

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
	Program: Bachelor in Science (Honors/Honors with Research)	Semester - VII	Session:2024-2025
1	Course Code	MASC-07	
2	Course Title	Advanced Real Analysis	
3	Course Type	Discipline Specific Course (DSC)	
4	Pre-requisite(if any)	Knowledge of basic real analysis, sequence, series	
5	Course Learning Outcome (CLO)	<p>At the end of the course, the students will be able to :</p> <ul style="list-style-type: none"> ➤ Understand the concept of sequences and series of functions, power series apply the test for their convergence, divergence and apply Abel's and Tauber's theorems. ➤ Understand the concept of functions of several variables and properties of sets of vectors in R^n, maxima and minima of real valued functions from R to R and from R^n to R, concept of Integration theory that is closely related to the theory of Euclidean spaces and derivatives of functions of several variables. ➤ Understand the concept of Riemann-Stieltjes integral and apply it to evaluate definite integrals arising in different fields of science and engineering. 	
6	Credit Value	4 C	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course

Total no of teaching – learning period =60 Periods (60 Hours)

UNIT	Topics	No of Periods
I	<p>The Riemann –Stieltjes Integral: Definition and existence of Riemann-Stieltjes integral, Properties of the Integral, integration and differentiation, the fundamental theorem of Calculus, integration of vector-valued functions, Uniform convergence and Riemann-Stieltjes integration, Rectifiable curves.</p>	15
II	<p>Sequence and Series of Functions: Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and differentiation, uniform convergence and integration, Weierstrass approximation theorem.</p>	15
III	<p>Functions of Several Variables: Linear transformations, Derivatives in an open subset of R^n, Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem, Implicit function theorem.</p>	15

Dr. S. Dasgupta
(Dr. P. K. Sahu)

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IV	Jacobians, extremum problems and Power Series: Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals. Uniqueness theorem for power series, Abel's theorem, Taylor's theorem Tauber's theorems	15
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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Principle of Mathematical Analysis By Walter Rudin(3rd edition) McGrawHill, 1976, International student edition.
2. Real Analysis By H.L.Roydon, Macmillan Pub.Co.Inc.4th Edition, New York .1962.

References Books Recommended-

1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985.
2. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar,Inc. New York,1975.
3. A.J. White, Real Analysis; an introduction, Addison-Wesley Publishing Co.,Inc.,1968.
4. E. Hewitt and K. Stromberg. Real and Abstract Analysis, Berlin, Springer, 1969.
5. I.P. Natanson, Theory of Functions of a Real Variable. Vol. 1, Frederick Ungar Publishing Co., 1961.
- 6.A. Friedman, Foundations of Modern Analysis, Holt, Rinehart and Winston, Inc., New York, 1970.
7. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1969.
- 8..Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing Co.Ltd. NewDelhi,1966.

E-resources:

- <https://onlinecourses.nptel.ac.in>
- <https://epqp.inflibnet.aci.in>
- <https://swayam.gov.in>
- <https://www.mooc.org>

Part D: Assessment and Evaluation

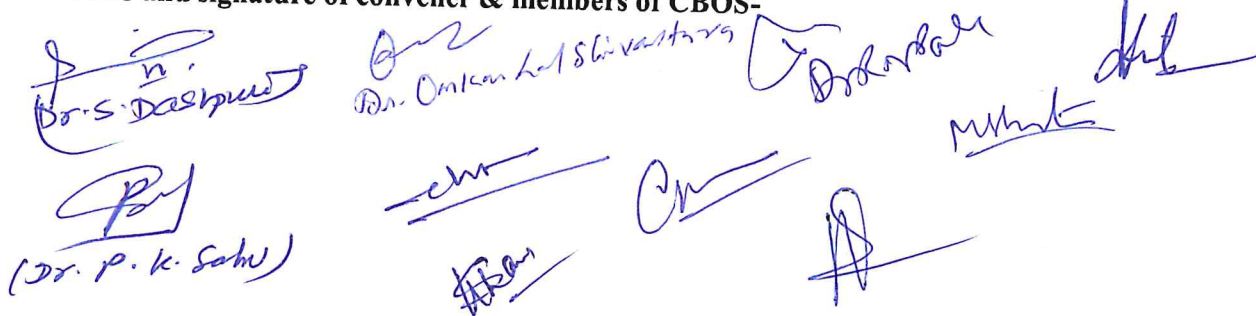
Suggested Continuous Evaluation Methods:

Maximum Marks:	100 Marks
Continuous Internal Assessment (CIA):	30 Marks
End Semester Examination (ESE):	70 Marks

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
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End Semester Examination (ESE)	Two Section-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks
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Name and signature of convener & members of CBOS-

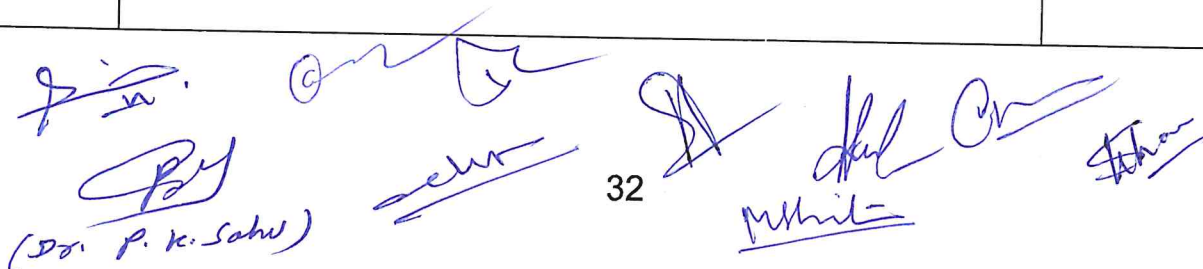


 (Dr. P. K. Sahu)

FOUR YEAR UNDERGRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		Semester - VII	Session:2024-2025
1	Course Code	MASE-05	
2	Course Title	Integral Transforms	
3	Course Type	Discipline Specific Elective (DSE)	
4	Pre-requisite (if any)	Basic idea of differentiation and integration	
5	Course Learning Outcome (CLO)	This Course will enable the students to: <ul style="list-style-type: none"> ➤ Know about piece wise continuous functions,Dirac delta function,Laplace transforms and its properties. ➤ Solve ordinary differential equations using Laplace transforms. ➤ Explain Parseval's identity,Plancherel's theorem and applications of Fourier transforms to boundary value problems. 	
6	Credit Value	4C	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks : 40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	Topics	No. of Periods
I	LaplaceTransforms: Integral transform, Kernel of an integral transform, Reduction of integral transform intoLaplace transform, Linearity, Existence theorem, Laplace transforms of derivatives andintegrals, Shifting theorems, Change of scale property, Laplace transforms of periodicfunctions,Dirac'sdeltafunction.	15
II	Laplace Transforms (Continued) and Applications: Differentiation and integration of transforms, Convolution theorem, Integral equations, Inverse Laplace transform, Lerch's theorem, Linearity property of inverse Laplace transform, Translations theorems of inverse Laplace transform, Inverse transform of derivatives, Applications of Laplace transform in obtaining solutions of ordinary differential equations and integral equations.	15
III	FourierTransforms: Fourier and inverse Fourier transforms, Fourier sine and cosine transforms, Inverse Fouriersine and cosine transforms, Linearity property, Change of scale property, Shifting property, Modulation theorem, Relation between Fourier and Laplace transforms.	15



IV	Solution of Equations by Fourier Transforms : Solution of integral equation by Fourier sine and cosine transforms, Convolution theorem for Fourier transform, Parseval's identity for Fourier transform, Plancherel's theorem, Fourier transform of derivatives, Applications of infinite Fourier transforms to boundary value problems, Finite Fourier transform, Inversion formula for finite Fourier transforms.	15
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Part C - Learning Resource

Text Books, Reference Books, Other Resources

- Text Books Recommended-**
1. James Ward Brown & Ruel V. Churchill. *Fourier Series and Boundary Value Problems*. McGraw-Hill Education. 2011
 2. Charles K. Chui. *An Introduction to Wavelets*. Academic Press 1992

- Reference Books Recommended-**
3. Erwin Kreyszig. *Advanced Engineering Mathematics* (10th edition). Wiley. 2011
 4. Walter Rudin. *Fourier Analysis on Groups*. Dover Publications. 2017
 5. A. Zygmund. *Trigonometric Series* (3rd edition). Cambridge University Press. 2002

- E-Recourses:**
- <https://onlinecourses.nptel.ac.in>
 - <https://epqp.inflibnet.aci.in>
 - <https://swayam.gov.in>
 - <https://www.mooc.org>

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	100 Marks
Continuous Internal Assessment (CIA):	30 Marks
End Semester Examination (ESE):	70 Marks

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
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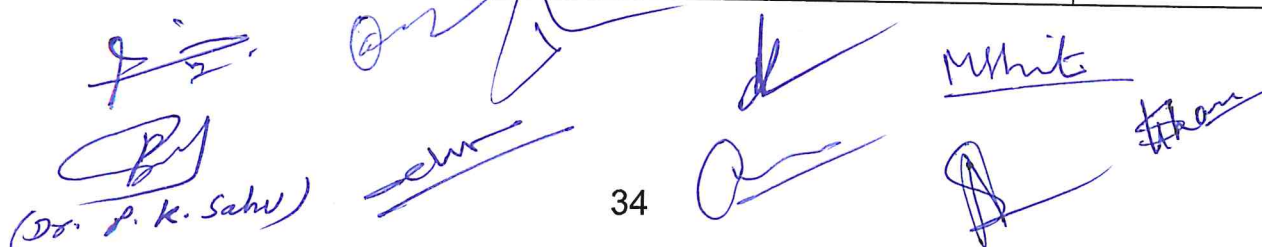
End Semester Examination (ESE)	Two Section-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks
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Name and signature of convener & members of CBOS-

Dr. S. Dashputra
 Dr. P. K. Sahu
 Dr. Anjan Kumar Mishra
 Dr. Anil Kumar
 Dr. M. K. Mishra
 Dr. Anil Kumar
 Dr. Anil Kumar

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		Semester - VII	Session:2024-2025
1	Course Code	MASE-06	
2	Course Title	Topology	
3	Course Type	Discipline Specific Elective (DSE)	
4	Pre requisite(if any)	Knowledge of basic ideas of set theory and analysis including metric spaces.	
5	Course Learning Outcome (CLO)	<p style="text-align: center;">This Course will enable the students to:</p> <ul style="list-style-type: none"> ➤ Understand the concept of countable and uncountable sets and its properties. Understand the concept of topological spaces and its examples, bases, sub-bases, subspaces and relative topology. ➤ Understand the concept of countable, separable spaces and separation axioms with their characterizations and basic properties. ➤ Understand the concept and properties of compactness, continuous functions. ➤ Understand the concept and properties of countable compactness in metric spaces. ➤ Understand the concept and properties of connectedness, continuous functions. 	
6	Credit Value	4C	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks : 40
Part B: Content of the Course			
Total no of teaching – learning period =60 Periods (60 Hours)			
Unit	Topics		No. of Periods
I	Topological Space : Cardinal numbers and its arithmetic. Definition and examples of topological spaces. Neighbourhood Systems, Limit point. Derived sets and closed sets; Interior, Exterior and Frontier points ,Bases and sub-bases.. Alternate methods of defining a topology in terms of Kuratowski Closure Operator , Subspaces and relative topology.		15
II	Continuous function of Topological space: Continuous functions and homeomorphism. First and Second Countable spaces. Lindelof's theorems. Separable spaces. Second countability and separability.		15
III	Compactness and Connectedness: Compactness. Continuous functions and compact sets. Basic properties of Compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness, Connected spaces, Connectedness on the real line.Components, Locally connected spaces. Totally connected spaces.		15



(Dr. P. K. Sahu)

IV	Separation axioms: Separation axioms; T ₀ , T ₁ , T ₂ , T ₃ , T ₄ ; their Characterizations and basic properties. Urysohn's lemma, Tietze extension theorem. T ₅ spaces and Tychonoff spaces	15
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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. Introduction to General Topology By K.D.Joshi, Wiley Eastern Ltd., 1983.
2. Topology, A First Course By James R. Munkres, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

References Books Recommended :

1. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.).
2. George F. Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company
3. J. Hocking and G Young, Topology, Addison-Wiley Reading, 1961.
4. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York, 1995.
5. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.
6. W. Thron, Topologically Structures, Holt, Rinehart and Winston, New York, 1966.
7. N. Bourbaki, General Topology Part I (Transl.), Addison Wesley, Reading, 1966.
8. R. Engelking, General Topology, Polish Scientific Publishers, Warszawa, 1977.
9. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York, 1964.
10. E.H. Spanier, Algebraic Topology, McGraw-Hill, New York, 1966.
11. S. Willard, General Topology, Addison-Wesley, Reading, 1970.

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Part D: Assessment and Evaluation

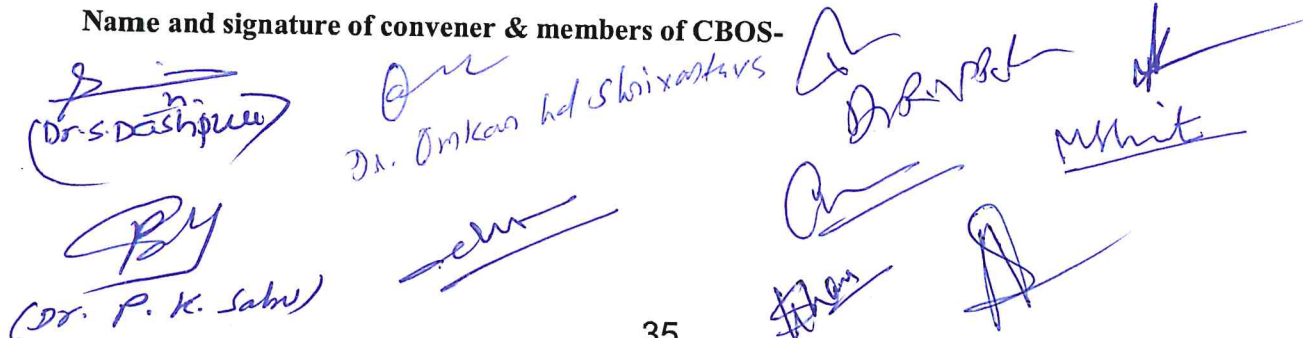
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End Semester Examination (ESE)	Two Section-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks
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Name and signature of convener & members of CBOS-



 (Dr. S. Dashgupta)

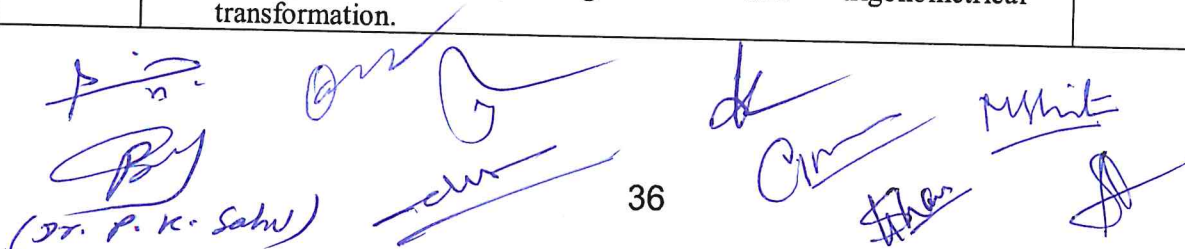
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 (Dr. P. K. Sahu)

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		Semester - VII	Session:2024-2025
1	Course Code	MASE -07	
2	Course Title	Complex Analysis - I	
3	Course Type	Discipline Specific Elective (DSE)	
4	Pre-requisite(if any)	Basic knowledge of complex analysis and calculus.	
5	Course Learning Outcome (CLO)	This Course will enable the students to: <ul style="list-style-type: none"> ➤ Understand Complex number and their properties. ➤ Learn about properties of linear transformation and isomorphism theorems. ➤ Understand the concept of Limit, Continuity, Differentiability of Complex and Analytic function. ➤ Obtain various variants of Mobius transformations. ➤ Obtain various Conformal mapping and types of transformations. 	
6	Credit Value	4C	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks :100	Minimum Passing Marks :40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	Topics	No. of Periods
I	Complex Numbers and Their Geometrical Representation: Complex numbers as ordered pairs, Geometrical representation of complex numbers, Modulus and argument of complex numbers and its Properties, Equation of straight line and circle, Cauchy's inequality and Lagrange's identity.	15
II	Continuity and Differentiability of Complex and Analytic Functions: Limit, Continuity, Differentiability of functions of a Complex variables, Analytic function, Cauchy – Riemann equations, Conjugate function, Laplace's Differential equations, Harmonic functions, Orthogonal system and Construction of Analytic function.	15
III	Mobius Transformation: Jacobian of Transformation, Linear Transformation, Mobius Transformation, Linear Group, Fixed point of Mobius transformation, Cross ratio, Inverse Point, Properties of Mobius transformation.	15
IV	Conformal Mappings: Conformal mapping, Necessary and sufficient condition for $w = f(z)$ to represent a conformal mapping, Transformation $w = z^a$, Inverse, exponential, logarithmic and trigonometrical transformation.	15



Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. Complex Analysis By L.V.Ahlfors, McGraw - Hill, 1979.
2. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student- Edition, Narosa Publishing House, 1980.
3. H.K. Pathak, Complex Analysis and Applications, ShikshaSahityaPrakashan , 2019

Reference Books Recommended :

1. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990.
2. Complex Function Theory By D.Sarason
3. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996.
4. S. Lang, Complex Analysis, Addison Wesley, 1977.
5. D. Sarason, Complex Function Theory, Hindustan Book Agency, Delhi, 1994.
6. Mark J.Ablowitz and A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University press, South Asian Edition, 1998.
7. C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964.
8. E.C Titchmarsh, The Theory of Functions, Oxford University Press, London.
9. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

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Part D: Assessment and Evaluation

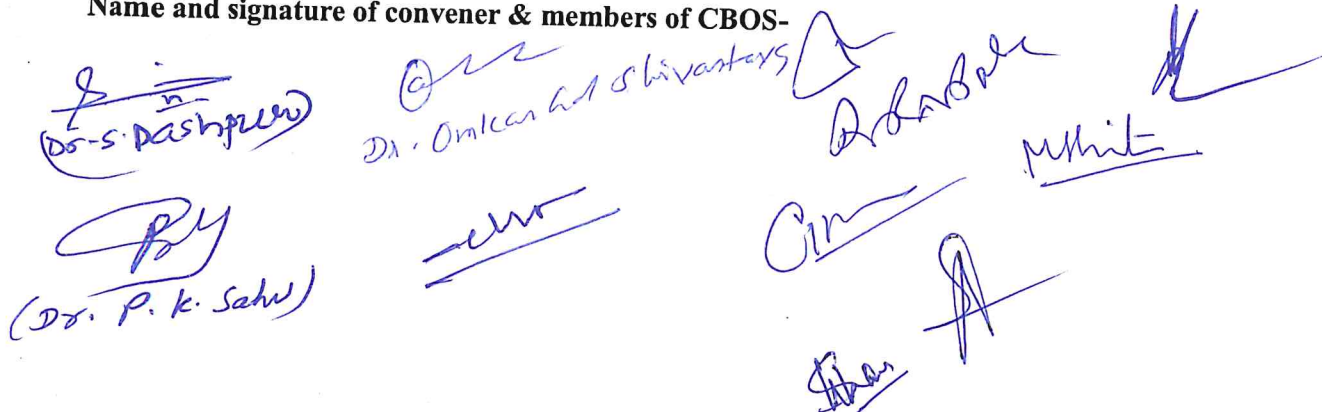
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Name and signature of convener & members of CBOS-



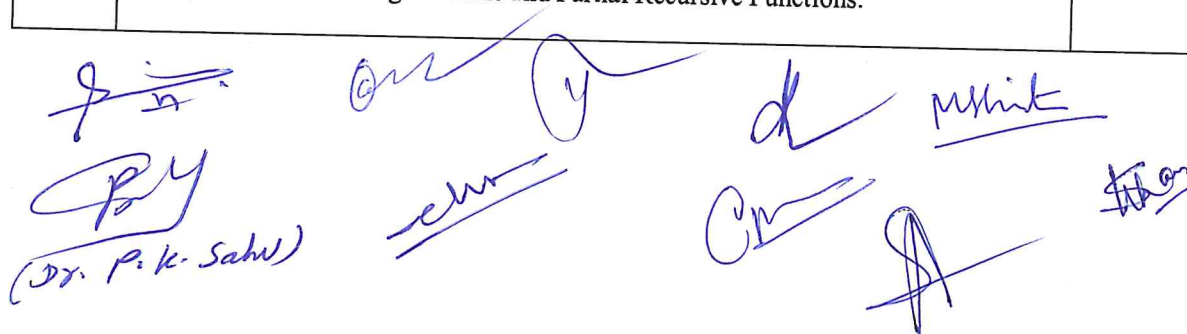
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(Dr. P. K. Sahu) [Signature] [Signature] [Signature]

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		Semester - VII	Session:2024-2025
1	Course Code	MASE-08	
2	Course Title	Discrete Mathematics	
3	Course Type	Discipline Specific Elective (DSE)	
4	Pre-requisite (if any)	Basic idea of logic and order relations.	
5	Course Learning Outcome (CLO)	This Course will enable the students to: <ul style="list-style-type: none"> ➤ The course aims at introducing the concepts of Lattices, sub Lattices and Homomorphisms between Lattices. ➤ Understand the uses of Boolean algebra in daily life. ➤ Understand the uses of grammar and languages in daily life. ➤ Learn about the Finite state machines in different fields. ➤ Solve real-life problems using finite-state and Turing machines. 	
6	Credit Value	4C	1Credit = 15 hours- Learning and observation
6	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

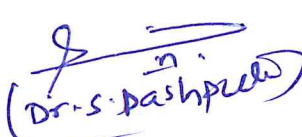
Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	Topics	No. of Periods
I	Lattices -Lattices as partially ordered sets-their properties. Lattices as Algebraic Systems. Sublattices. Direct products and Homomorphisms. Some special Lattices e.g. Complete, Complemented and Distributive Lattices.	15
II	Boolean Algebras: Boolean Algebras. Boolean Algebras as Lattices. Various Boolean Identities. Boolean Functions, The Switching Algebra example, Sub-algebras.	15
III	Grammars, Languages and Regular sets. Phrase-structure Grammars. Rewriting rules. Derivations. Sentential forms. Language generated by a Grammar. Regular, Context-Free and Context Sensitive Grammars and Languages. Regular expressions and the Pumping Lemma. Kleen's theorem. Notions of Syntax Analysis. Polish Notations. Conversion of Infix Expressions to Polish notation. The Reverse Polish notations.	15
IV	Finite state machines – Equivalent machines. Finite state machines as language recognizers. Finite Automata. Acceptors. Non-deterministic Finite Automata and equivalence of its power to that of Deterministic Finite Automata. Moore and mealy Machines. Turing Machine and Partial Recursive Functions.	15

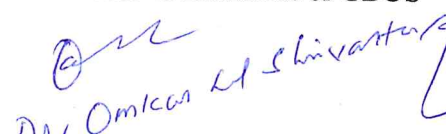



 (Dr. P. K. Sahu)


Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Text Books Recommended :		
1. M.K. Gupta. Discrete Mathematics. Krishna Prakashan Media(P) Ltd 2. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co. New York.		
Reference Books Recommended :		
1. C.L. Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co. 3. Seymour Lipschutz, Finite mathematics McGraw-Hill Book Co. New York. 4. S. Wiitala Discrete mathematics McGraw-Hill Book Co. New York		
E-Recourses:		
https://onlinecourses.nptel.ac.in https://epqp.inflibnet.aci.in https://swayam.gov.in https://www.mooc.org		
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Name and signature of convener & members of CBOS-



 (Dr. S. Pashupathi)


 Dr. Omkar K. Shivastava


 (Dr. P. K. Sahu)


 M. H. M. H. M.

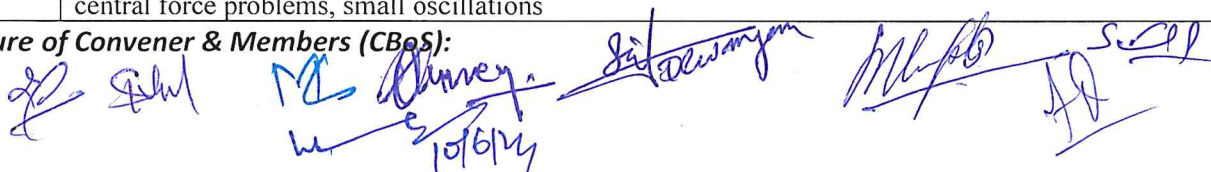

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FOUR YEARS UNDERGRADUATE PROGRAM (2024-28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART – A: INTRODUCTION			
Program: Bachelor in science <i>(Honors/Honors with Research)</i>		Semester: VII	Session: 2024-25
1	Course Code	PHSC-07	
2	Course Title	Classical Mechanics	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: <ul style="list-style-type: none"> ➤ The ideas and concepts in classical physics ➤ Explain Newtonian Mechanics, Lagrangian, and Hamiltonian formulation ➤ Gain knowledge about central force problems and its application in scattering phenomena ➤ Explain small oscillations and its applications. Apply mechanics to solve various physical problems 	
6	Credit Value	04 Credits	1 Credit = 15 Hours for Learning & Observation
7	Total Marks	Maximum Marks: 100	Minimum Pass Marks: 40
PART – B: CONTENT OF THE COURSE			
Total No. of Teaching-learning Periods (01 Hr. per period) – 60 Periods (60 Hours)			
Unit	Topics		No. of Period
I	Preliminaries of classical mechanics Review of Newtonian Mechanics; Conservation laws; Constraints and their classification; Principle of virtual work; Generalized coordinates and velocities, D' Alembert's principle, Lagrangian and the Euler-Lagrange equations, Simple applications of Lagrangian formulation, Hamilton's principle, Lagrange's equation from Hamilton's principle; Legendre transformations and Hamilton's equation of motion; Hamilton's equation from Hamilton's principle; The principle of least action simple applications of Hamiltonian formulation; Conservation theorems, cyclic coordinates and symmetry properties		15
II	Canonical transformations and relativistic mechanics Canonical transformations; Poisson's Bracket; equation of motion and Conservation theorems in the Poisson Bracket formulation; Hamilton Jacobi (HJ) theory; Harmonic oscillator as an example of HJ method Four vectors; Four velocity and acceleration; Lorentz Covariant form of equation of motion.		15
III	Central forces Two-body central force problems and their reduction to the equivalent one-body problem; The equations of motion and first integrals; one-dimensional problems and classification of orbits; The differential equation of the orbit, Closure and stability of orbits; Kepler's laws and planetary motion; Scattering in central force; Rutherford's scattering		15
IV	Rigid body and Periodic motion Euler's angles, Euler's theorem on the motion of a rigid body; The Coriolis force; The Euler equations of motion of rigid bodies; Small oscillations; normal modes; Formulation of the problem of small oscillations; Vibrating string; normal vibrations; dispersion; Coupled vibrating systems, free vibration of a linear triatomic molecule.		15
Keywords:	Newtonian Mechanics, Lagrangian formulation, Hamiltonian formulation, Poisson's bracket, central force problems, small oscillations		

Signature of Convener & Members (CBOS):



PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Classical Mechanics by Herbert Goldstein, Charles Poole, and John Safko
2. Mechanics by L.D. Landau and E.M. Lifshitz
3. Classical Mechanics: Systems of Particles and Hamiltonian Dynamics by Walter Greiner
4. Introduction to Classical Mechanics: With Problems and Solutions by David Morin
5. Classical Dynamics of Particles and Systems by Jerry B. Marion and Stephen T. Thornton
6. Classical Mechanics by R. Douglas Gregory
7. Analytical Mechanics by Grant R. Fowles and George L. Cassiday

Reference Books Recommended

1. Classical Mechanics, H. Goldstein, C.P. Poole, J.L. Safko, 3rd Edn. 2002, Pearson Education.
2. Classical Mechanics, P.S. Joag, N.C. Rana, 1st Edn., McGraw Hall.
3. Classical Mechanics, R. Douglas Gregory, 2015, Cambridge University Press.
4. Classical Mechanics: An Introduction, Dieter Strauch, 2009, Springer.

Online Resources (e-books/ learning portals/ other e-resources)

1. Classical Mechanics-<https://archive.nptel.ac.in/courses/115/106/115106123/>
2. Classical Mechanics- <https://archive.nptel.ac.in/courses/115/105/115105098/>
3. Classical Mechanics- <https://archive.nptel.ac.in/courses/122/106/122106027/>

PART – D: ASSESSMENT AND EVALUATION

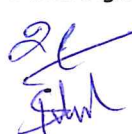
Suggested Continuous Evaluation Methods:

Maximum Marks:	100 Marks
Continuous Internal Assessment (CIA):	30 Marks
End Semester Examination (ESE):	70 Marks

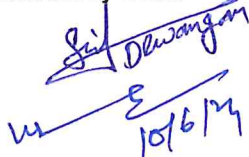
Continuous Internal Assessment (CIA): (By course teacher)	Internal Test/ Quiz (2):	20+20	Better marks out of the two Test / Quiz + marks obtained in Assignment shall be considered against 30 Marks
	Assignment/ Seminar (1):	10	
	Total Marks:	30	

End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type, 1 out of 2 from each unit- 4 x 10 =40 Marks
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Name and Signature of Convener & Members of CBoS:






10/6/24

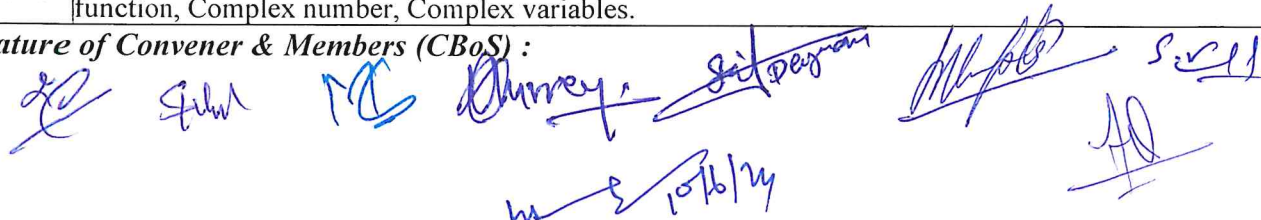




FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART-A: INTRODUCTION			
Program : Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	PHSE- 05	
2	Course Title	Mathematical Physics -II	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Apply Fourier analysis of periodic functions in physical problems such as vibrating strings etc. ➤ Solve the beta, gamma and the error functions and their applications in doing integrations. ➤ Relate basic theory of errors, their analysis, and estimation with examples of simple experiments in Physics. ➤ Solve partial differential equations with the examples of important partial differential equations in Physics 	
6	Credit Value	4 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: CONTENT OF THE COURSE			
Total No. of Teaching-learning Periods (01 Hr. per period) - 60 Periods (60 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry		15
II	Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series		15
III	Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite & Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Orthogonality. Simple recurrence relations. Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral).		15
IV	Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula		15
Keywords	Calculus, Partial derivatives, Differential equations, Periodic function, Singular point, Beta and Gamma function, Complex number, Complex variables.		

Signature of Convener & Members (CBoS) :



PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Calculus of Several Variables and Partial Differential Equations by M.L. Krasnov, S.G. Miskin, and A.I. Gromova
2. Fourier Series and Boundary Value Problems by James Brown and Ruel Churchill
3. Differential Equations with Boundary Value Problems by Dennis G. Zill and Warren S. Wright
4. Complex Variables and Applications by James Ward Brown and Ruel V. Churchill

Reference Books Recommended-

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. An Introduction to Ordinary Differential Equations, E.A Coddington, 1961, PHI Learning
5. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
6. Partial Differential Equations for Scientists and Engineers, S.J. Farlow, 1993, Dover Publications.
7. Mathematical methods for Scientists & Engineers, D.A. Mc Quarrie, 2003, Viva Books

Online Resources-

e-Resources / e-books and e-learning portals

1. NPTEL Online Courses: Dr Saurabh Basu (Complex analysis) <https://nptel.ac.in/courses/115103036>
2. NPTEL Online Course: V. Balkrishanan (Fourier Transform) :<https://nptel.ac.in/courses/115106086>
3. NOC: Mathematical Methods in Physics 1, IISER Bhopal, Prof. Auditya Sharma
<https://nptel.ac.in/courses/111106148>
4. Vector Calculus, egyankosh: <https://egyankosh.ac.in/handle/123456789/25388>
5. e-PG pathshala: Mathematical Physics,
<https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+4mIqRALksfwQH9v8YSMrw==>

PART -D:Assessment and Evaluation

Suggested Continuous Evaluation Methods:

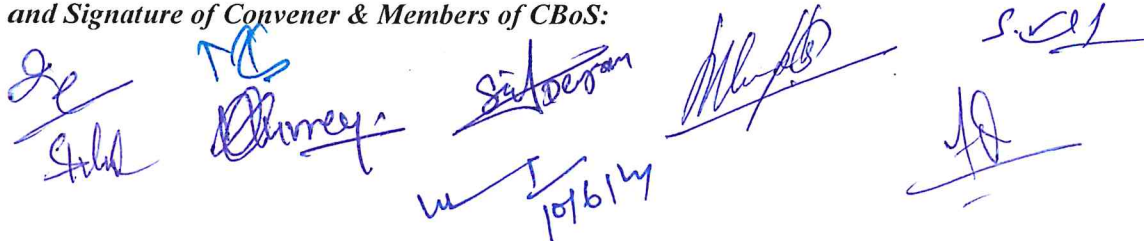
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2):	20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - Total Marks -	10 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks		

Name and Signature of Convener & Members of CBoS:



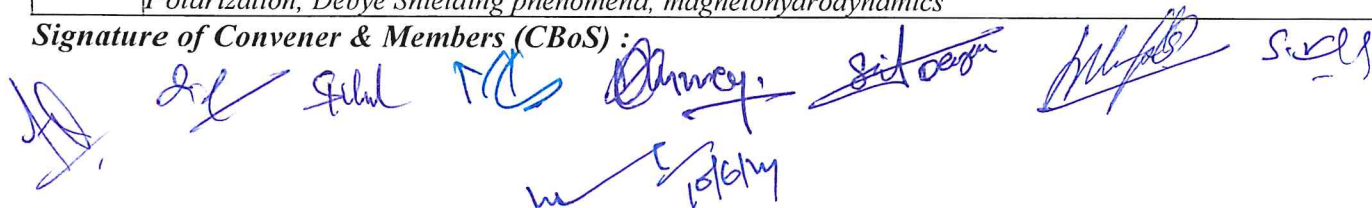
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF PHYSICS

COURSE CURRICULUM

PART-A: INTRODUCTION			
Program : Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	PHSE- 06	
2	Course Title	Classical Electrodynamics & Electromagnetic Theory	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Calculate the reflection and transmission of waves at the media interface. ➤ Understand the aspects related to Polarized lights and its generation as the superposition of different waves. ➤ Understanding the plasma state, the concept of Debye screening, and collective behavior 	
6	Credit Value	4 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: CONTENT OF THE COURSE			
Total No. of Teaching–learning Periods (01 Hr. per period) – 60 Periods (60 Hours)			
Unit	Topics (Course Contents)		No. of Period
I	Maxwell Equations: Review of Maxwell’s equations. Vector and Scalar Potentials. Maxwell’s equations in terms of scalar and vector potentials. Concept of Gauge. Gauge Transformations: Lorentz and Coulomb Gauge; four-vectors, mathematical properties of space-time in special relativity; matrix representation of Lorentz transformation; Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density and Momentum Density. Radiation Pressure. Radiation by moving charges: Lienard-Wiechert potential and fields for a point charge; total power radiated by an accelerated charge- Larmor’s formula and its relativistic generalization		15
II	EM Wave Propagation in Unbounded : Transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, skin depth. Propagation of E.M. Waves in Anisotropic Dielectrics. EM Wave in Bounded Media: Boundary Conditions at Interface between two Media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Brewster's law. Total internal reflection, Metallic reflection (normal Incidence)		15
III	Polarization of Electromagnetic Waves: Description of Linear, Circular and Elliptical Polarization. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extra – ordinary refractive indices. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Optical Rotation. Fresnel’s Theory of optical rotation. Specific rotation. Laurent’s half-shadepolarimeter		15
IV	Plasma: Definition, Debye Shielding phenomena and criteria for plasma, motion of charged particles in electromagnetic field, Uniform E and B fields, electric field drift, non-uniform magneto-static field, Gradient B drift, parallel acceleration and magnetic mirror effect, Elementary concepts of plasma kinetic theory, the Boltzmann equation, the basic plasma phenomena, plasma oscillations; Fundamental equations of magneto - hydrodynamics (MHD); Plasma confinement schemes		15
Keywords	<i>Maxwell Equations, scalar and vector potentials, Lienard-Wiechert potential, EM wave propagation, Polarization, Debye Shielding phenomena, magnetohydrodynamics</i>		

Signature of Convener & Members (CBoS) :



PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.
2. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
3. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
4. Electromagnetic Theory, Chopra & Agrawal, K. Nath Publishing
5. Classical Electrodynamics J. D. Jackson, Wiley

Reference Books Recommended –

1. Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGraw Hill.
2. Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004, Cambridge University Press
3. Plasma Physics, Bittencourt
4. Plasma Physics, Chen

Online Resources– e-Resources / e-books and e-learning portals

1. All e-books of physics <https://www.e-booksdirectory.com/listing.php?category=2>
2. Free physics textbook in PDF
https://www.motionmountain.net/?gclid=CjwKCAjwmq3kBRB_EiwAjkNDp5v8Yy6xK1s0Kma0VR0AWGlichRwFfCC0-vpZK1jrPoEOAnBq8fcqRoCILsQAvD_BwE
3. Cambridge University Books for Physics <https://www.cambridgeindia.org/>
4. Books for solving physics problems <https://bookboon.com/en/physics-ebooks>
5. NPTEL Online courses: https://onlinecourses.nptel.ac.in/noc21_ph05/preview
6. <https://archive.nptel.ac.in/courses/115/104/115104088/>
7. Classical Electromagnetism - 1 (Electrostatics) <https://bsc.hcverma.in/course/cee1>
8. Plasma Physics and Applications https://onlinecourses.nptel.ac.in/noc24_ph20/preview

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment(CIA): 30 Marks

End Semester Exam(ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 & 20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10	
	Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B	
	Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART-A: INTRODUCTION			
Program : Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	PHSE- 07 T	
2	Course Title	DIGITAL ELECTRONICS	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Understand basics of logic gates, Boolean algebra, and simplifying complex Boolean functions. ➤ Learn about combinational circuits, logic families, and digital ICs. ➤ Understand the working of flip-flops and thus memory ➤ Capable to know the various sequential circuits an Ads & DAs 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

PART -B: CONTENT OF THE COURSE			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	<p>Number system: Decimal, Binary, Octal and Hexadecimal Number System with mutual conversion, Mathematics of number systems (addition, subtraction, multiplication and division), 1's and 2's compliments, addition and subtraction using 1's and 2's compliments.</p> <p>Binary Codes: Binary Coded Decimal (BCD), its addition and subtraction, Excess –3 code, its addition and subtraction, Gray code, binary to gray code and gray code to binary code conversion.</p> <p>Logic gates: Positive and negative logic, Basic gates, Universal building block. Basic laws of Boolean Algebra, De-Morgan's Theorem</p>		12
II	<p>Simplification of Boolean Functions: Simplification of Boolean functions through Boolean laws, Realization through logic gates, Minterms and Maxterms, Two, Three and Four variable Karnough Map (K-Map), and minimization of SOP and POS expressions.</p> <p>Combinational Logic Circuits: Half-adder, Full-adder, Binary serial and parallel adders, Half Subtractor, Full Subtractor. Multiplexers (2:1, 4:1 and 16:1), Demultiplexer (1:2, 1:4 and 1:16), Encoders (Octal to Binary encoder, Decimal to BCD), Binary decoders BCD to Decimal, BCD to Seven Segment)</p>		11
III	<p>Digital logic Families: Introduction, Basic concepts of RTL, DTL, TTL, ECL and CMOS logic families and their characteristics (Fan-in, Fan-out, Supply voltage range, Power dissipation, Input/ Output logic levels, Noise margin, Speed of operation)</p> <p>Flip-flop and timing diagram: RS flip-flop, R-S flip-flop using NOR gate, RS flip-flop using NAND gate, Clocked RS flip-flop, D- latch flip-flop, Flip-flop with Preset and Clearinputs, JK flip-flop, Positive and negative edge triggered flop-flops., JK Master Slave flip-flop</p>		11
IV	<p>Sequential Circuits: Counters: Synchronous and Asynchronous counters: Binary ripple counter, up counter, down counter, up-down counter and ring counter with their time diagrams.</p> <p>Registers: Shift Register, PIPO, SIPO, PISO, SISO and Bi-directional shift Register, Application of shift register (Serial Adder, Sequence generator)</p> <p>Digital to analog converter and Analog to Digital converters: D/A converters using binary weighted resistor network and R-2R ladder Network; Counter type A/D converter, applications of DACs and ADCs</p>		11
<i>Keywords</i>	Number System, Logic gates, Codes, Digital Logic Families, Flip flops, Registers, counters		

Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended-

1. Digital Design by M. Morris Mano and Michael D. Ciletti
2. Modern Digital Electronics by R.P. Jain
3. Digital Electronics: Principles, Devices and Applications by Anil K. Maini

Reference Books Recommended-

1. Digital and Analogue Technique- Navneet Gokhale and Kale, Kitab Mahal
2. Digital Electronics and Micro-Computers- R K Gaur, Dhanpat Rai Publications
3. Digital electronics- D K Kaushik, Dhanpat Rai Publication Company
4. Digital Electronics: Principles, Devices and Applications- A K Maini, John Wiley & Sons Ltd.
5. Digital Principles and applications – Malvino and Leach, Tata McGraw Hills, New Delhi
6. Hand Book of Electronics – Gupta and Kumar, Pragati Prakashan, Meerut
7. Digital integrated Electronics _ Taub and Schilling, McGraw International Edition
8. Fundamentals of Digital Circuits – A.Anand Kumar, Prentice Hall of India, New Delhi
9. Modern Digital Electronics- R P Jain, Tata McGraw Hill Publication, New Delhi

Online Resources-

e-Resources / e-books and e-learning portals

1. https://www.freebookcentre.net/Electronics/Digital-CircuitsBooks.html#google_vignette
2. https://www.researchgate.net/profile/DkKaushik/publication/264005171_Digital_Electronics/links/53fca84a0cf2364ccc04b6dd/Digital-Electronics.pdf
3. <https://www.freebookcentre.net/electronics-ebooks-download/Digital-Electronics-Notes.html>
4. https://www.academia.edu/40001993/Digital_Electronics
5. <https://www.technicalbookspdf.com/electronic-engineering/digital-electronics/>
6. https://www.tutorialspoint.com/digital_circuits/digital_circuits_multiplexers.htm
7. https://www.electronics-tutorials.ws/combination/comb_3.html
8. <https://www.youtube.com/watch?v=Eb56gaw6JrQ>
9. https://www.tutorialspoint.com/computer_logical_organization/digital_counters.htm
10. <https://www.youtube.com/watch?v=bAQfPQqKCHs>
11. <https://www.youtube.com/watch?v=K2wPxfiggAU>

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

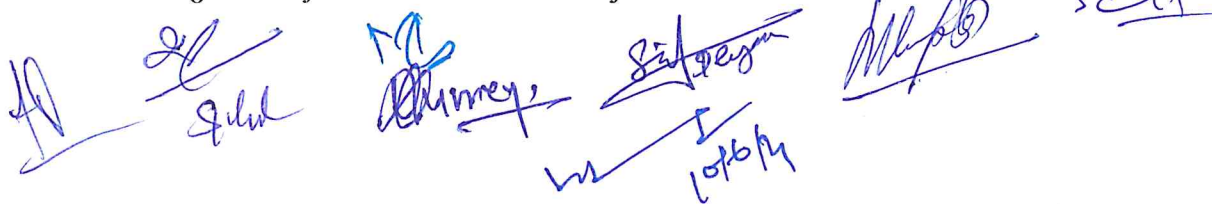
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam(ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART-A: INTRODUCTION			
Program : Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	PHSE- 07 P	
2	Course Title	DIGITAL ELECTRONICS	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if,any)	As per Program	
5	Course Learning Outcomes(CLO)	After completion of this course a student will be able to- <ul style="list-style-type: none"> ➤ Understand the working of logic gates and realization of Functions ➤ Clarify the concept of combinational logic circuits ➤ Understand the differences between MUX, DMUX, Encoder and Decoder and their uses ➤ Familiar with basic memory elements (Flip-flop) ➤ Understand the concept of counters and shift registers, Able to use D/A and A/D convertors. 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max. Marks: 50	Min Passing Marks:20

PART -B: CONTENT OF THE COURSE

Total No. of learning-Training/performance Periods:30 Periods (30 Hours)		
Module	Topics (Course Contents) At least 10 of the following or related Experiments	No. of Period
Lab./Field Training/ Experiment Contents of Course	<ol style="list-style-type: none"> 1. To study and verify the truth-tables of various logic gates 2. To study the Binary to Gray and Gray to Binary conversion 3. To verify the Boolean Laws with the help of logic gates 4. To realize Half Adder and Full Adder 5. To realize Half and Full subtractor 6. To verify the working and truth table of a Multiplexer 7. To verify the working and truth table of a Demultiplexer 8. To study the Decimal to BCD Encoder 9. To study the BCD to Seven Segment Decoder 10. To verify the truth table of (i) R-S flip-flop, (ii) Data latch and (iii) Edge triggered flip-flop 11. To verify the truth table of (i) J-K flip-flop, (ii) J-K Master-Slave flip-flop and (iii) T flip-flop 12. To understand the working of Ripple counter and verify its truth table 13. To understand the working of Up-Down counter and verify its truth table 14. To understand the working of Left/Right Shift Register and verify its truth table 15. To understand the working of SIPO/ PIPO Shift Register and verify its truth table 16. To understand the working of Sequence generator 17. To study the R-2R ladder Digital to Analog convertor 18. To study Counter type Analog to Digital convertor 	30
<i>Keywords</i>	<i>Logic gates, Boolean algebra, Adders, Multiplexer, Flip-flop, Counter, Shift register. Convertors.</i>	

Signature of Convener & Members (CBoS):

PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Digital Electronics: Theory and Practical- Virendra Kumar, New Age International Publications
2. Digital Electronics – A Comprehensive Lab Manual- Cherry Bhargava, B S Publication
3. Digital electronics experiment manual- Toger Tokheim, McGraw Hill
4. Handbook of Experiments in Electronics and Communication- B Sasikala & S P Rao, Vikas Publishing
5. Practical Digital Electronics Manual- Nigel P Cook, Prentice Hall

Reference Books Recommended-

1. Digital Design by M. Morris Mano and Michael D. Ciletti
2. Fundamentals of Digital Circuits by A. Anand Kumar
3. Digital Electronics: Principles and Integrated Circuits" by Anil K. Maini
4. Digital Fundamentals by Thomas L. Floyd
5. Modern Digital Electronics by R. P. Jain
6. Digital Logic Design by B. Somanathan Nair

Online Resources-

➤ e-Resources / e-books and e-learning portals

1. https://nationallibraryopac.nvli.in/cgi-bin/koha/opac-detail.pl?biblionumber=15445&query_desc=Provider%3ANew%20Age%20International%2
2. https://books.google.com/books/about/Digital_Electronics.html?id=b7WwzQEACAAJ
3. <https://ssit.edu.in/dept/assignment/declabmanual.pdf>

PART-D: ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:

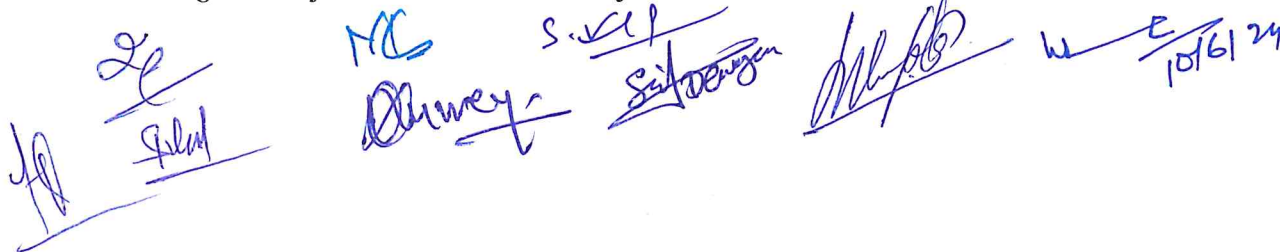
Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2):	10 & 10	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar + Attendance- Total Marks -	05 15	
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment		Managed by Course teacher as per lab. status
	A. Performed the Task based on lab. work - 20 Marks		
	B. Spotting based on tools & technology (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks		

Name and Signature of Convener & Members of CBoS:



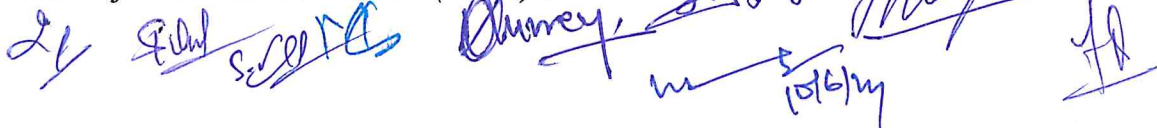
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF PHYSICS

COURSE CURRICULUM

PART-A: INTRODUCTION			
Program : Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester -VII	Session: 2024-2025
1	Course Code	PHSE- 08 T	
2	Course Title	Operational Amplifier & Its Applications	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<p>After completion of the course students will be able to –</p> <ul style="list-style-type: none"> ➤ The Idea and concepts of differential amplifier ➤ Basic concepts of Ideal operational amplifier and Practical operational amplifier with its electrical parameters ➤ Gain the knowledge of op-amp with feedback and its effect on different parameters ➤ Understand the concept of various oscillators and their applications ➤ Know the uses of Timer circuits and their applications 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: CONTENT OF THE COURSE			
TotalNo.of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course Contents)		No. of Period
I	Differential amplifier: Basic idea of direct coupled amplifier and its drawbacks, Circuit configurations of Differential amplifier, need for dual power supply, Basics of different configurations, dual input-balanced output differential amplifier, Its DC analysis and AC analysis. Inverting and Non-Inverting inputs, CMRR, need for constant current bias level transistor circuit Level translator		11
II	Operational Amplifier: Introduction, Block diagram, Functions of each block, Electrical parameters, Ideal op-amp, it's characteristics and equivalent circuit, Open-loop configurations: Differential, Inverting and Non-inverting amplifiers, Op-Amp with negative feedback: Block diagrams of feedback configurations, Voltage series feedback and its effect on Input resistance, Output resistance, Bandwidth, Total output offset voltage. Voltage follower, Voltage shunt feedback, Inverting input terminal at virtual ground, its effect on Input resistance, Output resistance, Bandwidth, Total output offset voltage		12
III	Practical Op-Amp: Input offset voltage, Input bias current, Input offset current, Total output offset voltage, Thermal drift, Error voltage, Common mode configuration and CMMR, Linear Applications: Summing, Scaling and Averaging amplifiers, Basics of Instrumentation amplifier, Instrumentation amplifier using Transducer bridge, Its uses, Voltage to current converter, Theory of Integrator and Differentiator		11
IV	Active Filters Using Op-Amp: Idea of active filters and their classification, First order and Second order low-pass Butterworth filter Op-Amp Oscillators: Oscillator block diagram and condition for sustained oscillations, Phase Shift oscillator, Wien Bridge oscillator and calculation for their frequency of oscillations. Square-wave generator, Triangular wave generator. The 555 Timer: Block diagram of 555, The 555 as a Monostable Multivibrator, Its use as pulse stretcher, 555 as a Stable Multivibrator, Its use as Square-wave oscillator		11
<i>Keywords</i>	<i>Differential Amplifier, Operational Amplifier, Configuration, Feedback, Practical op-amp, Integrator, differentiator, Filters, Oscillators.</i>		

Signature of Convener & Members (CBoS) :



PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Op-amps and Linear Integrated Circuits- Ramakant A Gayakwad, Prentice Hall, India
2. Op-amps and Linear Integrated Circuits- R F Coughlin & F F Driscoll, Prentice Hall, India
3. Op- Amp and Linear Integrated circuits: K. Lal. Kishore, Pearson Education, Delhi
4. Op- Amp with Linear Integrated circuits: William D. Stanly, Pearson Education, Delhi
5. Linear Integrated circuits: D. Roy Choudhury and Shail B. Jain, New Age International Publications, New Delhi.
6. Op- Amp and Linear Integrated circuits: concept and applications- James N Flore, Cengage Learning India Pvt. Ltd

Reference Books Recommended-

1. Microelectronic Circuits by Adel S. Sedra and Kenneth C. Smith
2. Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky
3. Operational Amplifiers and Linear Integrated Circuits by Robert F. Coughlin and Frederick F. Driscoll
4. Design with Operational Amplifiers and Analog Integrated Circuits by Sergio Franco
5. Op-Amps and Linear Integrated Circuits by Ramakant A. Gayakwad
6. Operational Amplifiers with Linear Integrated Circuits" by William D. Stanley**
7. Analog Filter Design" by M.E. Van Valkenburg\

Online Resources-

e-Resources / e-books and e-learning portals

1. https://www.reddit.com/r/AskElectronics/comments/aevtj1/looking_for_some_books_to_learn_about_opamps/
2. <https://open.umn.edu/opentextbooks/textbooks/574>
3. <https://community.element14.com/learn/publications/ebooks/w/documents/27823/a-quick-beginner-s-introduction-to-op-amps---ebook>
4. <https://www.analog.com/en/resources/technical-books/op-amp-applications-handbook.html>
5. <https://mgcub.ac.in/pdf/material/202004041708263c4d2b87a6.pdf>
6. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/10082021/LINEAR%20&%20DIGITAL%20IC.pdf
7. <https://alan.ece.gatech.edu/ECE3040/Lectures/Lecture28-Operational%20Amplifier.pdf>

PART -D:ASSESSMENT ANDEVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

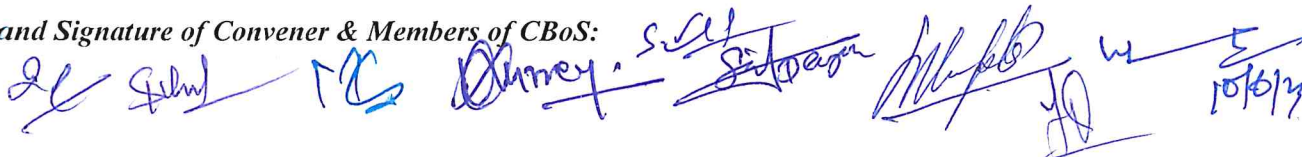
Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2):	20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - Total Marks -	10 30	

End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks
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Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART-A: INTRODUCTION			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	PHSE- 08 P	
2	Course Title	Operational Amplifier & Its Applications	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes(CLO)	After completion of this course a student will be able to- <ul style="list-style-type: none"> ➤ Understand the working of differential amplifier and its inverting and non-inverting configurations. ➤ Know the importance of negative feedback ➤ Know the uses of op-amp IC. Understand the idea of Oscillators ➤ Understand the working of active filters ➤ Have the idea about Multivibrators 	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max.Marks:50	Min Passing Marks:20

PART -B: CONTENT OF THE COURSE

Total No. of learning-Training/performance Periods - Periods (30 Hours)

Module	Topics(Course Contents) At least 10 of the following or related Experiments	No. of Period
Lab./ Experiment Contents of Course	1. To study the differential amplifier and to find the voltage gain 2. To study Inverting and Non-Inverting op-amp 3. To study Voltage series feedback and its effect on Input resistance, Output resistance using op-amp 4. To study Summing op-amp (IC741) and verify their theoretical and practical output 5. To study Subtractor op-amp (IC741) and verify their theoretical and practical output 6. To study Scaling op-amp (IC741) and verify their theoretical and practical output 7. To study the operation of the Integrator & differentiator using op-amp and trace the output wave forms for sine and square wave inputs 8. To study the operation of RC phase shift oscillators using op-amp and trace the output wave forms 9. To study the operation of Wien bridge oscillators using op-amp and trace the output wave forms 10. To study the First order low-pass Butterworth filter 11. To study the Second order low-pass Butterworth filter 12. To study the function of Square wave generator and trace the expected wave form 13. To study the function of Triangular wave generator and trace the expected wave form 14. To use 555 timer as Monostable multivibrator and trace the expected wave form 15. To use 555 timer as Astable multivibrator and trace the expected wave form	30
Keywords	Differential amplifier, Feedback, Op-amp, Integrator, Differentiator, Oscillator, Waveforms, Filters, Multivibrators.	

Signature of Convener & Members (CBoS):

PART-C:LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Handbook of operational amplifier applications- Bruce Carter and Thomas R. Brown, Texas Instruments
2. Operational Amplifier: Theory and Experiments- Shrikrishna Yawale & Sangita Yawale, Springer
3. Op-Amps for Everyone- Ron Mancini, Texas Instruments

Reference Books Recommended-

1. Op-Amps and Linear Integrated Circuits by Ramakant A. Gayakwad
2. Design with Operational Amplifiers and Analog Integrated Circuits by Sergio Franco
3. Operational Amplifiers and Linear Integrated Circuits by Robert F. Coughlin and Frederick F. Driscoll
4. Op Amps for Everyone by Ron Mancini
5. Op Amp Applications Handbook by Analog Devices Inc.
6. Practical Electronics for Inventors by Paul Scherz and Simon Monk
7. Electronic Devices and Circuits by David A. Bell
8. Electronic Principles by Albert Malvino and David J. Bates

Online Resources-

e-Resources / e-books and e-learning portals

1. <https://www.scribd.com/document/370796028/Op-Amp-Lab-Manual>
2. [https://gnindia.dronacharya.info/ECE/Downloads/Labmanuals/EC_%20LAB_\(EE-451\)_IVSem_18012013.pdf](https://gnindia.dronacharya.info/ECE/Downloads/Labmanuals/EC_%20LAB_(EE-451)_IVSem_18012013.pdf)
3. https://www.researchgate.net/publication/282055366_7_Lab_Experiments_with_Op-amp_A_manual_for_undergrad_students_teaching_staff
4. <https://www.utdallas.edu/~rmh072000/EE3101/exp5.pdf>
5. <https://www.csun.edu/sites/default/files/ECE340%20Lab%20Manual.pdf>
6. <https://link.springer.com/book/10.1007/978-981-16-4185-5>

PART-D:ASSESSMENT ANDEVALUATION

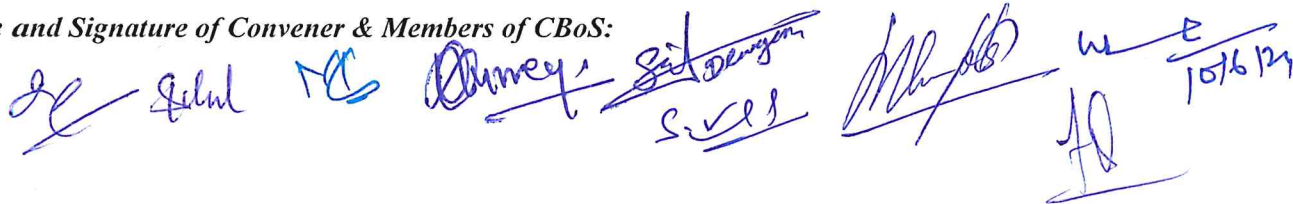
Suggested Continuous Evaluation Methods:

Maximum Marks:	50 Marks
Continuous Internal Assessment (CIA):	15 Marks
End Semester Exam (ESE):	35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance- 05 Total Marks - 15	Better marks out of the two Test / Quiz *obtained marks in Assignment shall be considered against 15 Marks
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End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools& technology (written) - 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status
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Name and Signature of Convener & Members of CBoS:



**DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM**

PART- A: Introduction			
Program: Bachelor in Science (Honors/Honors with research)		Semester - VII	Session: 2024-25
1	Course Code	CHSC-07T	
2	Course Title	INORGANIC & PHYSICAL CHEMISTRY-II	
3	Course Type	DSC	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Study the formation, stability and electronic spectra of complexes ➤ Analyze the chemistry of metal carbonyls and metal nitrosyls. ➤ Solve the Schrodinger equation for the hydrogen atom and utilize Huckel theory for conjugated systems. ➤ Analyze collision theory and transition state theory to understand chemical reactions. 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	MOT & Electronic Spectra of Complexes Electronic spectra and MO theory of Transition Metal complexes , M.O. Theory for octahedral, tetrahedral and square planar complexes with and without π -bonding Determining the Energy terms, Spin-orbit (L-S) coupling scheme, Hund's rule for term symbol, Hole formalism, Determination of the term symbol (ground and excited states) for d 1 to d 9 configurations, Electronic spectra of transition metal complexes, Types of transitions, Laporte 'orbital' selection rule, spin selection rule. Orgel diagrams for octahedral metal complexes. Charge transfer spectra, Racah parameters, calculations of $10Dq$, B, β parameters. Tanabe- Sugano Diagrams of octahedral complexes with d 2 and d8 configuration.		12
II	Metal – Ligand Equilibria A) Metal – Ligand Equilibria in Solution: Stepwise and overall formation constants; trends in stepwise formation constants; factors affecting stability of metal complexes with reference to nature of metal ion, ligand, chelate effect and thermodynamic origin. Determination of formation constant by: (1) spectrophotometric method (Job's and Mole ratio method) (2) Potentiometric method (Irving-Rossotti Method) B) Reaction Mechanism of Transition metal complexes- : Energy Profile of a reaction, reactivity of metal complexes, Inert and Labile complexes, Kinetics of Octahedral substitution C) Metal carbonyls : vibrational spectra of metal carbonyls for bonding and structure elucidation, important reaction of metal carbonyls. Metal carbonyl clusters with reference to classification, synthesis and structures. D) Metal nitrosyls : Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and X-ray diffraction studies of transition metal nitrosyls for bonding and structure elucidation.		11
III	Advanced Quantum Mechanics Discussion of solutions of the Schrodinger equation to three - dimensional box, concept of degeneracy, the harmonic oscillator, the rigid rotor, the hydrogen atom. Approximate Methods		11

	<p>The variation theorem and perturbation theory (first order and non-degenerate). Applications of variation method and perturbation theory to hydrogen and helium atom.</p> <p>Angular Momentum</p> <p>Ordinary angular momentum, eigen functions and eigen values of angular momentum, ladder operator, concept of spin, antisymmetry and Pauli's exclusion principle.</p> <p>Molecular Orbital Theory</p> <p>Huckel theory of conjugated systems, Applications to ethylene, butadiene and cyclobutadiene.</p>	
IV	<p>Advanced Chemical Dynamics</p> <p>A) Methods of determining rate laws, Temperature dependence of chemical reaction rates, Arrhenius equation, Energy of activation, pre-exponential factor and its limitations, Collision theory and its limitations, steric factors, Transition State theory of gas and liquid phase bimolecular reactions, comparison of three theories of reaction rates, kinetic salt effects. Kinetics of Photochemical reactions (Hydrogen-bromine and hydrogen - chlorine reactions).</p> <p>B) Bodeinstein steady state approximation and its application in consecutive reactions, Dynamics of unimolecular reactions :Lindeman-Hinshelwood mechanism, RRKM theory, Thermodynamic formulation of transition state theory, Enthalpy, Gibbs free energy and enthalpy of activation.</p>	11
Keywords	<p><i>Electronic spectra, MO theory, Complex stability, Spectrophotometry, Vibrational spectra, Bonding, Metal nitrosyls, Schrodinger equation, Huckel theory, Collision theory, Transition state theory</i></p>	

Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Bali, R. (2014). *Principles of inorganic chemistry (5th ed.)*. New Age International.
2. Prasad, R. K. (2012). *Quantum mechanics (3rd ed.)*. New Age International.
3. Puri, B. R., Sharma, L. R., & Rastogi, V. D. (2012). *A textbook of physical chemistry*. Vishwa Prakashan.
4. Rakshit, P. C. (2014). *Elements of physical chemistry*. S. Chand & Company.

Reference Books Recommended:-

1. Lee, J. D. (2008). *Inorganic chemistry (4th ed.)*. Wiley India.
2. Greenwood, N. N., & Earnshaw, A. (2012). *Chemistry of the elements (2nd ed.)*. Elsevier.
3. Laidler, K. J. (1987). *Chemical kinetics (3rd ed.)*. Pearson Education.
4. Cotton, F. A., Wilkinson, G., Boch, P. L., & Bailar, M. Bailar Jr. (2018). *Inorganic chemistry (6th ed.)*. John Wiley & Sons.
5. Mathews, P. M., & McFarlane, F. W. (2014). *A textbook of quantum mechanics (2nd ed.)*. Mc Graw Hill Education.
6. Houston, P. L. (2001). *Chemical kinetics and reaction dynamics*. Dover Publications.

Online Resources-

- <https://nptel.ac.in/courses/115106066>
- <https://nptel.ac.in/>
- https://onlinecourses.nptel.ac.in/noc23_cy02/preview
- <https://swayam.gov.in/>

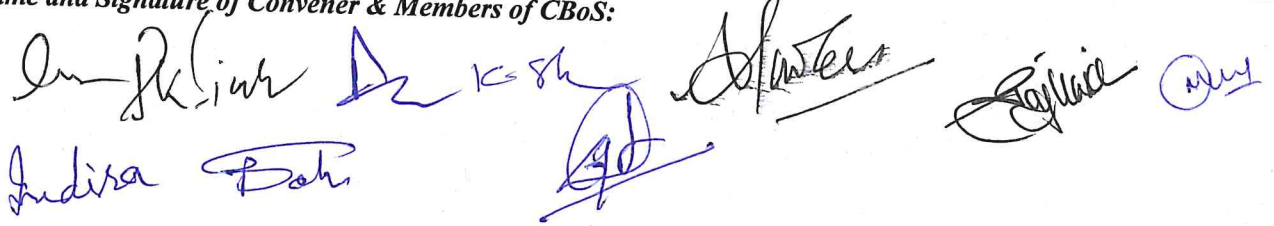
PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	100 Marks
Continuous Internal Assessment (CIA):	30 Marks
End Semester Exam (ESE):	70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit- 4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science <i>(Honor/Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	CHSC-07P	
2	Course Title	CHEMISTRY LAB. COURSE-VII	
3	Course Type	DSC	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Master separating and estimating acidic and basic radicals in inorganic mixtures. ➤ Apply qualitative and quantitative analysis skills to real samples. • Inorganic Synthesis & Characterization ➤ Gain hands-on experience synthesizing inorganic compounds and identify them using spectral analysis. ➤ Grasp basic physical chemistry concepts through practical experiments and learn to operate basic equipment. 	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20
PART -B: Content of the Course			
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)			
Module	Topics (Course contents)	No. of Period	
Lab./Field Training/ Experiment Contents of Course	<p>Qualitative analysis of mixture containing eight radicals including two less common metals from among the following by semi micro method.</p> <p>Basic Radicals: Ag, Pb, Hg Bi, Cu, Cd, As, Sb, Sn, Fe, Al, Cr, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg, Na, K, Ce, Th, Zr, W, Te, Ti, Mo, U, V, Be, Li, Au, Pt.</p> <p>Acidic Radicals: Carbonate, Sulphite, Sulphide, Nitrite, Nitrate, Acetate, Fluoride, Chloride, Bromide, Iodide, Sulphate, Borate, Oxalate, Phosphate, Silicate, Thiosulphate, Ferricyanide, Sulphocyanide, Chromate, Arsinat and Permanganate.</p> <p>Separation and determination of two metal ions in ores, alloys, or mixtures in solution, one by volumetric and the other by gravimetric methods.</p> <p>Estimations</p> <p>(a) Phosphoric acid in commercial orthophosphoric acid. (b) Boric acid in borax. (c) Ammonia in an ammonium salt. (d) Manganese dioxide in pyrolusite. (e) Available chlorine in bleaching powder. (f) Hydrogen peroxide in a commercial sample.</p> <p>Preparations Preparation of selected inorganic compounds and their study by I.R. Electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds. Theoretical study of structure and their identification of some preparations by spectral analysis</p>	30	

- | | |
|--|--|
| 1. VO (acac) ₂ | 2. TiO (C ₉ H ₈ NO) ₂ 2H ₂ O |
| 3. Cis-K [Cr (C ₂ O ₄) ₂ (H ₂ O) ₂] | 4. Na[Cr(NH ₃) ₂ (SCN) ₄] |
| 5. Mn (acac) ₃ | 6. K ₃ [Fe (C ₂ O ₄) ₃] |
| 7. Prussian Blue, Turnbull's Blue. | 8. [Co (NH ₃) ₆][Co(NO ₂) ₆] |
| 9. Cis-[Co(trien)(NO ₂) ₂]Cl.H ₂ O | 10. Hg[Co(SCN) ₄] |
| 11. [Co(Py) ₂ Cl ₂] | 12. [Ni(NH ₃) ₆]Cl ₂ |
| 13. Ni(DMG) ₂ | 14. [Cu(NH ₃) ₄]SO ₄ .H ₂ O |

Adsorption

- To study surface tension – concentration relationship for solution (Gibb's equation).
- To study the adsorption of oxalic acid on charcoal and to verify Freundlich adsorption isotherm.

Chemical Kinetics

- Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions.
- Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction.

Polarimetry

- Determine the specific and molecular rotation of optically active substance.
- To determine the concentration of a solution of an optically active substance.

Solutions

- Determination of molecular weight of non-electrolyte/electrolyte by cryoscopic method and to determine the activity coefficient of an electrolyte.
- Determination of molecular weight of non-volatile substances by Landsberger's method.

Spectrophotometry

- Verification of Beer-Lambert law and determination of concentration of unknown solution.
- Effect of pH in aqueous coloured system.

Potentiometry/pH metry

- Determination of temperature dependence of EMF of a cell.
- To determine pK_a of the given monobasic acid by pHmetric titration.
- Determination of the dissociation constant of monobasic/dibasic acid by Albert- Serjeant method.

Keywords

Qualitative Analysis, Separation and Determination, Estimations, Preparations, Spectroscopic Techniques, Adsorption, Chemical Kinetics, Polarimetry, Solutions, Instrumental Methods

Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended

1. Das, R. C., & Behra, B. (2009). *Experimental Physical Chemistry (1st Ed.)*. Tata McGraw-Hill Education.
2. Chatwal, G. R., & Sharma, A. (2019). *Instrumental Methods of Chemical Analysis*. Himalaya Publishing House.

Reference Books Recommended

1. Bassett, J., Denney, R. C., Jeffery, G. H., & Mendham, J. (1974). *Vogel's Textbook of Qualitative Chemical Analysis (5th Ed.)*. ELBS.
2. Jolly, W. L. (1970). *Synthesis and Characterization of Inorganic Compounds*. Prentice Hall.
3. James, A. M., & Prichard, F. E. (1981). *Practical Physical Chemistry (4th Ed.)*. Longman.
4. Plevitt, B. (1974). *Findlay's Practical Physical Chemistry (9th Ed.)*. Longman.

Online Resources-

- (<https://www.wiley.com/en-us/Microscale+Inorganic+Chemistry%3A+A+Comprehensive+Laboratory+Experience-p-9780471619963>)
- (<https://onlinelibrary.wiley.com/doi/book/10.1002/9780470405840>)
- (<https://www.amazon.com/Physical-Chemistry-Molecular-Donald-McQuarrie/dp/0935702997>)
- (<https://www.amazon.com/Laboratory-Manual-Physical-Chemistry-Davison/dp/1297998979>)

Online Resources-

- e-Resources / e-books and e-learning portals

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance - 05 Total Marks - 15	
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment	Managed by Course teacher as per lab. status
	S. Performed the Task based on lab. work - 20 Marks	
	T. Spotting based on tools & technology (written) - 10 Marks U. Viva-voce (based on principle/technology) - 05 Marks	

Name and Signature of Convener & Members of CBoS:

Indira
K. Sh
D. S
S. S
S. S
S. S

FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM

PART-A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		Semester VII	Session: 2024-2025
1	CourseCode	CHSE-05T	
2	CourseTitle	PHOTOCHEMISTRY AND PERICYCLIC REACTION	
3	CourseType	DSE	
4	Pre-requisite(if,any)	As per Program	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ To study the photochemical reaction and pericyclic reaction ➤ To gain knowledge about mechanism of light induced reaction. ➤ To learn the mechanism of thermal reaction ➤ To understand the difference between light and thermal reaction. 	
6	CreditValue	3 Credits	Credit = 15 Hours -learning & Observation
7	TotalMarks	Max.Marks: 100	Min Passing Marks:40
PART -B: Content of the Course			
TotalNo.of Teaching-learning Periods(01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics(Coursecontents)		No.ofP eriod
I	Photochemical reactions and Reaction Mechanism Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecules, quantum yield, transfer of excitation energy, actinometry. Classification, rate constants and life times of reactive energy states - determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions – Photo-oxidation, photo-reduction, photo-dissociation, gas phasephotolysis.		12
II	Photochemistry of Alkenes Intramolecular reactions of the olefinic bond - geometrical isomerism, cyclisation reactions, photochemical rearrangement of alkenes, rearrangement 1, 4- and 1,5-dienes. Photochemistry of Aromatic Compounds: Photochemical isomerization of aromatic compounds, Photochemical addition and substitutions reactions shown by aromatic compounds.		11
III	Photochemistry of Carbonyl Compounds Photochemical reactions of carbonyl compounds: Norrish type I and II reactions Intramolecular reactions of carbonyl compounds - saturated cyclic and acyclic, β , γ - unsaturated and α , β - unsaturated compounds. Cyclohexadienones. Intermolecular cycloaddition reactions –photo-dimerisation reaction and oxetane formation. Miscellaneous Photochemical Reactions Photo-Fries reactions of anilides. Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.		11
IV	Pericyclic Reactions Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3- butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffman correlation diagrams. FMO and PMO approach. Electrocyclic reactions- conrotatory and		11

disrotatory motions, $4n$, $4n+2$ and allyl systems. Cycloadditions- antarafacial and suprafacial additions, $4n$ and $4n+2$ systems, $2+2$ addition of ketenes. Sigmatropic rearrangements, suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, $3, 3$ - and $5, 5$ - sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements.

Keywords *Photochemical reaction, thermal reaction,*

Signature of Convener & Members (CBoS):

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Singh, J., & Singh, J. (n.d.). *Photochemistry and pericyclic reactions*. [Publisher not provided].
2. Gupta, A. L. (2024). *Photochemistry*. Pragati Prakashan (7th Edition).

Reference books Recommended:

1. Ramamurthy, V., & Schanze, K. S. (1999). *Organic photochemistry*. Taylor & Francis.
2. Wardle, B. (2000). *Principles and applications of photochemistry*. John Wiley & Sons.

Online Resources–

- <https://nptel.ac.in/courses/104105038>
- <https://archive.nptel.ac.in/courses/104/106/104106077/>
- <https://www.scribd.com/document/512848351/Photochemistry-and-Pericyclic-Reactions-by-J-Singh>

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

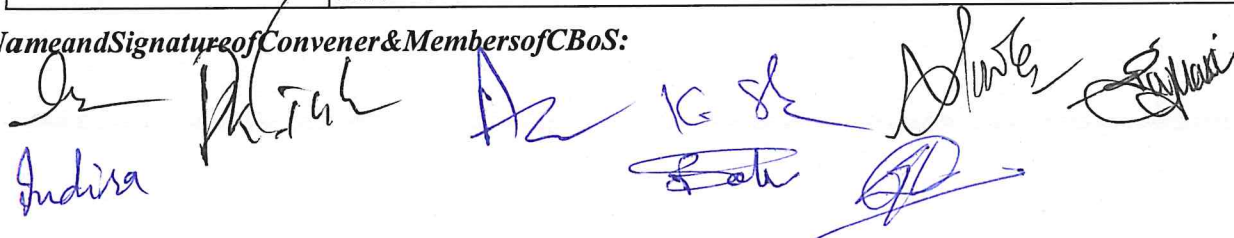
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment/Seminar- 10 Total Marks -30	Better marks out of the two Test / Quiz+ obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit- 4x10=40Marks	

Name and Signature of Convener & Members of CBoS:



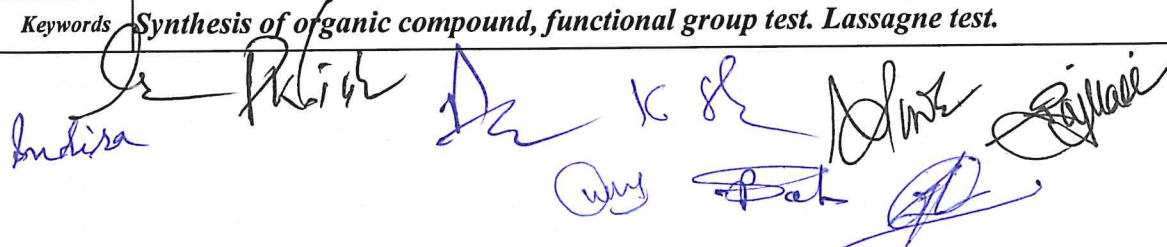
 Indira

FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM

PART-A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		Semester VII	Session: 2024-2025
1	CourseCode	CHSE-05P	
2	CourseTitle	PHOTOCHEMISTRY & PERICYCLIC REACTION LAB. COURSE	
3	CourseType	DSE	
4	Pre-requisite(if,any)	-	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ To learn the advanced organic chemistry concept that will applied in solving their future chemistry problems. ➤ To learn about arenium ion ,classical versus non classical carbonium ion ,different rearrangement reactions ➤ To make student aware the level of basic organic chemistry to apply in different reaction mechanisms and organic transformations. 	
6	CreditValue	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	TotalMarks	Max.Marks:50	Min Passing Marks:20
PART -B: Content oftheCourse			
TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)			
Module	Topics(Coursecontents)		No.ofP eriod
Lab./Field Training/ Experiment Contents of Course	1. Synthesis of organic compound involving important chemical reaction:- (a)Acetylations salicylic acid, aniline, glucose and hydroquinone, (b) Benzoylation of aniline and phenol. (c) Aliphatic electrophilic substitution: preparation of iodoform from ethanol and acetone (d) Aromatic electrophilic substitution: nitration-preparation of meta dinitrobenzene, p-nitroacetinalide, halogenation: preparation of p-bromoaetanilaide,2,4,6-tribromophenol. (e) Diazotisation/ coupling :- Preparation of methyl orange and methyl red, (f)Oxidation: Preparation of benzoic acid from toluene (g) Reduction: Preparation of aniline from nitrobenzene, m-nitroanilene from m-dinitrobenzene. 2. Isolation of some natural products(casein from milk, lycopene from tomato, nicotine from tobacco leaves etc.) 3. Detection of element, functional group and organic compound.		30
Keywords	Synthesis of ofganic compound, functional group test. Lassagne test.		


 A collection of handwritten signatures in blue ink, including names like Indira, Rishi, and others, written over the bottom of the curriculum document.

Signature of Convener & Members (CBoS):

PART-C: Learning Resources		
Text Books, Reference Books and Others		
Text books Recommended:		
<ol style="list-style-type: none"> 1. Bansal, R. K. (1994). <i>Laboratory manual of organic chemistry</i>. New Age International Publishers. 2. Vogel Textbook of Practical Organic Chemistry 5th edition, Pearson Publication. 		
Reference books Recommended:		
<ol style="list-style-type: none"> 1. Vishnoi, N. K. (2010). <i>Advanced practical organic chemistry (3rd ed.)</i>. Vikas Publishing House. 2. Saikia, B. (Year). <i>Organic chemistry-I with practical.</i> 3. Agrawal, O. P. (Year). <i>Advanced practical organic chemistry</i>. Krishna Publication. 		
Online Resources:		
https://www.organic-chemistry.org/synthesis/ https://www.orgsyn.org/ https://vlab.amrita.edu/?sub=2&brch=191&sim=344&cnt=1#:~:text=In%20order%20to%20detect%20them,detected%20by%20simple%20chemical%20tests.		
PART-D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 50 Marks		
Continuous Internal Assessment (CIA): 15 Marks		
End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar + Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment M. Performed the Task based on lab. work - 20 Marks N. Spotting based on tools & technology (written) - 10 Marks O. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

Indira

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science (Degree/Honors)		Semester - VII	Session: 2024-2025
1	Course Code	CHSE-06T	
2	Course Title	SPECTROSCOPY-I	
3	Course Type	DSE	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ To equips students with advanced spectroscopic techniques for in-depth molecular analysis. ➤ To enable classification, isotope effect analysis, and vibrational energy calculations of techniques like microwave and infrared spectroscopy ➤ To provide detailed information on structure, environment, and electronic configuration on advanced methods like NMR, NQR, and PES. ➤ To allows students to probe chemical and surface properties of materials using Photoacoustic spectroscopy. ➤ 	
6	Credit Value	3 Credits	Credit = 15 Hours - learning & Observation
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course contents)		No. of Period
I	Molecular Spectroscopy Energy levels, molecular orbital, vibronic transitions, vibration progressions and geometry of the excited states, Franck - Condon principle, electronic spectra of polyatomic molecules. Emission spectra: radiative and non-radiative decay, internal conversion, spectra of transition metal complex, charge transfer spectra. Microwave Spectroscopy Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.		12
II	Infrared spectroscopy Review of linear harmonic oscillator, vibrational energy of diatomic molecules, zero point energy, force constant and bond strengths, anharmonicity. Morse potential energy diagram, vibration – rotation Spectroscopy, P, Q, R branches. Breakdown of Oppenheimer approximation, vibration of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis. Raman Spectroscopy Classical and quantum theories of Raman effect – Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle. Resonance Raman Spectroscopy, coherent anti stokes Raman Spectroscopy (CARS)		11
III	Nuclear Magnetic Resonance Spectroscopy Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors influencing chemical shift,		11

	<p>deshielding, spin- spin interactions, factors including coupling constant 'J'. Classification (ABX, AMX, ABC, AB etc), spin decoupling. Basic ideas about instruments, FT NMR, advantages of FT NMR, use of NMR in medical diagnostics.</p> <p>Nuclear Quadruple Resonance Spectroscopy Quadruple nuclei, Quadruple moments, electric field gradient, coupling constant, splitting, applications.</p>	
IV	<p>Photoelectron Spectroscopy Basic principle: photo-electric effect, ionization process, Koopmans theorem, photoelectron spectra of simple molecules, ESCA, chemical information from ESCA.</p> <p>Photo acoustic Spectroscopy Basic principles of photo acoustic spectroscopy (PAS), PAS gases and condensed systems, chemical and surface applications.</p> <p>Electron Spin Resonance Spectroscopy Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and McConnell relationship, measurement techniques, applications.</p>	11
Keywords	<p><i>Electronic Transitions, Emission Spectra, Isotope Effect, Vibrational Energies, Raman Spectroscopy, Nuclear Magnetic Resonance (NMR), Nuclear Quadrupole Resonance (NQR), Photoelectron Spectroscopy (PES), Photoacoustic Spectroscopy (PAS), Molecular Structure</i></p>	

Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Muthu, K. S. (2010). *Applications of spectroscopy*. Medtech Publications.
2. Ambika, Dr., & Singh, P. P. (2017). *Organic spectroscopy*. Viva Books.

References Books Recommended –

1. Hollas, J. M. (2019). *Modern Spectroscopy* (John Wiley & Sons).
2. *Applied Electron Spectroscopy For Chemical Analysis* (Wiley-Interscience).
3. Parish, R. V. (1983). *NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry* (Ellis Horwood).
4. Drago, R. S. (1977). *Physical Methods in Chemistry* (Saunders Company).
5. Nakamoto, K. (2009). *Infrared and Raman Spectra: Inorganic and Coordination Compounds* (Wiley).
6. Williams, D. H., & Fleming, I. (2010). *Spectroscopic Methods in Organic Chemistry* (Tata Mcgraw-Hill).
7. Dyer, J. R. (1975). *Application of Spectroscopy of Organic Compounds* (Prentice Hall).

Online Resources–

➤ e-Resources / e-books and e-learning portals

Online Resources–

- (<https://archive.nptel.ac.in/courses/104/106/104106122/>)
- (<https://m.youtube.com/watch?v=o8zELwp358A>)
- (<https://archive.nptel.ac.in/courses/103/108/103108139/>)
- (<https://nptel.ac.in/courses/104108078>)

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

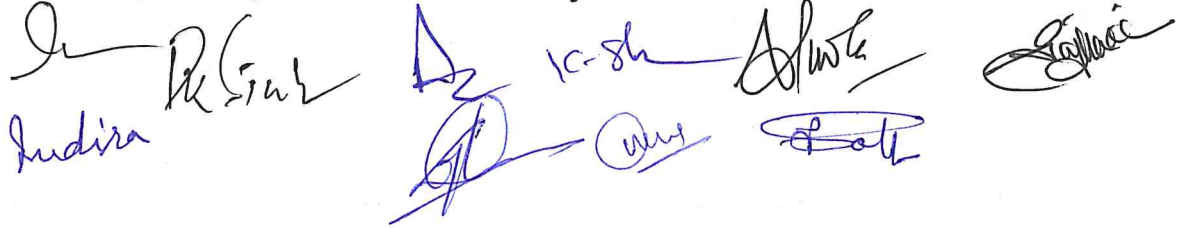
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

Name and Signature of Convener & Members of CBoS:



 The image shows several handwritten signatures in blue ink. On the left, there is a signature that appears to be 'Indira'. To its right are several other signatures, some of which are more stylized and difficult to decipher, but they appear to be names of the convener and members of the CBoS.

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science (Certificate / Diploma / Degree/Honors)		Semester - VII	Session: 2027-2028
1	Course Code	CHSE-06P	
2	Course Title	SPECTROSCOPY-I LAB. COURSE	
3	Course Type	DSE	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes (CLO)	<ul style="list-style-type: none"> ➤ Understand the fundamental principles of different spectroscopic techniques (Microwave, Infrared, Raman, NMR, UV-Vis (optional) and interpret the data obtained from various spectroscopic experiments. ➤ Relate the observed spectroscopic features to the structure, bonding, and dynamics of molecules. ➤ Develop practical skills in operating spectroscopic instrumentation and analyzing data. ➤ Enhance critical thinking and problem-solving skills in a laboratory setting. 	
6	Credit Value	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/Experiment Contents of Course	<p>Rotational Spectroscopy of a Diatomic Molecule (Microwave Spectroscopy): Analyze the rotational spectrum of simple molecules and calculate its moment of inertia.</p> <p>Infrared (IR) Spectroscopy of a Simple Molecule: Record and interpret the IR spectrum of a molecule, identifying functional groups based on characteristic frequencies.</p> <p>Raman Spectroscopy of a Liquid Sample: Compare the Raman spectrum of a liquid to its IR spectrum and explore the concept of mutual exclusion principle.</p> <p>Nuclear Magnetic Resonance (NMR) Spectroscopy of Simple Molecules: Analyze the ¹H NMR spectrum of simple organic molecule, understanding the effects of chemical environment and spin-spin coupling.</p> <p>(Ultraviolet-Visible (UV-Vis) Spectroscopy of a Conjugated System: Concentration Determination of Using Lambert Beer's Law, measurement of the UV-Vis spectrum of a chromophore-containing molecule (e.g., conjugated diene, transition metal complex) and analyze the observed absorption bands based on their λ_{max} (wavelength of maximum absorption) values, Investigate the electronic transitions of a conjugated molecules (polyenes and conjugated carbonyls) using UV-Vis spectroscopy, study the formation of a colored complex in a complexation reaction, Calculation of the equilibrium constant using Beer's Law and relevant equations.</p> <p>ESR: Common examples include studying free radicals generated during chemical reactions or analyzing organic radicals in biological systems.</p>	30

Keywords	<i>Electronic Transitions, Emission Spectra, Raman Spectroscopy, Nuclear Magnetic Resonance (NMR), Electron Spin Spectroscopy (ESR), UV-Visible Spectroscopy</i>
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Signature of Convener & Members (CBoS) :

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Mukherjee, P. S. (2009). *Electronic Absorption Spectroscopy and Related Techniques* (1st Ed.). New Age International (Publishers).
2. Sharma, Y. R. (2007). *Elementary organic spectroscopy* (Reprint). S. Chand Publishing.
3. Yadav, D. S. (2004). *Organic spectroscopy*. [Kindle Edition]. doi: 10.1007/978-1-4020-2575-4

Reference Books:

1. Smith, R. A. (1974). *Infrared and Raman Spectra of Inorganic Compounds*. CRC Press.
1. Abraham, R. J., & Settle, F. A. (2011). *Interpreting NMR Spectra*. Wiley-Blackwell.
2. Jaffe, H. H., & Orchin, M. (1962). *UV-Vis Spectral Library of Common Organic Molecules*. Prentice-Hall.
3. Carnevale, A., & Piacenti, P. (2017). *Experimental Techniques in Nuclear Magnetic Resonance Spectroscopy*. Royal Society of Chemistry.
4. Chalmers, J. M., & Griffiths, P. R. (2002). *Handbook of Vibrational Spectroscopy*. John Wiley & Sons, Ltd.

Online Resources–

> e-Resources / e-books and e-learning portals

- (<https://www.nist.gov/>)
- (<https://edu.rsc.org/resources/spectroscopy-videos/1041.article>)
- (<https://acsanalytical.org/>)
- (<https://nscl.msu.edu/>)
- (<https://new.nsf.gov/funding/opportunities/nsf-national-quantum-virtual-laboratory-nqvl>)
- (<https://www.chemtube3d.com/sym-operationsrotations/>)

Online Resources–

> e-Resources / e-books and e-learning portals

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	50 Marks
Continuous Internal Assessment (CIA):	15 Marks
End Semester Exam (ESE):	35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar + Attendance - 05 Total Marks - 15	
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment	
	P. Performed the Task based on lab. work	- 20 Marks
	Q. Spotting based on tools & technology (written) – 10 Marks	
	R. Viva-voce (based on principle/technology)	- 05 Marks
		Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

Indira Kumar, Dr. R. Sharma, Anurag Raj, [Signature]

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction			
Program: Bachelors in Science <i>(Honors/Honors with Research)</i>		Semester-VII	Session:2024-25
1	CourseCode	CHSE-07T	
2	CourseTitle	CHEMICAL KINETICS AND NUCLEAR CHEMISTRY	
3	CourseType	DSE	
4	Pre-requisite(if,any)	<i>As per Program</i>	
5	CourseLearning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ <i>To understand types/kinetics of composite reactions and elucidate mechanism and derive rate laws, calculate various activation parameters and predict feasibility of reaction of its basis.</i> ➤ <i>To explain the concept of acidity functions and illustrate the various rate correlations, isotopic effect and solvent effect.</i> ➤ <i>To discuss various aspects of nuclear models, nuclear reactions and nuclear reactors.</i> ➤ <i>To understand the principles of radioactivity, its measurements, counters, apply in determining reaction mechanism, structures, physicochemical properties and in chemical analysis.</i> 	
6	CreditValue	03Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	TotalMarks	Max.Marks:100	MinPassingMarks:40

PART-B: Content of the Course
TotalNo.of Teaching-learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics(Coursecontents)	No.of Period
I	<p>Kinetics of CompositeReactions Types of composite mechanism, rate equation for composite mechanisms- simultaneous and consecutive reactions, microscopic reversibility, some inorganic mechanisms- formation and decomposition of phosgene, decomposition of nitrogen pentoxide and ozone and thermal para-ortho hydrogen conversion.</p> <p>Kinetics of Catalytic Reactions Kinetics of acid-base catalysis: general and specific, hydrolysis of ester and amide; Enzyme catalysis, Micellar catalysis.</p> <p>Activation Parameters Activation parameters from experimental results- Arrhenius factor, standard free energy of activation, standard enthalpy of activation, entropy of activation and their physical significance.</p>	12
II	<p>Acidity function and various rate correlations Hammett acidity function, various treatments of rate correlation, Linear Free Energy Relationship (LFER), The Hammett equation, Zucker-Hammett-hypothesis, Bunnett-Olsen parameter.</p> <p>Isotopic Effect Theory of isotopic effects; Primary and secondary kinetic isotope effects. Heavy atom isotope effects, Tunneling effect. Kinetic solventeffects.</p> <p>Solvent Effect Qualitative theory of influence of solvent on reaction rate; Solvent effect in terms of dielectric constant, Grunwald - Weinstein parameter, Z and E values. Application of solvent polarity, Koppel - Palm treatment.</p>	11

III	<p>Nuclear Models Shell model – magic numbers, salient features and merits; liquid drop model – analogy with liquid drop, merits, semi-empirical equation; Fermi gas model; collective model and optical model.</p> <p>Nuclear Reactions Nuclear fusion and fission; Nuclear fission – mass, energy and charge distribution of fission products; fission neutrons; liquid drop model.</p> <p>Nuclear Reactors Natural uranium reactors, classification of reactors – typical reactors, Breeder reactor.</p>	11
IV	<p>Radioactivity General characteristics of radioactive decay and decay kinetics, measurement of radioactivity: Ionization chamber, electron pulse counters – variation of pulse size with voltage, Geiger-Muller counter, proportional counter and scintillation counters.</p> <p>Applications of Radioactivity Typical applications of radioisotopes as tracers; chemical investigation – reaction mechanism and structure determination; physicochemical applications – solubility of sparingly soluble and surface area of a powder; analytical applications – isotope dilution analysis and neutron activation analysis; age determination and medical applications.</p>	11
<i>Keywords</i>	<i>Kinetics, composite reactions, catalytic reactions, activation parameters, acidity function, isotopic effect, nuclear models, radioactivity.</i>	

Signature of Convener & Members (CBoS):

PART-C
Learning Resources: Textbooks, Reference Books and Others
<p>Textbooks Recommended– 1. Arnikar, H. J. (1995). <i>Essentials of nuclear chemistry</i> (No. 1653). New Age International.</p> <p>Reference Books Recommended–</p> <ol style="list-style-type: none"> Laidler, K. J., & Keith, J. (1965). <i>Chemical kinetics</i> (Vol. 2). New York: McGraw-Hill. Chorkendorff, I., & Niemantsverdriet, J. W. (2017). <i>Concepts of modern catalysis and kinetics</i>. John Wiley & Sons. Vannice, M. A., & Joyce, W. H. (2005). <i>Kinetics of catalytic reactions</i> (Vol. 134). New York: Springer. Investigation of Reduction Rates and Mechanism of Reactions. Edward Lewis.
<p>Online Resources – e-Resources/e-books and e-learning portals</p> <ul style="list-style-type: none"> ➤ https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry - The Central Science (Brown et al.)/14%3A_Chemical Kinetics/14.S%3A_Chemical Kinetics (Summary) ➤ https://www.vssut.ac.in/lecture_notes/lecture1425072667.pdf ➤ https://www.khanacademy.org/science/chemistry/chem-kinetics/arrhenius-equation/a/types-of-catalysts ➤ https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-3-radioactivity/ ➤ https://www.orano.group/en/unpacking-nuclear/all-about-radioactivity

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

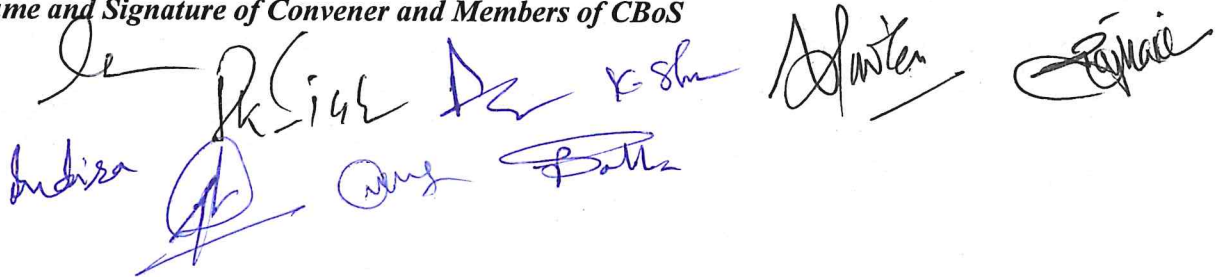
Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 &20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit- 4x10=40 Marks	

Name and Signature of Convener and Members of CBoS



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science (Honors/ Honors with Research)		Semester - VII	
Session: 2024-2025			
1	CourseCode	CHSE-07P	
2	CourseTitle	CHEMICAL KINETICS AND NUCLEAR CHEMISTRY LAB. COURSE.	
3	CourseType	DSE	
4	Pre-requisite(if,any)	As per Program	
5	Course Learning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ To understand basic concepts in Physical Chemistry through experiential learning. ➤ To acquaint with the basic principles of equipment/instruments and its applications. ➤ To determine the order of reaction with respect to various reactants and overall order and activation parameters using experimental data. ➤ To acquire the knowledge of radioactive decay and GM counter. 	
6	Credit Value	01Credit	(Credit = 30 Hrs laboratory or Field learning / training)
7	Total Marks	Max.Marks:50	MinPassingMarks:20

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics(Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	<p>Chemical Kinetics</p> <ol style="list-style-type: none"> 1. Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions. 2. Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction. <p>Polarimetry</p> <ol style="list-style-type: none"> 1. Determine the specific and molecular rotation of optically active substance. 2. To determine the concentration of a solution of an optically active substance. <p>Viscosity</p> <ol style="list-style-type: none"> 1. To determine viscosity of an organic liquid using Ostwald viscometer. 2. To verify Kendall's equation. 3. To study the variation of viscosity with temperature. <ol style="list-style-type: none"> 1. To study the effect of concentration of the reactant and catalysts on the rate of hydrolysis of ester. 2. To study the effect of temperature, concentration of the reactant and catalysts on the rate of hydrolysis of ester and to calculate energy of activation, frequency factor, enthalpy of activation, entropy of activation and free energy of activation. 	30

	<ol style="list-style-type: none"> 3. To study the kinetics of saponification of ethyl acetate by (a) Volumetric method (b) Conductometric method 4. To study the influence of ionic strength on the reaction between potassium persulphate and iodide. 5. To study the Kinetics of reaction between H₂O₂ and KI. 6. To study the kinetics of reaction between sodium formate and iodine. 7. To study the kinetics of reaction between acetone and iodine. 8. To determine the rate constant of hydrolysis / inversion of sugar using polarimeter and factors effecting. 9. To study some simple enzyme catalysed reaction. 10. To determine plateau and optimal operating voltage of Geiger-Muller counter. 1. To determine the dead time or resolving time of GM counter. 2. Simulation of Radioactive decay using rolling of dice. 	
Keywords	Chemical Kinetics, nuclear chemistry, Activation energy, GM counter, Decay kinetics	

Signature of Convener & Members (CBoS):

PART-C
Learning Resources: Text Books, Reference Books and Others
<p>Textbook Recommended-</p> <ol style="list-style-type: none"> 1. Athawale, V. D., & Oza, N. R. (2001). <i>Experimental physical chemistry</i>. New Age International Publishers. 2. Bahl, B. S., Bahl, A., & Tuli, G. D. (2018). <i>Essentials of physical chemistry (Vol. 2: Practical physical chemistry)</i>. S. Chand Publishing. <p>Reference Books Recommended</p> <ol style="list-style-type: none"> 1. Friedlander, G., Kennedy, J. W., Miller, J. M., Seaborg, G. T., & Nuclear Regulatory Commission. (2014). <i>Radiochemistry and nuclear chemistry (Vol. 2: Practical radiochemistry)</i>.
<p>Online Resources-</p> <p>https://www.mdpi.com/books/reprint/4856-synthesis-and-characterization-of-nanomaterials</p> <p>https://swayam.gov.in</p> <p>https://epathshala.nic.in</p> <p>http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000803.html</p>

PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 50 Marks		
Continuous Internal Assessment (CIA): 15 Marks		
End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar + Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory/Field Skill Performance : on spot Assessment A: Perform task Based on the lab work- 20 Mark B: Spotting Based on tools and techniques- 10 marks C: Viva-voce (Based on principle/technology)-05 Marks	Managed by Course teacher as per Lab. Status.

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM

PART-A: Introduction			
Program: Bachelors in Science <i>(Certificate/Diploma /Degree/Honors)</i>		Semester-VII	Session:2024-2025
1	CourseCode	CHSE-08T	
2	CourseTitle	ELECTRO CHEMISTRY & SURFACE CHEMISTRY	
3	CourseType	DSE	
4	Pre-requisite(if,any)	<i>As per Program</i>	
5	CourseLearning Outcomes(CLO)	<ul style="list-style-type: none"> ➤ <i>Understand electrochemistry fundamentals, explain laws and industrial applications</i> ➤ <i>To explain and derive equations related to the theory of strong electrolytes – Debye-Huckel law and its extensions, structure/models and thermodynamics of electrified interfaces, polarography and its applications.</i> ➤ <i>To describe and interpret various adsorption isotherms and its applications, concept and various aspects of micelles.</i> ➤ <i>To understand the fundamentals, types, and applications of surfactants and micelles.</i> 	
6	CreditValue	03Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	TotalMarks	Max.Marks:100	MinPassingMarks:40
PART-B: Content of the Course			
TotalNo.of Teaching-learning Periods(01 Hr. per period) - 45 Periods (45 Hours)			
Module /Unit	Topics(Coursecontents)		No.of Period
I	Electrochemistry-1 Electrolyte conductance: specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law indetermination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations. Single electrode potential, standard electrode potential, electrochemical series and its applications. Concept of overvoltage.		12
II	Theory of strong electrolyte: limitation of Ostwald's dilution law weak and strong electrolyte, Debye-Huckel-Onsager's(DHO) equation for strong electrolytes, relaxation, and electrophoretic effect. Migration of ions: Transport number-definition and determination by Hittorf method and movingboundary method. Electrochemical cells or Galvanic cells: reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell, effect of temperature on EMF of cell, Nernst equation calculation of ΔG , ΔH and ΔS for cell reaction.		11
III	Electrochemistry-2 Electrochemistry of solutions: Ion- solvent interactions, Debye-Huckel theory for activity coefficient of electrolyte solutions, ionic strength, Debye-Huckel limiting law, Debye- Huckel- Onsager treatment and its extension. Thermodynamics of electrified interface equations: Derivation of electro-capillarity, Lippmann equations, determination of surface excess. Structure of electrified interfaces: Guoy-Chapman and Stern models. Over		11

	potentials, exchange current density, derivation of Butler-Volmer equation. Tafel plot. Polarography theory - Ilkovic equation, half wave potential and its significance.	
IV	Surface Chemistry Adsorption Surface tension, capillary action, pressure difference across curved surface (Laplace equation), Gibbs adsorption isotherm, BET equation and estimation of surface area using BET equation. Micelles Surface active agents, classification of surface active agents, micellization, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization, reverse micelles.	11
Keywords	<i>Electrochemistry, Kohlrausch law, electrode potential, standard electrode potential, electrochemical series, Debye-Huckel limiting law, surface chemistry, micelles, adsorption.</i>	

Signature of Convener & Members (CBoS):

PART-C		
Learning Resources: Textbooks, Reference Books and Others		
Textbooks Recommended-		
1. Soni, P. L., & Mahajan, S. N. (2013). A textbook of physical chemistry (Vol. 3: Electrochemistry and surface chemistry). Sultan Chand & Sons. 2. Rakshit, P. C. (2009). A textbook of physical chemistry (Vol. 2: States of matter). Tata McGraw-Hill Education.		
Reference Books Recommended-		
1. Moroi, Y. (2013). <i>Micelles: theoretical and applied aspects</i> . Springer Science & Business Media. 2. Glasstone, S. (2011). <i>An introduction to electrochemistry</i> . Read Books Ltd. 3. Plieth, W. (2008). <i>Electrochemistry for materials science</i> . Elsevier. 4. Bikerman, J. J. (2013). <i>Surface chemistry: theory and applications</i> . Elsevier. 5. Somorjai, G. A., & Li, Y. (2010). <i>Introduction to surface chemistry and catalysis</i> . John Wiley & Sons.		
Online Resources - e-Resources/e-books and e-learning portals		
<ul style="list-style-type: none"> • https://ceramrtr.ceramika.agh.edu.pl/~szyszkin/eis/Modern%20Electrochemistry%20Vol%20B%20Electrode%20in%20Chemistry,%20Engineering.pdf • https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCYA5303.pdf • https://www.genesis-tutorials.com/wp-content/uploads/2018/04/Surface-chemistry.pdf • https://study.com/academy/lesson/micelles-biology-structure-function.html 		

Part-D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks		
Continuous Internal Assessment (CIA): 30 Marks		
End Semester Exam (ESE): 70 Marks		
Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 & 20 Assignment / Seminar - 10 Total Marks - 30	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section - A & B Section A: Q1. Objective - 10 x 1 = 10 Mark; Q2. Short answer type - 5 x 4 = 20 Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit - 4 x 10 = 40 Marks.	

Name and Signature of Convener and Members of CBoS

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		Semester - VII	Session: 2024-2025
1	CourseCode	CHSE-10P	
2	CourseTitle	NANOTECHNOLOGY AND SOLID STATE LAB. COURSE	
3	CourseType	DSE	
4	Pre-requisite(if,any)	As per Program	
5	CourseLearning.O utcomes(CLO)	<ul style="list-style-type: none"> ➤ The consolidation of knowledge about the structure-property relationship of solids through the self-directed synthesis, structure and property determination ➤ To apply the knowledge gained on the synthesis, structure and function of solid-state compounds. ➤ To acquire knowledge to synthesize nanomaterials and interpret its characteristics. ➤ To acquire the knowledge of basic sciences required to understand the fundamentals of nanomaterials 	
6	CreditValue	01Credit (Practical)	(Credit = 30Hrs laboratory or Field learning / training)
7	TotalMarks	Max.Marks:50	MinPassingMarks:20
PART-B: Content oftheCourse			
TotalNo.ofTraining/performancePeriods (01Hr.perperiod)(30 Period 30hours)			
Module	Topics(Coursecontents)		No.of Period
Lab./Field Training/ Experiment Contents of Course	Preparation of several solid-state compounds using different synthesis methods Characterization of the compounds by FTIR and X-ray diffraction Analysis of the crystal structures and the properties of the prepared solids Synthesis and characterization of nanoparticle of Fe ₃ O ₄ by chemical method. Synthesis of graphene oxide from graphene by chemical methods. Synthesis of graphene oxide from graphene by green methods. Synthesis and characterization of Ag nano-particles by green method. Synthesis and characterization of Ag nano-particles by chemical method. Synthesis and characterization of Cu nano-particles by green method. Synthesis and characterization of Cu nano-particles by chemical method. Synthesis and characterization of Ni nano-particles by chemical method. Synthesis and characterization of Ni nano-particles by green method Microwave synthesis of materials. organic compounds. The Nano World. Nanomaterials and Their Synthesis. Characterization Methods for Studying Nanomaterials. Laboratory Safety and Scientific Report Writing.		30
Keywords	X-ray Diffraction;Microwave Synthesis,Nanomaterails, Charecterization, Green Methods.		

Signature of Convener & Members (CBoS):

PART-C**Learning Resources: Text Books, Reference Books and Others****TextBooks Recommended-**

1. Venkatraman, D., Mukhopadhyay, C., & Das, K. (2018). *Introduction to nanoscience and nanomaterials*. McGraw-Hill Education.
2. Byrappa, K., & Yoshimura, M. (2010). *Functional nanomaterials and devices*. Elsevier.
3. Kumar, S. (2018). *Green chemistry for sustainable development*. Springer Nature Singapore Pte Ltd.

Reference Books Recommended-

1. Rao, C. N. R., Müller, A., & Cheetham, A. K. (2007). *Nanomaterials chemistry*. Wiley-VCH.
2. Chakravarty, A., & Singh, P. (2024). *Green synthesis of nanomaterials: Biological and environmental applications*. Wiley.
3. Sharon, M. (2018). *Green processes and sustainable chemistry*. Springer Nature Singapore Pte Ltd.
4. Anastas, P. T., & Warner, J. C. (1998). *Green chemistry: Theory and applications*. Oxford University Press.

OnlineResources-

- <https://www.mdpi.com/books/reprint/4856-synthesis-and-characterization-of-nanomaterials>
- <https://swayam.gov.in>
- <https://epathshala.nic.in>
- <http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000803.html>

Web Resources :-

Not Voodoo

The Safety Net

Comp Chem Website

PART -D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:****Maximum Marks:** 100 Marks**Continuous Internal Assessment (CIA):** 30 Marks**End Semester Exam (ESE):** 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 / 20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - 10 Total Marks - 30	
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit- 4x10=40 Marks	

Name and Signature of Convener & Members of CBoS: