FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

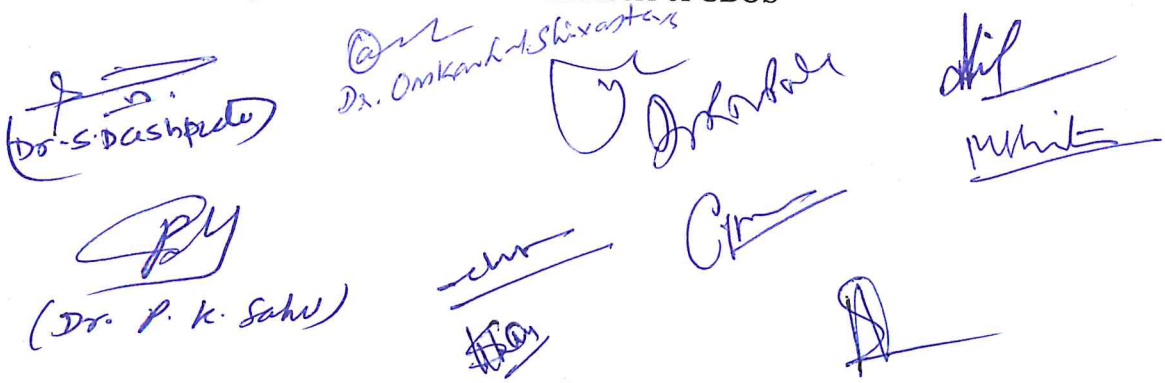
Part A: Introduction			
Program: Bachelor in Science (Degree/Honors)		**Semester - VI**	**Session:2024-2025**
1	Course Code	**MASC-06**	
2	Course Title	Metric Spaces	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of basic real analysis	
5	Course Learning Outcome (CLO)	**This Course will enable the students to-** ➢ Understand concepts of metric, distance, convergence, completeness, compactness, connectedness, Bolzano-Weierstrass property. ➢ Apply these concepts to key classes of spaces. ➢ Learn to analyze mapping between spaces. ➢ Identify the continuity of a function defined on metric spaces homeomorphism. ➢ Attain background for advanced courses in real analysis, functional analysis and topology.	
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	**Concepts in metric spaces:** Definition and examples of metric spaces, Open spheres and closed spheres, Neighborhoods, Open sets, Interior, exterior and boundary points, Closed sets, Limit points and isolated points, Interior and closure of a set, Boundary of a set, Bounded sets, Distance between two sets, Diameter of a set, Subspace of a metric space	15
II	**Complete Metric Spaces and Continuous Functions:** Cauchy and Convergent sequences, Completeness of metric spaces, Cantor's intersection theorem, Dense sets and separable spaces, Nowhere dense sets and Baire's category theorem, Continuous and uniformly continuous functions, Homeomorphism, Banach contraction principle.	15
III	**Compactness:** Compact spaces, Sequential compactness, Bolzano-Weierstrass property, Compactness and finite intersection property, Heine-Borel theorem, Totally bounded sets, Equivalence of compactness and sequential compactness, Continuous functions on compact spaces.	15
IV	**Connectedness:** Separated sets, Disconnected and connected sets, Components, Connected subsets of $\mathbb{R}$, Continuous functions on connected sets.	15

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

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Text Books Recommended- . 1. Mathematical Analysis II- Metric Spaces, J N Sharma, Krishna Prakashan Mandir, Meerut		
Reference Books Recommended- 2. Metric Spaces, P K Jain and Khalil Ahmad, New Age International, NewDelhi. 3. An Introduction to Metric Spaces, D Gopal, A Deshmukh, A S Randive and S Yadav, CRC Press, London.		
E-resources: https://onlinecourses.nptel.ac.in https://epgp.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
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	

Name and signature of convener & members of CBOS-



FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction				
Program: Bachelor in Science (Degree/Honors)		**Semester - VI**	**Session:2024-2025**	
1	Course Code	**MASE-04**		
2	Course Title	**Number Theory**		
3	Course Type	**Discipline Specific Elective (DSE)**		
4	Pre-requisite (if any)	Basic idea of theory of equation and congruence relations		
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Know about distribution of prime and congruence. ➢ Solve Number theoretic functions ➢ Learn primitive, Quadratic Reciprocity Law and Public Key Encryption		
6	Credit Value	4C	1Credit = 15 hours- Learning and observation	
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks : 40	

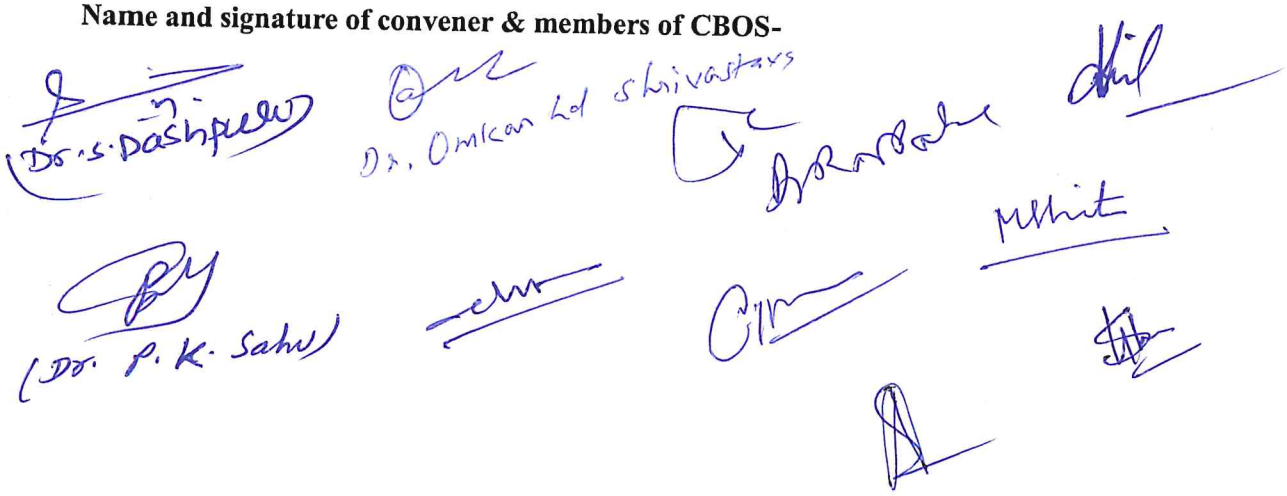
Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Distribution of Primes and Theory of Congruences** Linear Diophantine equation, Prime Counting function, Prime number theorem, Goldbach conjecture, Fermat and Mersenne primes, Congruence relation and it's properties, Linear congruence and Chinese remainder theorem, Fermats' little theorem, Wilson's theorem.	15
II	**Number Theoretic Functions** Number theoretic functions for dum and number of divisors, Multiplicative function, The Mobius inversion formula, The greatest integer function. Euler's phi-function and properties, Euler's theorem.	15
III	**Primitive** The order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots; Definition of quadratic residue of an odd prime, and Euler's criterion.	15
IV	**Quadratic Reciprocity Law and Public Key Encription** The Legendre symbol and it's properties, Quadratic reciprocity, Quadratic congruences with composite moduli; Public key encription, RSA encription and decription.	15

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

Part C - Learning Resource
Text Books, Reference Books, Other Resources
Text Books Recommended- 1. Burton, David M. (2012) : Elementary Number Theory(7th ed.) Mc-Graw Hill Education Pvt. Ltd. Indian Reprint.
Reference Books Recommended- 2. Jones, G. A., & Jones, J. Mary. (2005) : Elementary Number Theory. Undergraduate Mathematics Series(SUMS). First Indian Print.
E-Recourses: https://onlinecourses.nptel.ac.in https://epgp.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
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	

Name and signature of convener & members of CBOS-



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

PART – A: INTRODUCTION

Program: Bachelor in Science *(Degree/ Honors)*		Semester: VI	Session: 2024-25
1	Course Code	PHSC-06 T	
2	Course Title	Solid State Physics and Solid State Devices	
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: ➢ To give knowledge of some basic electronic components and circuits. Understand the basic principles and industrial applications of semiconductor diode, Zener diode and transistor ➢ Use diodes and transistors in electronic circuits ➢ Understand the construction working and applications of transistor ➢ Understand the construction and working principles of various instruments that are used in the physics laboratory ➢ Gain knowledge on importance of filter a circuit. Describe the working of oscillators	
6	Credit Value	03 Credits	1 Credit = 15 Hours- Learning & Observation
7	Total Marks	Maximum Marks: 100	Minimum Pass Marks:40

PART – B: CONTENTSOF THE COURSE

Total No. of Teaching-learning Periods (01 Hr. per period) – 45 Periods (45 Hours)

Unit	Topics	No. of Period
I	**India Semiconductor Mission** Vision, objectives and schemes of India Semiconductor Mission (ISM). **Crystallography** Amorphous and crystalline solids, Elements of symmetry, seven crystal system, Cubic lattice, crystal planes, Miller indices, Laue's equation for X-ray diffraction, Bragg's law, Bonding in solids, Classification, Cohesive energy of solids, Madelung constant, evaluation of parameters, vibrational modes of one-dimensional monoatomic lattice, Dispersion relation, Brillouin Zone.	11
II	**Introduction to semiconductors** Intrinsic and extrinsic semiconductors, concept of Fermi level, generation and recombination of electron hole pairs in semiconductors, Mobility of electrons and holes, drift and diffusion currents, Carrier Concentration at Normal Equilibrium inIntrinsic Semiconductors, Dependence of Fermi Level on Temperature and Doping Concentration, Temperature Dependence of Carrier Concentrations. **Semiconductor Diodes** p and n type semiconductors, Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode, PN junction and its characteristics, depletion width and potential barrier, junction capacitance, Structure and working of Zener diode and Tunnel diode.	12

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III	**Opto-electronic devices** Construction, working and applications of LEDs, Photodiode and Solar cell. **Power Supply** Half-wave Rectifier, Full-wave Rectifiers, Central-tapped and Bridge rectifier, Calculation of Ripple Factor and Rectification Efficiency,Zener diode as voltage regulator. Basic idea about capacitor filter, L-section filter and π-section filter.	10
IV	**Transistors:** n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Active, Cutoff, and Saturation Regions. Current gains α, β and γ. Relations between α, β and γ. Load Line analysis of Transistors. DC Load line and Q-point, FET, **Bipolar transistor as amplifier**: h-parameters (low frequency), h-parameter equivalent circuit (CE small signal amplifier), Classification of Amplifiers: Class A, B, and C **Sinusoidal Oscillator** Barkhausen's criterion for Self-sustained oscillations, Determination frequency of RC oscillator. Wein Bridge Oscillator, Hartley oscillator and Phase shift oscillator.	12
Keywords:	Crystalline solids, Miller indices, Bragg's law, semiconductors, Fermi level, junction diodes, transistors, filter circuits, amplifiers, oscillators	

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PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Basic electronics (Solid state), B L Thareja
2. Electronics: Fundamentals and Applications, D Chattopadhyay, PC Rakshit
3. Basic Electronics A Simplified Approach, Raghunandan G. H, Chaithanya G. H.
4. Basic Electronics, D.P. Kothari, I. Nagrath
5. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
6. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.

Reference Books Recommended-

1. Fundamentals of Solid State Physics by B.S. Saxena, R.C. Gupta, P.N. Saxena
2. Solid State Physics by S.O. Pillai
3. Semiconductor Physics and Devices by K. Purushothaman
4. Electronic Devices and Circuits by S. Salivahanan, N. Suresh Kumar
5. Optoelectronics and Optical Communication by B.P. Singh, Rekha Singh
6. Basic Electronics and Linear Circuits by N.N. Bhargava, D.C. Kulshreshtha, S.C. Gupta
7. Electronic Devices and Circuits by J.B. Gupta
8. Principles of Electronics by V.K. Mehta, Rohit Mehta

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

1. https://nptel.ac.in/courses/122106025
2. https://archive.nptel.ac.in/courses/108/101/108101091/
3. http://www.digimat.in/nptel/courses/video/117103063/L31.html
4. https://archive.nptel.ac.in/courses/117/103/117103063/

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** Assignment/ Seminar (1): **10** Total Marks: **30**	Better marks out of the two Test / Quiz + marks obtained 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, **1 out of 2** from each unit- **4x10 =40 Marks**	

Name and Signature of Convener & Members of CBoS:

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

PART – A: INTRODUCTION

Program: Bachelor in Science (Degree/ Honors)	Semester: VI	Session: 2024-25

1	Course Code	**PHSC- 06 P**	
2	Course Title	**Solid State Physics and Solid State Devices**	
3	Course Type	**Discipline Specific Course**	
4	Pre-requisite (if any)	**As per Program**	
5	Course Learning Outcomes (CLO)	After the completion of the course, the students are expected to: ➢ Assemble required parts/devices and arrange them to perform experiments. Record/ observe data as required by the experimental objectives. ➢ Analyse recorded data and formulate it to get desired results. ➢ Interpret results and check for attainment of proposed objectives related to theory of semiconductors. ➢ Apply theory and principle of semiconductors for various device applications ➢ Verify various I/P, O/P and other characteristics of various semiconductor (solid state) devices and interpret the phenomena.	
6	Credit Value	**01 Credit**	**1 Credit = 30 Hours Laboratory Work**
7	Total Marks	**Maximum Marks: 50**	**Minimum Pass Marks: 20**

PART – B: CONTENT OF THE COURSE

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

Sr. No.	Objects (At least 10 of the following or related Experiments)	No. of Periods
1	To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150°C) and to determine its band gap.	30
2	To determine the Hall coefficient of a semiconductor sample.	
3	To study V-I characteristics of PN junction diode, and Light emitting diode.	
4	To study the V-I characteristics of a Zener diode and its use as voltage regulator.	
5	Study of V-I & power curves of solar cells, and find maximum power point & efficiency.	
6	To study the characteristics of a Bipolar Junction Transistor in CE configuration.	
7	To study the various biasing configurations of BJT for normal class A operation.	
8	To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.	
9	To study the frequency response of voltage gain of a RC-coupled transistor amplifier.	
10	To design and study a Wien bridge oscillator.	
11	To design a phase shift oscillator of given specifications using BJT.	
12	To study the Colpitt`s oscillator.	

Keywords:	Semiconductor Resistivity, Hall Coefficient, Diode Characteristics, Zener Diode Voltage Regulation, Solar Cell Efficiency, Bipolar Junction Transistor (BJT), BJT Biasing Configurations, Oscillator Design

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PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
4. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India.
5. Practical Physics B.Sc III : R P Goyal, Shivlal Agrawal Publications

Reference Books Recommended-

1. Semiconductor Physics and Devices by Donald A. Neamen
2. Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky
3. Microelectronic Circuits by Adel S. Sedra and Kenneth C. Smith
4. Practical Electronics for Inventors by Paul Scherz and Simon Monk

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

1. Virtual Lab : https://vlab.amrita.edu/?sub=1&brch=282
2. https://vlab.amrita.edu/index.php?sub=1&brch=282&sim=370&cnt=3
3. https://bop-iitk.vlabs.ac.in/exp/energy-band-gap/simulation.html
4. http://vlabs.iitkgp.ac.in/ssd/index.html#
5. http://vlabs.iitkgp.ac.in/psac/newlabs2020/ssds/#
6. https://ae-iitr.vlabs.ac.in/List%20of%20experiments.html
7. https://da-iitb.vlabs.ac.in/List%20of%20experiments.html

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 **+Marks** obtained in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory Performance: On spot Assessment** **Performed the Task based on lab. work - 20 Marks** **Spotting based on tools & technology (written) – 10 Marks** **Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

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

PART-A: INTRODUCTION

Program : Bachelor in Science *(Degree/Honors)*	Semester - VI	Session: 2024-2025

1	**Course Code**	**PHSE-04 T**		
2	**Course Title**	**Numerical Methods and C Programming**		
3	**Course Type**	**Discipline Specific Elective**		
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: ➢ Analyse the convergence of solutions to numerical methods.Understand the principles of Gaussian elimination, pivoting, and iterative methods to solve linear systems ➢ Use interpolation methods, Perform numerical differentiation and integration using Newton-Cotes formulae ➢ Explain the roles of compilers, interpreters, and operating systems, Learn the basics of C programming		
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	Methods for determination of zeroes of linear and nonlinear algebraic equations and transcendental equations, convergence of solutions. Solution of simultaneous linear equations, Gaussian elimination, pivoting, iterative method, matrix inversion, Finite differences, interpolation with equally spaced and unevenly spaced points, curve fitting, polynomial least squares and cubic spline fitting. Numerical differentiation and integration, Newton-Cotes formulae, error estimates, Gauss method.	**13**
II	Numerical solution of ordinary differential equations, Euler and Runga-Kutta methods, Solution of related problems, Predictor-corrector method, Solution of related problems, Elementary ideas of solutions of partial differential equations	**10**
III	Problem analysis and solving scheme. Computational procedure, programming outline, flow chart. Branching and looping writing. Character set, constants, (numeric string) variables (numeric string) rules for arithmetic expressions and hierarchy of operators, rational expressions, logical expressions, and operators, library functions. Identifiers, qualifiers, define statements, value Initialized variables, operators, and expressions. Operator precedence and associativity. scanf with specifier, search set arrangements and suppression Character, format specifier for scanf. Control structure, if statement, if else statement, multiway decision, compound statement.	**10**
IV	Loops: for loop, while loop, do while loop, break statement, compound statement continue statement, go to statement, Function - function main, function accepting more than one parameter, user defined and library function concept associatively with functions, function parameter, return value, recursion comparison. Arrays, strings, multidimensional array, array of strings function in string	**12**

Keywords	Transcendental equations, Ordinary differential equations, Numerical integration, Numerical differentiation, Flow charts, C - Statement.

Signature of Convener & Members (CBoS):

10/6/24

PART–C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended –

1. Numerical Methods for Scientists and Engineers by R. W. Hamming
2. Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, and R. K. Jain
4. Programming in ANSI C by E. Balagurusamy
5. Let Us C" by Yashavant Kanetkar
6. Numerical Methods and Programming by P. B. Patil and U. P. Verma
7. Numerical Methods with Programs in C by T. Veerarajan and T. Ramachandran
8. Numerical Methods by B S Grewal

Reference Books Recommended –

1. Sastry: Introductory Methods of Numerical Analysis
2. Rajaraman: Numerical Analysis
3. Numerical Methods by Dr. P. Kandasamy, Dr. K Thilagavathy, Dr. K. Gunvanthi
4. Fundamentals of Numerical Methods by Rajeev K Bansal

Online Resources–

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

1. Numerical methods https://archive.nptel.ac.in/courses/111/107/111107105/
2. Numerical analysis https://archive.nptel.ac.in/courses/111/101/111101165/
3. Numerical Methods for Engineers https://archive.nptel.ac.in/courses/127/106/127106019/
4. Introduction to Numerical Methods https://nptel.ac.in/courses/105105043

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): Assignment/Seminar- Total Marks -	**20 +20** **10** **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- **4 x 10=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 *(Degree/Honors)*			**Semester - VI**	Session: 2024-2025
1	**Course Code**	**PHSE-04 P**		
2	**Course Title**	**Numerical Methods and C Programming**		
3	**Course Type**	**Discipline Specific Elective**		
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: ➢ Get experimental Knowledge of computational methods in physics ➢ Learn C language ➢ Use C programming to solve various equations ➢ Perform Interpolation and curve fittings through various tools.		
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) **At least 10 of the following or related Experiments**	No. of Period
Lab./ Experiment Contents of Course	Any 8 program from the list given below or similar program. 1. To solve Simultaneous Linear equation by Gauss Elimination Method 2. To calculate the root of Transcendental equation by Newton-Raphsons Method 3. Solving the system of Linear simultaneous equation by Gauss-Serdel Method 4. Numerical Integration by Simposon's 1/3 rule 5. Solving simultaneous Linear equation by Gauss-Jordan method 6. Solution of differential equation by Euler's Method 7. To invert a given Matrix by Gauss-Jordan Method 8. Solution of differential equation by Runge-Kutte Method 9. To fit the given data in straight line by Linear Regression Method (a) Write a program to find the largest of n number of series. (b) To calculate the standard deviation of a given set of data 10. To write a program to compute the complex roots of a given polynomial of Nth degree by Graffe's method 11. To write a program to compute the Eigen Values a given Matrix 12. To integrate a given function by (a) Trapezoidal method or by (b) Gauss quadrature 13. To find solutions of first order, ordinary differential equation by Taylor method	**30**
Keywords	Gauss Elimination, Newton-Raphson, Numerical Integration, Euler's Method, Runge-Kutta, Linear Regression, Eigenvalues, Differential Equations	

Signature of Convener & Members (CBoS):

PART–C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended –

1. Introductory Methods of Numerical Analysis: Sastry:
2. Numerical Analysis : Rajaraman
3. Numerical methods : Antia
4. Numerical Methods by Dr. P. Kandasamy, Dr. K Thilagavathy, Dr. K. Gunvanthi
5. Fundamentals of Numerical Methods by Rajeev K Bansal
6. Numerical Methods in Engineering & Science: with Programs in C, C++, and MATLAB by B S Grewal
7. Raja Raman: FORTRAN programming

Reference Books Recommended –

1. Numerical Methods: Problems and Solutions by M.K. Jain, S. R. K. Iyengar, and R. K. Jain
2. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, and R. K. Jain
3. Numerical Methods: Principles, Analysis, and Algorithms by A. Singaravelu
4. Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale

Online Resources–

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

1. Numerical methods https://archive.nptel.ac.in/courses/111/107/111107105/
2. Numerical analysis https://archive.nptel.ac.in/courses/111/101/111101165/
3. Numerical Methods for Engineers https://archive.nptel.ac.in/courses/127/106/127106019/
4. Introduction to Numerical Methods https://nptel.ac.in/courses/105105043

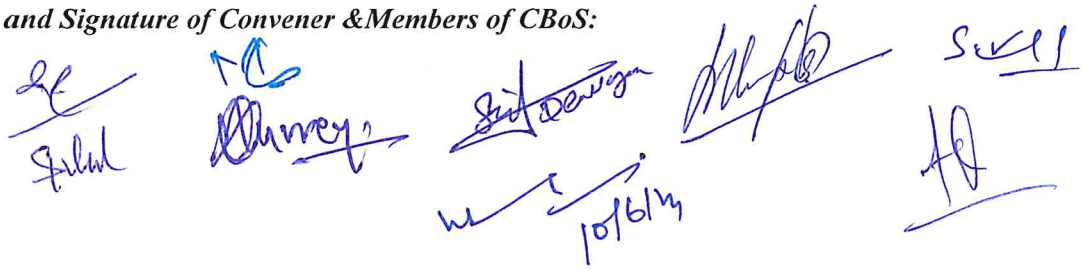
PART-D: ASSESSMENT AND EVALUATION

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** **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**

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 *(Degree/Honors)*			**Semester -VI**	Session: **2024-2025**
1	**Course Code**	**DSC-06T**		
2	**Course Title**	**ORGANIC AND PHYSICAL CHEMISTRY- II**		
3	**Course Type**	**DSC**		
4	**Pre-requisite(if,any)**	*As per Program*		
5	**Course Learning. Outcomes(CLO)**	➢ *To understand role of quantum mechanics in chemistry.* ➢ *To know the organic compound in biological system* ➢ *To know the polymers in chemistry their preparation and application of polymer.* ➢ *To learn the techniques for studying the structure of chemical molecule.*		
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 Periods
I	**Quantum Chemistry I:**-Black body radiation ,plank's radiation law, photoelectric effect, Compton effect, de-Broglie's idea of matter and waves and its experimental verification. Heisenberg's uncertainty principle, operators: Hamiltonian operator, angular momentum operator, Laplacian operator, postulates of quantum mechanics, Eigen values, Eigen function, Schrodinger time independent wave equation, physical significance of Ψ and Ψ^2. Application of Schrodinger wave equation to Particle in one dimensional box. **Quantum Chemistry II:**-Quantum mechanical approach of molecular orbital theory basic idea, criteria of forming Molecular orbitals, LCAO(Linear combination of atomi orbital) approximation, formation of H_2^+ ion, calculation of energy of energy levels fron wave functions, bonding and antibonding wave functions, concept of sigma bonding sigma antibonding, pi bonding and pi anti bonding M.Os. and their characteristics Comparison of M.O. theory and V.B. Model.	12
II	**(A)Carbohydrate:** Introduction and classification of carbohydrate, monosaccharide: open chain and cyclic structure of glucose and fructose, epimer and anomers of glucose. Relative and absolute configuration of carbohydrates, Specific rotation and mutarotation of glucose. Determination of ring size in glucose. Chemical properties of gluose: Osazone formation, oxidation, reduction, Reaction with HIO_4, Interconversion of Glucose and fructose, Chain lengthening and chain shortening. Structure of Disaccharide Sucrose, Lactose and Maltose. Structure of polysaccharide: Starch, Cellulose. **(B) Amino Acid & Protein**: amino acid types of amino acid, isoelectric point, structure of protein primary, secondary and tertiary structure. **(C) Nucleic Acid:** components of nucleic acid, types of nucleic acid, nucleoside, nucleotide, structure of nucleic acid.	11
III	**(A)Organometallic compound:** Preparation, Structure, and chemical reactions of organomagnesium(Grignard Reagent), Organozinc compound, Organolithium compound, Organosulphur compound **(B) Synthesis of organic compound via enolates :** Active methylene compound, Keto-enol tautomerism, Alkylation of diethyl malonate and acetoacetic ester. Claisen ester	11

	condensation and Robinson anealation. Synthesis of monoalkyl and dialkyl derivative, fatty acids, dibasic acid, α, β unsaturated acid, valeric acid, monoketone, diketone, heterocyclic compounds etc.	
IV	Spectroscopy II(Organic) (A) Infra red Spectroscopy: Basic principle and instrumentation, introduction, Modes of vibrations, fundamental band of different bond and functional groups, identification of band for compound and IR spectra of different compounds. Applications of IR spectroscopy. (B)Principle and instrumentation of UV-visible spectroscopy, Introduction, wavelength maxima, Beer Lambert's Law, Shifts in UV-visible spectra, Chromophore –Auxochrome theory, Effect of conjugation on wavelength maxima. Types of electronic transitions. Applications of UV-visible spectroscopy. Woodward Fischer rule for polyene wavelength maxima calculation. (C) NMR (Nuclear Magnetic Resonance): Introduction to NMR, Basic principle and instrumentation, No. of signal in PMR(proton Magnetic Resonance),Chemical shift, Sheilding and deshielding effect, Splitting of signal or spin-spin interaction, Intensity of Signal and peak height and peak ratio. Coupling Constant J. Proton NMR of some compound like ethanol, propanol, toluene, acetaldehyde, ketone,1,2-dibromoethylene etc.	**11**
Keywords	***Particle in one Dimensional Box, Hydrogen atom, Proton NMR, UV Visible, Vibrational Spectra. Woodward Fischer Rule.***	

SignatureofConvener&Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Tandon, M. M. N., & Agarwal, S. C. (2022). Unified chemistry. Shivalal and Company.*
2. *Sharma, B. K. (2010). Spectroscopy comprehension. Goel Publishing House.*
3. *Puri, B. R., Sharma, L. R., & Pathania, M. S. (2021). Principles of physical chemistry. Vishal Publications.*
4. *Gurtu, J. N., & Gurtu, R. (2015). Advanced physical chemistry. Pragati Prakashan.*

Reference Books Recommended:

5. *Atkins, P. W., de Paula, J., & Keeler, J. A. (2005). Atkins' physical chemistry Oxford University Press.*
6. *Pandya, A. J. (2010). A textbook of biochemistry: Nucleic acids, proteins and carbohydrates.*
7. *Korte, F., & Goto, M. (2009) Nucleic acids, proteins and carbohydrates, John Willy & Sons*

Online Resources:

- **https://onlinecourses.nptel.ac.in/noc23_cy09/preview**
- **https://www.udemy.com/course/ochemnmr/?couponCode=LEADERSALE24A**
- **https://en.wikipedia.org/wiki/Bioorganic_chemistry#:~:text=Biophysical%20organic%20chemistry%20is%20a,nature%20to%20determine%20their%20properties.**
- **https://onlinecourses.nptel.ac.in/noc21_cy38/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** ~~40~~ **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.,**1out of 2** from each unit-**4x10=40Marks**	

Name and Signature of Convener & Members ofCBoS:

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

PART-A: Introduction				
Program:Bachelor in Science *(Diploma / Degree)*			**Semester VI**	Session: **2024-2025**
1	**CourseCode**	**CHSC-06P**		
2	**CourseTitle**	**CHEMISTRY LAB COURSE-VI**		
3	**CourseType**	**DSC**		
4	**Pre-requisite(if,any)**	***As per Program***		
5	**Course Learning. Outcomes(CLO)**	➢ ***To understand the basic principles involved in separation and identification of organic compound.*** ➢ ***To apply the knowledge of qualitative and quantitative estimations in real sample analysis.*** ➢ ***To learn the synthesis of organic compounds*** ➢ ***To learn the use of conductometer and spectrophotometer in analysis.***		
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.ofPeriod**
Lab./Field Training/ Experiment Contents of Course	1)To determine the solubility and solubility product of Sparingly soluble salt using conductometer. 2)To titrate potentiometrically the given ferrous sulphate solution using KMnO4 / $K_2Cr_2O_7$ as titrant and calculate redox potential of Fe^{2+} /Fe^{3+} system on the hydrogen scale. **Organic mixture analysis** Separation and Identification of two solid organic compounds from given binary organic mixture by H_2O,$NaHCO_3$, NaOH for separation and preparation of suitable derivative. **Synthesis of one organic compound :-** (a)synthesis of m-dinitrobenzene from nitrobenzene. (b) synthesis of acetanilide from aniline (c)Preparation of iodoform from ethanol and acetone (d)Preparation of p-bromoacetanilide (e)Preparation of 2,4,6-tribromophenol. (f)Preparation of methyl orange and methyl red. (g)Preparation of benzoic acid from toluene. (h)Preparation of aniline from nitrobenzene.	**30**
Keywords	***Organic mixture analysis, synthesis of organic compound, solubility product, conductometer.***	

Signature of Convener & Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Tandon, M. M. N., & Shiva Lal Agarwal & Company. (2012). BSc. Practical Chemistry.*
2. *Pandey, O. P., BajPai, D. N., Giri, S., & S. Chand. (2013). Practical Chemistry.*

Reference Books Recommended:

1. *Bassett, J., Denney, R. C., Jeffery, G. H., & Mendham, J. (2000). Vogel's Text Book of Qualitative Analysis (revised). ELBS.*
2. *Das, R. C., & Behra, B. (2002). Experimental Physical Chemistry. Tata McGrawHill.*

Online Resources:

- **e-Resources / e-books and e-learning portals**
- **https://chem.libretexts.org/Courses/University_of_California_Davis/Chem_4C_Lab%3A_General_Chemistry_for_Majors/Chem_4C%3A_Laboratory_Manual/05%3A_Potentiometric_Titrations_(Experiment)**
- **https://vlab.amrita.edu/?sub=2&brch=191**
- **https://www.orgsyn.org/**

PART-D: Assessment and Evaluation

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

Continuous Internal Assessment(CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks -**15**	Better marks out of thetwo Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks
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:

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

PART- A: Introduction				
Program: Bachelor in Science *(/ Degree/Honors)*			**Semester - VI**	Session: **2024-2025**
1	**Course Code**	**CHSE-04T**		
2	**Course Title**	**HETEROCYCLIC CHEMISTRY**		
3	**Course Type**	**DSE**		
4	**Pre-requisite** (if, any)	***- As per Program***		
5	**Course Learning. Outcomes (CLO)**	➢ ***To apply Hantzsch-Widman and IUPAC nomenclature for heterocyclic compounds.*** ➢ ***To understand the concept of tautomerism in aromatic heterocycles and to analyze the influence of strain on small ring heterocycles.*** ➢ ***To learn the synthesis and reactions of three-, four-, five- and six-membered heterocycles with one heteroatom.*** ➢ ***To learn the synthesis of important bicyclic heterocycles (indole, quinoline, and isoquinoline) and learn the mechanisms of reactions.***		
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	**Nomenclature and Stereochemistry** Introduction to heterocyclic compounds, Trivial names of common ring systems Hantzsch-Widman nomenclature for: Monocyclic heterocycles, Fused heterocycles Bridged heterocycles Replacement of Hantzsch-Widman nomenclature by IUPAC nomenclature	11
II	**Tautomerism and Strain in Heterocycles** Tautomerism in aromatic heterocycles The effect of strain: Bond angle strain Torsional strain Consequences of strain in small ring heterocycles **Three- and Four-Membered Heterocycles** Synthesis and reactions of: Aziridines, Oxiranes (epoxides), Thiiranes, Azetidines Oxetanes, Thietanes	11
III	**Five- and Six-Membered Heterocycles with One Heteroatom** Preparation and properties (chemical and physical) of: Pyrroles (including Paal-Knorr synthesis, Knorr pyrrole synthesis, and Hantzsch synthesis), Furan, Thiophene Pyridine (including Hantzsch synthesis) **V. Five-Membered Heterocycles with Two Heteroatoms** Preparation, properties, and Substitution reactions of: Pyrazoles, Imidazoles, Oxazoles	11
IV	**Bicyclic Heterocycles: Reactions and Synthesis** Indole (including Fischer indole synthesis and Madelung synthesis) Quinoline and isoquinoline (including Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, and Pomeranz-Fritsch reaction) Reactions of bicyclic heterocycles: Mechanisms of electrophilic and nucleophilic substitutions, Oxidation and reduction reactions	12
Keywords	***Heterocyclic Chemistry, Nomenclature, Tautomerism, Strain, Rings, Synthesis, Reactions, Bicyclic hetrocycles,***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books Recommended

1. *Gupta, R.R., Kumar, M., & Gupta, V. (Eds.) (1984). Heterocyclic Chemistry (Vol. 1-3). Springer Verlag.*
2. *Arora, M. K. (2009). Heterocyclic chemistry. New Age International Publishers.*

Reference Books Recommended

1. *Acheson, R.M. (1961). An Introduction to the Heterocyclic Compounds. John Wiley.*
2. *Katritzky, A.R., & Rees, C.W. (Eds.) (1984). Comprehensive Heterocyclic Chemistry. Pergamon Press.*
3. *Joule, J.A., Mills, K., & Smith, G.F. (2010). Heterocyclic Chemistry. Wiley-Blackwell.*
4. *Gilchrist, T.L. (1992). Heterocyclic Chemistry. Pearson Education Limited.*

Text Books Recommended -

Online Resources–

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

- https://www.masterorganicchemistry.com/
- https://docs.chemaxon.com/display/lts-helium/functions-by-categories.md
- https://archive.catalog.arizona.edu/faculty/courses/001/chem.html
- https://www.organic-chemistry.org/
- https://www.sciencedirect.com/org/journal/journal-of-heterocyclic-chemistry
- https://www.wiley.com/en-us/Heterocyclic+Chemistry%2C+5th+Edition-p-9781405133005
- https://www.amazon.com/Chemistry-Heterocycles-Structures-Reactions-Applications/dp/3527327479
- https://www.wiley.com/en-us/Name+Reactions+in+Heterocyclic+Chemistry-p-9780471302155

Online Resources–

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

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 & Members of CBoS:

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

PART- A: Introduction				
Program: Bachelor in Science *(Degree/Honors)*			**Semester - VI**	Session: **2024-2025**
1	**Course Code**	**CHSE-04P**		
2	**Course Title**	**HETEROCYCLIC CHEMISTRY LAB. COURSE I**		
3	**Course Type**	**DSE**		
4	**Pre-requisite** (if, any)	*As per Program*		
5	**Course Learning. Outcomes (CLO)**	➢ *Proficient in basic laboratory techniques like distillation, extraction, crystallization, and chromatography.* ➢ *Skilled in the synthesis and purification of heterocyclic compounds.* ➢ *Adept at using various spectroscopic techniques (IR, NMR, MS) to characterize heterocyclic structures.* ➢ *Able to analyze reaction mechanisms and predict product formation in heterocyclic reactions.*		
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	**Synthesis and Characterization of a Simple Pyridine Derivative:** This experiment will involve the synthesis of a pyridine derivative (e.g., 2-aminopyridine, 2,6-dimethylpyridine(Hantzsch-syntheis) or nicotinamide) followed by purification (recrystallization/distillation) and characterization using melting point, thin-layer chromatography (TLC). **Synthesis and Characterization of a Five-Membered Heterocycle (e.g., Imidazole, Pyrazole, Furan):** Students will synthesize an 2,5 dimethyl pyrrole(Paal-Knorr synthesis) imidazole, pyrazole derivative using a condensation reaction. Purification (distillation/recrystallization) and characterization using techniques like melting point , TLC. **Synthesis and Characterization of a Benzofused Heterocycle** This experiment experiment will involve the synthesis of Coumarins, Coumarone, 2-Phenylindole, Indigo(Dye) **Isolation of Caffeine from Tea Leaves:** This practical involves the extraction and purification of caffeine (a purine derivative) from tea leaves. Techniques like solvent extraction, filtration, and sublimation might be employed. **Identification of Unknown Heterocycle:** Students will be presented with an unknown heterocyclic compound and utilize various spectroscopic techniques (IR, NMR, mass spectrometry) to identify the functional groups and propose the structure of the unknown molecule.	**30**
Keywords	***Synthesis, Characterization, Heterocycles, Techniques, TLC, IR, Extraction, Isolation***	

Signature of Convener & Members (CBoS) :

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. *Ahluwalia, V. K., & Aggarwal, R. (2000). Comprehensive practical organic chemistry: Preparations and quantitative analysis, Universities Press*

Reference Books Recommended –

1. *Miller, J. R., & Friswell, M. D. (2000). Organic Chemistry Laboratory Techniques. Pearson Education Limited.*
2. *Mohrig, J., Garland, T. L., & Hammond, P. C. (2022). Techniques and Experiments in Organic Chemistry. W. H. Freeman and Company*

Online Resources–

- **e-Resources / e-books and e-learning portals**
- (https://www.cas.org/)
- (https://www.youtube.com/channel/UCEWpbFLzoYGPfuWUMFPSaoA)
- (https://ocw.mit.edu/courses/chemistry/)

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** 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** **J. Performed the Task based on lab. work - 20 Marks** **K. Spotting based on tools & technology (written) – 10 Marks** **L. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS: