory. Thermodynamic parameters for activation – Eyring equation (no derivation needed), enthalpy and entropy of activation. Theory of unimolecular reactions – Lindemann Theory.

Kinetics of complex (composite) reactions: Opposing reactions, consecutive reactions, and parallel (simultaneous) reactions. Chain reactions – steady state treatment, Hydrogen– Bromine reaction- derivation of rate expression.

Catalysis: Homogeneous catalysis, enzyme catalysis – Michaelis–Menten equation (no derivation needed). Heterogeneous catalysis – Surface catalysis, Elementary idea about Autocatalysis.

SEMESTER – VI

CORE COURSE

CH6B12B18: PHYSICAL CHEMISTRY – IV

Credits - 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Explain theories and laws of binary liquid solutions, gases in liquids, electrical conductance measurements and colligative property.

CO2: Explain the Galvanic cell, concentration cells, fuel cell, thermodynamics of cell, applications of EMF and electrical conductance measurements.

CO3: Discuss the laws of photochemistry, Jablonski diagram, Quantum yield and selected photochemical reactions

CO4: Explain the symmetry elements of group theory and determination of point groups of simple molecules.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	1	1
CO2	3	3	2	1	1
CO3	3	3	2	1	1
CO4	3	3	2	1	1

Syllabus Content:

Module I : Solution Chemistry (24 Hrs)

Introduction – Binary liquid solutions – Raoult's law- ideal and non-ideal solutions– G_{mix}, V_{mix}, and $S_{mix}$for ideal solutions. Vapour pressure – composition and temperature– composition curves of ideal and non-ideal binary liquid solutions. Fractional distillation of binary liquid-liquid solutions – distillation of immiscible liquids, partially miscible liquid-liquid systems. Critical solution temperature (CST).

Solubility of gases in liquids – Henry's law. Distribution of a solute between two solvents– Nernst distribution law.

Partial molar quantities – Chemical potential – Gibbs–Duhem equation. Colligative properties of dilute solutions – vapour pressure lowering, Boiling point elevation and freezing point depression (thermodynamic derivation).Molar mass determination-related problems – Osmotic pressure – laws of osmotic pressure – Reverse osmosis – purification of sea water. Abnormal molecular masses – van't Hoff factor – Degree of association and Degree of dissociation.

Electrical Conductance: Introduction- Faraday's laws of electrolysis, electrochemical equivalent& chemical equivalent. Electrolytic conductivity, molar conductivity – Variation of molar conductivity with concentration. Kohlrausch's law – Applications. Abnormal ion conductivity of hydrogen and hydroxyl ions. Transference number and its experimental determination using Hittorf and Moving boundary methods.

Debye-Hückel theory of strong electrolytes – the concept of ionic atmosphere, Asymmetry and electrophoretic effect, Debye- Hückel-Onsager equation (no derivation). Activity, mean ionic activity and mean ionic activity coefficients of electrolytes. Ionic strength of a solution, Debye-Hückel limiting law (no derivation).

Applications of conductance measurements – Determinations of degree of dissociation of weak electrolytes, determination of solubility and solubility products of sparingly soluble salts,

conductometric titrations involving strong acid- strong base, weak acid- strong base, mixture of a strong acid and weak acid against strong base and precipitation titrations.

Module II : Electromotive Force (15 Hrs)

Introduction – Electrochemical cells and electrolytic cells, Galvanic cells, characteristics of reversible cells. Reversible electrodes – Different types, Reference electrodes – Standard Hydrogen Electrode, Calomel electrode, Electrode potential – Electrochemical series. Representation of cells, Electrode reactions and cell reactions.

Derivation of Nernst equation for electrode potential and cell potential, Gibb's Helmholtz equation and EMF of a cell, calculation of G, H and S from EMF data. Calculation of equilibrium constant from EMF data.

Concentration cells – Electrode concentration cell and electrolyte concentration cells. Types of electrolyte concentration cells – with transference and without transference, liquid junction potential and salt bridge. Fuel cells – the hydrogen-oxygen fuel cell.

Applications of emf measurements – determination of solubility product, determination of pH using hydrogen electrode, quinhydrone electrode and glass electrode.

Potentiometric titrations of acid-base and redox reaction, oxidation reduction indicators. Irreversible electrode processes – overvoltage.

Corrosion of metals – forms of corrosion,corrosion monitoring and prevention methods.

Module III : Photochemistry (6 Hrs)

Laws of photochemistry-Grothus-Draper law, Stark-Einstein law. Jablonsky diagram-qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing). Quenching of fluorescence.

Quantum yield, examples of low and high quantum yields, photochemical reactions (decomposition of HBr, isomerisation of maleic acid to fumaric acid), photosensitised reactions (photosynthesis, isomerization of 2-butene), chemiluminescence, bioluminescence.

Module IV : Group Theory **(9 Hrs)**

Elements of symmetry – Proper and improper axis of symmetry, plane of symmetry, centre of symmetry and identity element. Combination of symmetry elements, Schoenflies symbol, Point groups, C_2V, C_3V and D_3h, Group multiplication table of C_2V, Determination of point groups of simple molecules like H_2O, NH_3 and BF_3.

SEMESTER VI

CHOICE BASED COURSES

CH6B13aB18: NANOCHEMISTRY AND NANOTECHNOLOGY

Credits – 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Illustrate the history, classification, synthesis, preparation and applications of nanomaterials with special reference to Carbon nanotubes, Fullerenes, Self-assembled monolayers and Quantum dots.

CO2: Explain various Nano structural characterization techniques like SEM,TEM, STEM, ETEM, SPL, SIMS and AFM.

CO3: Describe the electrical and optical properties of nanomaterials.

CO4: Apply the knowledge of nanomaterials in the field of medicine, drug delivery, biotechnology, catalyst, sensors and their potential effects

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	1	1
CO2	3	1	2	1	2
CO3	3	1	2	1	1
CO4	2	1	2	1	3

Syllabus Content:

Module I : Introduction to Nanomaterials (18 Hrs)

History-Feynman's hypothesis- scales of nanosystems- Moore's law-Classification of nanomaterials based on dimensions -quantum dots-. Different types of nanomaterials. Synthesis,

properties and applications of fullerenes, carbon nanotubes and quantum dots. Various approaches in nanoparticle synthesis : CVD, Laser ablation and Arc discharge - self-assembled monolayers, monolayer protected metal nanoparticles.

Module II : Characterization of Nanomaterials (18 Hrs)

Important methods for the characterization of nanomaterials – electron microscopy (SEM), transmission electron microscopy (TEM), scanning tunneling electron microscopy (STEM), environmental transmission electron microscopy (ETEM), scanning probe electron microscopy (SPL), secondary ion mass spectrometry (SIMS) and atomic force microscopy (AFM).

Module III : Electrical and Optical Properties of Nanomaterials (6 Hrs)

Electrical and optical properties of metal nanoparticles- electrical and optical properties of carbon nanotubes.

Module IV : Applications of Nanomaterials (12 Hrs)

Nanocatalysis – nanomedicines - immunogold labeling- applications in medical diagnosis- nanobased drug delivery. Applications in biotechnology -nanosensors- self-assembly, nanosensor based on quantum size effects- nanobiosensors- destructive applications of nanomaterials.

SEMESTER VI

CHOICE BASED COURSES

CH6B13bB18: POLYMER CHEMISTRY

Credits – 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Classify polymers, polymerisation processes and polymerisation techniques.

CO2: Discuss the structure-property relationship of polymers.

CO3: Explain the reaction of polymers, polymer degradation, and polymer processing techniques.

CO4: Discuss preparation, structure, property and application of selected commercial polymers and specialty polymers.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	1	1
CO2	3	1	2	1	1
CO3	3	1	2	1	1
CO4	3	1	2	1	1

Syllabus Content:

Module I: Introduction and History of Polymeric Materials (4 Hrs)

History of Polymers. Terminology. Different schemes of classification of polymers. Polymer nomenclature.

Module II : Mechanisms of Polymerization (6 Hrs)

Classification of polymerization processes. Mechanism of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations. Mechanism of copolymerization. Mechanism of ring opening and group transfer polymerisations.

Module III : Polymerisation Techniques (4 Hrs)

Polymerisation techniques: Bulk, solution, suspension and emulsion polymerisations. Melt, solution and interfacial polycondensation techniques.

Module IV: Physical Properties of Polymers (14 Hrs)

Structure-Property relationships of polymers.

Crystallization and Crystallinity: Determination of crystalline melting point and degree ofcrystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point. ***Molecular weight of polymers:*** Determination of Molecular Weight of Polymers (M_n,M_w,etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

Glass Transition Temperature (T_g):Definition. Factors influencing glass transitiontemperature (T_g). T_g and molecular weight. T_g and melting point. Importance of T_g.

Module V: Reactions of Polymers (4 Hrs)

Hydrolysis, hydrogenation, addition, substitution, crosslinking, vulcanisation and cyclisation reactions.

Module VI: Polymer Degradation (4 Hrs)

Types of degradation. Thermal, mechanical, photo and oxidative degradations of polymers.

Module VII : Polymer Processing (4 Hrs)

Polymer processing techniques: Compression moulding, Injection moulding, Blow moulding, Extrusion moulding, Thermoforming, Die casting, Film casting, Rotational casting, Calendering and Spinning.

Module VIII: Chemistry of Commercial Polymers (8 Hrs)

Brief introduction to the preparation, structure, properties and applications of the following polymers: polyolefins (LDPE, HDPE and PP), poly(vinyl chloride), polystyrene, poly(vinyl acetate), acrylic polymers (PAN and PMMA), fluoro polymers (PTFE), aliphatic polyamides (Nylon 6,6 and Nylon 6), aromatic polyamides (Kevlar), polyesters (PET), formaldehyde resins (PF, UF and MF), polyurethanes, polycarbonates, epoxy resins.

Module IX : Specialty Polymers (6 Hrs)

High temperature resistant and flame retardant polymers. Biomedical applications of polymers. Controlled drug delivery systems. Conducting polymers - polyacetylene, polyaniline, poly(p-phenylene sulphide), polypyrrole, polythiophene. Conduction mechanism and applications. Carbon nanotubes. Synthesis and applications (elementary idea only).

SEMESTER VI

CHOICE BASED COURSES

CH6B13cB18: SOIL AND AGRICULTURAL CHEMISTRY

Credits – 3

Total Lecture Hours: 54

Course Outcomes:

CO1: Describe the origin of soil.

CO2: Explain the physical and chemical aspects of soil chemistry.

CO3: Discuss the different types, role and requirements of plant nutrients and fertilizers.

CO4: Discuss the different types of pesticides, fungicides and herbicides.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	1	1
CO2	3	1	2	1	1
CO3	3	1	2	1	1
CO4	3	1	2	1	1

Syllabus Content:

Module I: Origin of Soil (9 Hrs)

Definition of soil - origin - igneous - metamorphic and sedimentary rocks - rock systems – weathering of rocks and minerals - main components of soil- organic, inorganic, liquid and gaseous phase - minerals of importance with respect to industries and agriculture - Soil formation - physical, chemical and biological factors responsible for soil formation-soil forming processes -

Major soil groups of Kerala- methods of soil survey - remote sensing and soil mapping - soil resource management - use of satellite data for source inventory.

Module II: Physical Properties of Soil (9 Hrs)

Physical properties of soil - soil texture and textural classification - pore space - bulk density, particle density - soil structure and soil colour - surface area - soil colloids - plasticity, shrinkage - flocculation and deflocculation - soil air, soil temperature, their importance in plant growth – soil reaction - Ion exchange reaction- cation exchange - anion exchange - Buffering capacity – hydrogen ion concentration - determination of pH values - Factors affecting soil pH - Soil pH and nutrient availability - Soil degradation - causes.

Module III : Chemistry Aspects of Soil (9 Hrs)

Origin of problem soils, their properties- acid, alkali and saline soils - diagnosis - remediation of acid and salt affected soils - Methods of reclamation and after care - Quality of irrigation water – causes for poor quality waters for irrigation, their effects in soils and crops. Soil testing - concept, objectives and basis - soil sampling, collection processing, despatch of soil and water samples. soil organic matter - its decomposition and effect on soil fertility - source of organic matter in soil - maintenance and distribution - soil organism - their role - nitrification - denitrification, nitrogen fixation in soils - biological nitrogen fixation - microbial interrelationship in soil - microbes in pest and disease management - Bio-conversion of agricultural wastes.

Module IV: Plant Nutrients (18 Hrs)

Plant nutrients - macro and micro nutrients - their role in plant growth - sources- forms of nutrient absorbed by plants - factors affecting nutrient absorption - deficiency symptoms in plants - corrective measures - chemicals used for correcting nutritional deficiencies - nutrient requirement of crops, their availability, fixation and release of nutrients. Fertilizers - classification of NPK fertilizers - sources - natural and synthetic - straight – complex - liquid fertilizers, their properties, use and relative efficiency - micro nutrient fertilizers - mixed fertilizers - principle of fertilizers use - the efficient use of various fertilizers - integrated nutrient management - biofertilizers -

rhizobium, azospirillum, azetobacter - Blue green algae and azolla - production and quality control of bio-fertilizers.

Module V: Pesticides, Fungicides and Herbicides (9 Hrs)

Pesticides: Definition – Classification – organic and inorganic pesticides – mechanism of action – Characteristics – Safe handling of pesticides – impact of pesticides on soil, plants and environment – Acts and Laws concerning the pesticides. Fungicides: definition – classification – mechanism of action – sulfur, copper, mercury compounds, dithanes, dithiocarbamates. Herbicides: definition – classification – mechanism of action – Arsenic and boron compounds – nitro compounds, chloro compounds, triazines, propionic acid derivatives, urea compounds. Acaricides – rodenticides – attractants – repellants – fumigants, defoliants.

SEMESTER V & VI

PRACTICALS

CH6BP03B18: QUALITATIVE INORGANIC MICRO ANALYSIS

Credits – 2

Total Hours: 108

Course Outcomes:

CO1: Determine the anions and cations in a given inorganic salt mixture by semi-micro method

CO2: Develop analytical skills in the qualitative analysis of inorganic substances by semi-micro method

CO3: Record systematically the experimental procedures, observations and conclusions.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2
CO2	3	3	3	1	2
CO3	3	3	3	1	2

1. Study of the reactions of the following radicals with a view to their identification and confirmation. Ag^{+} , Hg^{2+}, Pb^{2+}, Cu^{2+}, Bi^{2+}, Cd^{2+}, As^{3+}, Sn^{2+}, Sb^{3+}, Fe^{2+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+} , Mn^{2+}, Co^{2+}, Ni^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Mg^{2+}, Li^{+} , Na^{+} , K^{+} , NH_4^{+} . CO_3^{2-} , S^{2-} , SO_4^{2-} , NO_3, F^{-} , Cl^{-} , Br^{-} , BO_2^{-} , $C_2O_4^{2-}$, $C_4H_4O_6^{2-}$, CH_3COO^{-} , PO_4^{3-}, AsO_3^{3-} , AsO_4^{3-} and CrO_4^{2-}

2. Systematic qualitative analysis of mixtures containing two acid and two basic radicals from the above list without interfering radical and with one interfering radical by Semi-micro method only. (Minimum of 10 mixtures to be analysed)

SEMESTER V & VI

PRACTICALS

CH6BP04B18: ORGANIC PREPARATIONS AND LABORATORY TECHNIQUES

Credits - 2

Total Lecture Hours: 72

Course Outcomes:

CO1: Develop analytical skills in quantitative analysis by preparation, distillation, separation and purification of organic compounds

CO2: Prepare organic compounds using different types of reactions, record the yield and recrystallize them.

CO3: Illustrate separation of two organic compounds using Thin Layer chromatography and by computing the Rf value.

CO4: Explain the techniques of solvent extraction and column chromatography.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	1	2
CO2	2	2	3	1	2
CO3	2	2	3	1	2
CO4	2	2	3	1	2

Syllabus Content

A. Basic Laboratory Techniques

1. Crystallisation – Any four compounds using ethyl acetate, ethanol, and water - Record the yield of recovery.
2. Distillation - Purification of water and ethyl acetate-Record the yield of recovery.
3. Solvent extraction – aniline from water - methyl benzoate from water - using ether- (Only demonstration)
4. Record the yield of recovery. (*Any two experiments shall be done*).

B. Organic Preparations

1. Oxidation (benzaldehyde to benzoic acid).
2. Hydrolysis (methyl salicylate or ethyl benzoate to the acid).
3. Nitration (*m*-dinitrobenzene and picric acid).
4. Halogenation (*p*-bromoacetanilide from acetanilide).
5. Acylation (Benzoylation of aniline, phenol, β-naphthol).
6. Esterification (benzoic acid ester).
7. Iodoform from acetone or ethyl methyl ketone.
8. Side chain oxidation (benzyl chloride to benzoic acid).
9. Claisen – Schmidt reaction: Dibenzal acetone from benzaldyde.

C. Chromatography

1. TLC - Separation and identification- Determination of Rf value of *o*-and *p*-nitroanilines,
   o- and *p*-chloroanilines, *p*-chlorophenol and *p*-nitrophenol, *p*-chloroaniline and *p*–nitroaniline, benzil and *o*-nitroaniline or any two amino acids.
2. Column Chromatography – Purification of *o*-nitro aniline, o-nitrophenol, benzil, m-dinitro benzene, benzene azo –β-naphthol (*non–evaluative*).

SEMESTER V & VI

PRACTICALS

CH6BP05B18: PHYSICAL CHEMISTRY PRACTICALS

Credits - 2

Total Lecture Hours: 108

Course Outcomes:

CO1: Determine the physical parameters of liquids using experiments based on Viscosity, Surface tension, Critical Solution Temperature, Transition Temperature and Thermochemistry.

CO2: Develop skills in the scientific method of planning, conducting, and accurately reporting experiments based on Conductometry, Potentiometry, Rast method and Chemical kinetics.

CO3: Illustrate graphically the equivalence point and unknown concentration of solutions manually/ using spreadsheet programme.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	1	3
CO2	2	1	3	1	3
CO3	2	3	3	1	2

Syllabus Content:

1. Viscosity – percentage composition of a mixture.
2. Heat of solution – KNO_3, NH_4Cl
3. Heat of neutralization
4. Determination of equivalent conductance of an electrolyte
5. Conductometric titration – strong acid *vs.* strong base, weak acid-strong base
6. Transition temperature of salt hydrates. (Sodium thiosulphate, sodium acetate)

7. Determination of the surface tension of a liquid(Drop number method or Drop weight method)
8. Critical solution temperature of phenol-water system.
9. Effect of electrolytes on the CST of phenol-water system.
10. Molecular weight determination by Rast's method. (using naphthalene,camphor or biphenyl as solvent and acetanilide, p-dichlorobenzene etc. as solute.)
11. Kinetics of simple reactions eg. Acid hydrolysis of methyl acetate.
12. Potentiometric titration – Fe^{2+} *vs.* $Cr_2O_7^{2-}$, I^- *vs.* MnO^{4-}
13. Data analysis of kinetic experiments using spreadsheet program (determination of rate constant)

14. Determination of equivalence point of potentiometric and conductometric titrations using spreadsheet program.

SEMESTER VI

PRACTICALS

CH6BP06B18: GRAVIMETRIC ANALYSIS

Credits – 2

Total Lecture Hours: 36

Course Outcomes:

CO1 : Explain the principle, standard procedure and calculation of Ba^{2+}, Fe^{2+} , Cu^{2+}, Ni^{2+}

CO2 : Develop skills in quantitative analysis based on gravimetry.

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	1	2
CO2	3	2	1	1	1

1. Estimation of Barium as barium sulphate

2. Estimation of iron as Fe_2O_3

3. Estimation of sulphate as barium sulphate

4. Estimation of copper as cuprous thiocyanate

5. Estimation of nickel as nickel dimethylglyoxime.

SEMESTER VI

CORE COURSE

CH6BPRB18: PROJECT

Credits - 2

Total Lecture Hours: 36

Course Outcomes:

CO1: Identify relevant problems related to environmental, industrial and social concerns

CO2: Design experiments, synthesize, analyze, and interpret data to provide solutions for the identified problems

CO3: Develop critical thinking, problem-solving and presentation skills in the areas of chemistry while observing responsible and ethical scientific conduct

Mapping of Course Outcomes with Program Specific Outcomes

Mapping	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	1	3
CO2	2	2	3	1	3
CO2	2	2	3	1	3