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

PART- A: Introduction

Program: Bachelor in Science (CS) *(Certificate / Diploma / Degree/Honors)*	Semester – III	Session: 2024-2025

1	Course Code	**CSSC -03T**	
2	Course Title	**Data Structure**	
3	Course Type	**DSC (Discipline Specific Course)**	
4	Prerequisite (if, any)	*As per program*	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: • Understand the fundamentals and applications of data structure. • Utilize various algorithms for real world problem solving. • Understanding about data management in computer memory. • Apply stack, Queue, Lists, Trees and Graphs for real world application. • Understand how various data structures can be used to implement through any programming language.	
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	**Introduction and Basic Concepts:** Introduction, Fundamentals of Algorithms, Data types: Primitive, Non-Primitive Absent Data Type (ADT), Classification of Data Structure: Linear and Nonlinear Data Structure. **Array:** Arrays and its types, Memory allocation and address calculations of Array, Sparse Array. **Linked List:** Types of Linked List and various Operations Like INSERT, DELETE, TRAVERSE. Introduction and Application of Stack and Queue.	12
II	**Stack:** Definition, Operations PUSH, POP, Implementations using Array and Linked list, Applications of Stack: Infix, Prefix, Postfix representation and conversion using Stack, Postfix expression evaluation using Stack, Recursion using Stack. **Queue:** Definition, Types of Queues: Priority Queue, Circular queue, Double Ended Queue, operations of Queue INSERT, DELETE, TRAVERSE, Implementation Queue using Array and Linked list, Applications of Queue.	11
III	**Tree:** Definition of Trees and their types, Binary trees, Properties of Binary trees and operations Insertion, deletion, searching and traversal algorithm: preorder, post order, in-order traversal, Binary Search Trees, Implementations, AVL Trees. **Graph:** Definition of Graph and their types, Adjacency and Incident (matrix & linked list) Representation of graphs, Graph Traversal – Breadth first Traversal, Depth first Traversal, Connectivity of Graphs; Weighted Graphs, Shortest Path Algorithm, Spanning Tree, Minimum Spanning Tree, Kruskal's and Prim's Algorithms.	11
IV	**Sorting Methods:** Types of Sorting Selection Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort, Radix Sort. **Searching**: Linear search, Binary search.	11
Keywords	*Data, ADT, Array, Linked List, Stack, Queue, Tree, Graph, Searching, Sorting.*	

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Hota
Chairman

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

- Michael T. Goodrich, Data Structures and Algorithms in C++, Wiley
- Horowitz and Sahani, Fundamentals of Data Structures, Computer Science Press

Reference Books ***Recommended:***

- Alfred V. Aho, Data structures and Algorithms, Jhon E. Hopcroft and J.E. Ullman.
- Jean Paul Trembley and Paul Sorenson, An Introduction to Data Structures with Applications, TMH, International Student Edition
- R. Kruse, Leung &Tondo, Data Structures and Program Design in C, PHI publication, 2nd Edition

Online Resources:

- NPTEL YouTube Channel: Data Structure Complete course
- https://youtube.com/playlist?list=PLc2MoXNv7E4mtsPlnn9BnTOENXsGyoDgR&si=aAYaVZ-vWfeuhFEO
- NPTEL YouTube Channel: Introduction to Data Structure
- https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F&index=1
- NPTEL YouTube Channel: Stacks
- https://www.youtube.com/watch?v=g1USSZVWDsY&list=PLBF3763AF2E1C572F&index=2
- NPTEL YouTube Channel: Queues and linked list
- https://www.youtube.com/watch?v=PGWZUgzDMYI&list=PLBF3763AF2E1C572F&index=3
- NPTEL YouTube Channel: Trees
- https://www.youtube.com/watch?v=tORLeHHtazM&list=PLBF3763AF2E1C572F&index=6
- NPTEL YouTube Channel: Graphs
- https://www.youtube.com/watch?v=9zpSs845wf8&list=PLBF3763AF2E1C572F&index=24
- W3schools Data Structure Reference: DSA Tutorial (w3schools.com)

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:

Chairman

ANJEETA KUJUR

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

PART- A: Introduction				
Program: Bachelor in Science (CS) *(Certificate / Diploma / Degree)*			**Semester – III**	Session: 2025-2026
1	Course Code	**CSSC-03P**		
2	Course Title	**Lab 3: Data Structure Using C++**		
3	Course Type	**DSC**		
4	Prerequisite	*As per program*		
5	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Understand how the concept of data structure can be implemented programmatically. • Implement the fundamentals data structure through C and C++ • Understand the functioning of Array and linked list programmatically. • Understand the applications of array, linked list stack, queue, tree and graph programmatic. • Write programs for various data structures for real world application.		
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	1. Write a program to create a square matrix, fill the data inside and print the diagonal elements. 2. Write a program to perform addition and subtraction on two matrices. 3. Write a program to perform multiplication on two matrices. 4. Write a program to perform insertion, deletion of nodes from the end in singly linked list. 5. Write a program to perform insertion and deletion of nodes from the end in singly linked list. 6. Write a program to perform insertion and deletion of nodes from the end in circular doubly linked list. 7. Write a program to perform push and pop operations in stack, where stack should be created using array. 8. Write a program to perform push and pop operation in stack, where stack should be created linked list. 9. Write a program to calculate factorial of given number using stack. 10. Write a program to perform insertion and deletion of data items in queue, queue should be implemented by using a linked list. 11. Write a program to perform insertion and deletion of data items in queue, queue should be implemented by using arrays. 12. Write a program to demonstrate functioning of a double ended queue. 13. Write a program to read the postfix arithmetic expression and evaluate its value using the stack. 14. Write a program to show how to handle the overflow and underflow situation in stack. 15. Write a program to convert infix notation-based expression into the postfix notation-based expression using the stack. 16. Write a program to implement the concept of priority-based element	**30**

traversing using priority queue.

17. Write a program to implement the concept of priority-based element traversing using priority queue.
18. Write a program to create binary search tree using the concept of linked list and array, suppose data set will be given at the run time.
19. Write a program to create a binary tree with any data set and traverse the data items in pre-order, in-order and post-order manner using recursion.
20. Write a program to perform deletion of any data item from the binary search tree.
21. Write a program to find the height of any tree.
22. Write a program to create any given undirected graph using the adjacency matrix, and print each node/element with list of its adjacent elements.
23. Write a program to find the height of any given tree.
24. Write a program to traverse the element of given graph according BFS and DFS.
25. Write a program to find the minimum spanning tree of any given graph.
26. Write a program to search any run time given element from the array of 10 elements in the array are unsorted.
27. Write a program to demonstrate the binary search.
28. Write a program to find the smallest and largest element in any array.
29. Write a program to arrange the data items of any array in ascending order.
30. Write a program to arrange the data items of any array in descending order using quick sort.

Note: Concerned teacher can add additional practical exercises as per requirement.

Keywords	*Array, Linked List, Stack, Queue, Traversing, Tree, Graph, Searching, Sorting, Hashing.*

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Hota
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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

- Michael T. Goodrich, Data Structures and Algorithms in C++, Wiley
- Horowitz and Sahani, Fundamentals of Data Structures, Computer Science Press

Reference Books ***Recommended:***

- Alfred V. Aho, Data structures and Algorithms, Jhon E. Hopcroft and J.E. Ullman.
- Jean Paul Trembley and Paul Sorenson, An Introduction to Data Structures with Applications, TMH, International Student Edition
- R. Kruse, Leung &Tondo, Data Structures and Program Design in C, PHI publication, 2nd Edition

Online Resources:

- NPTEL YouTube Channel: Data Structure Complete course https://youtube.com/playlist?list=PLc2MoXNv7E4mtsPInn9BnTOENXsGyoDgR&si=aAYaVZ-vWfeuhFEO
- NPTEL YouTube Channel: Introduction to Data Structure https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F&index=1
- NPTEL YouTube Channel: Stacks

https://www.youtube.com/watch?v=g1USSZVWDsY&list=PLBF3763AF2E1C572F&index=2

- NPTEL YouTube Channel: Queues and linked list
  https://www.youtube.com/watch?v=PGWZUgzDMYI&list=PLBF3763AF2E1C572F&index=3
- NPTEL YouTube Channel: Trees
  https://www.youtube.com/watch?v=tORLeHHtazM&list=PLBF3763AF2E1C572F&index=6
- NPTEL YouTube Channel: Graphs
  https://www.youtube.com/watch?v=9zpSs845wf8&list=PLBF3763AF2E1C572F&index=24
- W3schools Data Structure Reference: DSA Tutorial (w3schools.com)

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. **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:

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Chairman

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ANJEETA KUJUR

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

PART- A: Introduction

Program: Bachelor in Science (CS) *(Certificate / Diploma / Degree/Honors)*	Semester - III	Session: 2024-2025

1	Course Code	**CSSE-01**	
2	Course Title	**Data Communication and Networking**	
3	Course Type	**DSE (Discipline Specific Elective)**	
4	Prerequisite	*As per program*	
5	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Understand the fundamentals and functionalities of computer network technology. • Understand and explain the Data Communications System and its components. • Analyze the different types of network topologies and protocols. • Analyze various layers of OSI and TCP/IP models. • Explore wireless and wired LANs.	
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	**Introduction to Computer Network and Physical Layer:** Fundamentals of Computer network, types of computer networks: LAN, MAN, WAN, Network topologies, Transmission modes, ISO-OSI reference model, TCP/IP model, Concept of Analog and Digital Signals, Bandwidth, Multiplexing: TDM, FDM, WDM, CDMA, Transmission Media -Guided, Unguided, switching techniques: Circuit Switching, Message Switching, Packet Switching. **Common Network Architecture:** Wireless LANs 802.11 standards, Overview of VSAT and VPN.	15
II	**Data Link Layer:** Functions of Data Link Layer, Framing, Error detection and correction codes: checksum, CRC, hamming code, Flow Control: Stop & Wait and Sliding Window Protocols, Error Control: Stop & wait ARQ, Go-back-n, Selective Repeat ARQ, Data link protocols: HDLC and PPP, Medium Access Sublayer: LLC Protocol, IEEE Project 802 series of network standard and CSMA/CD.	15
III	**Network Layer and Transport Layer:** Functions of Network Layer, Routing Protocols & Algorithms, IPv4, IPv6, X.25, Networking & Internetworking devices, Functions of Transport Layer, Flow Control & Buffering, Transport Layer Protocols: TCP, UDP & SCTP, Network and Principles of Congestion Control.	15
IV	**Session Layer:** Overview, functioning and protocols. **Presentation Layer:** functioning and protocols. **Application Layer:** BOOTP, DHCP, DNS, TELNET, World Wide Web (WWW), File Transfer Protocol (FTP), Hypertext Transfer Protocol (HTTP), Email Protocols: MIME & SMTP, POP, IMAP, Proxy Server.	15
Keywords	*Protocol, Topology, Transmission Media, LAN, WAN, MAN, Wi-Fi.*	

Name and Signature of Convener & Members of CBoS:

Dr. H.S. Bala
Chairman
ANJEETA KW

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

- Andrew S. Tanenbaum, Computer Networks, PHI / Pearson Education Inc.
- Behrouz A. Forouzan, Data Communication and Networking, Tata McGraw-Hill.

Reference Books Recommended:

- William Stallings, Data and Computer Communication, Pearson Education.
- Nader F. Mir, Computer and Communication Networks, Pearson Education, 2007.
- Black, Data & Computer Communication, PHI

Online Resources:

- NPTEL link for Data Communication: https://nptel.ac.in/courses/106105082
- Introduction to Data Communication from SWAYAM Portal https://www.youtube.com/watch?v=swtH_okidQc&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=1
- Layered Architecture https://www.youtube.com/watch?v=xHO6LjSHco0&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=2
- Data and Signal https://www.youtube.com/watch?v=6ZGVZ7gUccE&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=3
- Guided Transmission Media https://www.youtube.com/watch?v=y7v3EAJsWXA&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=5
- Unguided Transmission Media https://www.youtube.com/watch?v=hKq1tYlVxdQ&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN&index=6

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:

Dr. H.S Hota
Chairman

ANJEETA KUSUM

FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - III**	**Session:2024-2025**
1	Course Code	**MASC-03**	
2	Course Title	**Differential Equations**	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of basic Differential and Integral calculus and differential equation.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Learn various techniques of getting exact solutions of certain solvable first order differential equations and linear differential equations of second order. ➢ Understand the genesis of ordinary as well as partial differential equations. ➢ Learn about solution of first order linear partial differential equations using Lagrange's method. ➢ Know how to solve second order linear partial differential equations with constant coefficients.	
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	**Contributions and Biography of Indian Mathematicians:** Aryabhatta, Varahmihir, Bhaskar-I, Shreedharacharya, Shreepati and Parmeshwar. **First Order and higher degree Differential Equations** : Differential equations of first order and first degree, Equations in which variables are separable, Homogeneous equations, Linear differential equations and equations reducible to linear form, Exact differential equations, Integrating factor, First order higher degree equations solvable for x, y and p, Clairaut's form and singular solutions, orthogonal trajectories.	15
II	**Linear and Ordinary simultaneous differential equations:** Linear differential equations with constant coefficients, Homogeneous linear ordinary differential equations. Linear differential equations of second order.Transformation of the equation by changing the dependent variable/the independent variable.Method of variation of parameters. Ordinary simultaneous differential equations.	15
III	**First order Partial differential equations:** Lagrange's solution, Some special types of equation which can be solved by methods other than general method, Charpit's general method of solution.	15

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IV	**Second and higher order Partial differential equations:** Classification of Linear partial differential equation of second order, Homogeneous and non- homogeneous equation with constant coefficients, Partial differential equation reducible to equation with constant coefficients. Monge's Method.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Dr. M. D. Rajsinghania, Ordinary and partial Differential Equation ,S. Chand and company Pvt.Ltd.
2. A.H. Siddiqi and P. Manchanda , A first course in Differential Equations with Applications, Macmillan India Ltd.

Reference Books Recommended-

3. Erwin Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). J. Wiley & Sons
4. B. Rai& D. P. Choudhury (2006). *Ordinary Differential Equations - An Introduction*. Narosa Publishing House Pvt. Ltd. New Delhi.
5. Shepley L. Ross (2007). *Differential Equations* (3rd edition). Wiley.
6. George F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis.
7. Ian N. Sneddon (2006). *Elements of Partial Differential Equations*. Dover Publications.

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-

Dr. Omkar Nath Srivastava

Dr. S. Dashputre

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

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - III**	**Session:2024-2025**
1	Course Code	**MASE-01**	
2	Course Title	Advanced Calculus	
3	Course Type	Discipline Specific Elective (DSE)	
4	Pre-requisite (if any)	Basic idea of elementary differential and integral calculus	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Calculate the limit and examine the continuity and understand the concepts of limit , continuity and differentiability of functions of more than one variable with geometrical interpretation. ➢ To Understand the concepts of mean value theorems with their applications . ➢ To understand the concept of maxima and minima for functions of two and three variables with their uses and techniques ➢ Understand conceptual variations while advancing from one variable to severalvariables in calculus. ➢ Understand the concept of integration of functions of two and three variables and their evaluation technique with emphasis on beta and gamma functions .	
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	Limit and continuity of function of two and three variables. Mean value theorems of function of two variables- First mean value theorem and taylor's theorem. Partial Differentiation and Euler's theorem on homogeneous functions, Change of variables.	**15**
II	Partial Derivation and differentiability of function of two variables. Schwartz's theorem, Young's theorem, Implicit function theorem. Fourier series, Fourier expansion of piece wise monotonic function.	**15**
III	Jacobians , Maxima, Minima and saddle points of function of two variables. Lagrange's multipliers method. Envelopes, Evolutes	**15**
IV	Beta and Gamma function. Double and triple integrals .Dirichelet's integrals. Change of order of integration.	**15**

Dr. S. Dashpute Dr. Omkar Lal Shrivastava Mishra

(Dr. P. K. Sahu)

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
2. Mathematical Analysis, S.C. malik and S. Arora, New age international,Delhi
3. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition).Wiley India.
4. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
5. Wieslaw Krawcewicz & Bindhyachal Rai (2003). Calculus with Maple Labs.
6. Principles of Mathematical analysis, W.Rudin,McGraw Hill Publication
7. Jerrold Marsden, Anthony J. Tromba & Alan Weinstein (2009). Basic
8. James Stewart (2012). Multivariable Calculus (7th edition). Brooks/Cole. Cengage.

E-resources: https://onlinecourses.nptel.ac.in
https://epgp.inflibnet.aci.in
https://swayam.gov.inhttps://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 (Diploma/ Degree/ Honors)	Semester: III	Session: 2024-25

1	Course Code	PHSC-03T	
2	Course Title	Heat and Thermodynamics	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	After going through the course, the student should be able to: • Demonstrate a deep comprehension of the fundamental principles of thermodynamics, including concepts such as energy, entropy and laws of thermodynamics. • Apply the laws of thermodynamics to analyze and solve problems related with energy transfer, heat engines, refrigeration system and other thermodynamic processes. • Analyze basic aspects of kinetic theory and transport phenomenon in gases.	
6	Credit Value	03 Credits	1 Credit= 15 Hours for Learning &Observation
7	Total Marks	Maximum Marks: 100	Minimum Pass 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	**Historical background:** A brief historical background of thermodynamics and statistical physics in the context of India and Indian culture, Contribution of S. N. Bose in Statistical mechanics. **Laws of Thermodynamics:** Thermodynamic Description of system, Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, various Thermodynamical Processes, Work Done during Isothermal and Adiabatic Processes, Reversible & irreversible processes. Second law of thermodynamics & Entropy, Carnot's cycle, Carnot's theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics.	12
II	**Thermodynamic Potentials:** Internal Energy, Enthalpy, Helmholtz Free Energy and Gibbs function. Maxwell's relations & applications, Clausius- Clapeyron Equation, Expression for ($C_P - C_V$), C_P/C_V, TdS equations, Thermodynamic energy equation- change in internal energy of an ideal and Vander Waal's gas, Joule-Thompson Effect, Cooling by adiabatic demagnetization.	11
III	**Kinetic Theory of Gases:** Maxwellian distribution of speeds in an ideal gas: distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values, Molecular Collision and Mean Free Path. **Transport Phenomena in gases**: Viscosity, Conduction and Diffusion, Law of equipartition of energy.	11
IV	**Theory of Radiation:** Blackbody radiation, Spectral distribution, Concept of Energy Density, Stefan Boltzmann Law, Newton's law of cooling from Stefan Boltzmann's law. Wien's displacement law and Rayleigh-Jeans Law (Only qualitative). Planck's radiation Law, Deduction of Wien's distribution law and Rayleigh- Jeans Law from Planck's law. Experimental verification of Planck's radiation law.	11

Keywords:	Zeroth and First Law of Thermodynamics, Second Law of Thermodynamics,Entropy, Thermodynamic Potentials, Maxwell's Thermodynamic RelationsKinetic Theory of Gases, Distribution of Velocities, Molecular Collisions, Real Gases, Laws of radiation

SignatureofConvener&Members (CBoS) :

PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books

1. Heat and Thermodynamics: Singhal, Agrawal and Satya Prakash, Pragati Prakashan 1984
2. Physics (Part-2): Editor, Prof. B.P.Chandra, M.P. Hindi Granth Academy
3. Unified Physics –II ,R.P.Goyal, Shivlal Agrawal &Sons
4. Unified Physics –II. NovbodhPrakashan

Reference Books

1. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears&G.L.Salinger. 1988, Narosa
2. Energy Science in Vedas: A Treatise on Vedic Thermodynamics and Free Energy (Exploring Lost Science and Technology in Vedas), Ramesh Kumar Mineria; Priya Veda Publications

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

1. Basics of thermodynamics ***https://www.youtube.com/watch?v=9GMBpZZtjXM&list=PLD8E646BAB3366BC8***
2. Thermodynamics ***https://www.youtube.com/watch?v=E9cOAMhFUz0***
3. Second law of thermodynamics ***https://www.youtube.com/watch?v=F_flGosPY8o***
4. ***NPTEL Online Lectures: https://archive.nptel.ac.in/courses/115/105/115105129/***
5. ***https://archive.nptel.ac.in/courses/115/106/115106090/***
6. ***https://bsc.hcverma.in/course/penopcyc***
7. Vedic Science and Thermodynamics :***https://www.puranavedas.com/vedic-physics/***
8. ***https://www.amazon.in/Vedic-Physics-Raja-Ram-Mohan/dp/0968412009?asin=1988207045&revisionId=&format=4&depth=2***
9. https://ia903100.us.archive.org/3/items/wholelottabooks/The%20Astronomical%20Code%20of%20the%20Rgveda%20-%20Shubash%20Kak.pdf

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100Marks
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 =20Marks** Section B: Descriptive answer type,**1out of 2** from each unit-**4x10=40 Marks**	

Name and Signature of Convener & Members of CBoS:

10/6/24

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

PART – A: INTRODUCTION

Program:Bachelor in Science (Diploma/ Degree/ Honors)		Semester: III	Session: 2024-25
1	Course Code	PHSC- 03P	
2	Course Title	Heat and Thermodynamics	
3	Course Type	Discipline Core Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	➢ Lab Proficiency: Thermometers, pressure gauges, calorimeters, heat transfer apparatus, experimental setup, data acquisition. ➢ Hands-on Learning**: Heat transfer, work done, entropy, phase transitions, experiments. ➢ Data Analysis: Experimental data, theoretical discrepancies, analysis. ➢ Predictive Skills: Thermodynamic behavior, varying conditions, experimentation. ➢ Theory-Practice Integration: Theoretical knowledge, practical lab work, synthesis, applications.	
6	Credit Value	01 Credit	1 Credit = 30 HoursLaboratory Work
7	Total Marks	Maximum Marks: 50	Minimum Pass Marks: 20

PART – B: CONTENT OF THE COURSE

TotalNo.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 determine the thermal conductivity of a non-conducting material by Lee's disc method.	30
2	To study the variation of thermo emf across two junctions of a thermocouple with temperature.	
3	To verify Newton's law of cooling.	
4	To determine the temperature co-efficient of resistance by Platinum resistance thermometer.	
5	To determine the coefficient of thermal conductivity(k) of a rubber tube.	
6	To study the heat efficiency of an electric kettle with varying voltage.	
7	To determine the ratio of specific heat at constant pressure and constant volume (γ=Cp/Cv) of air Clement and Desorme's method.	
8	To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.	
9	To study the variation of thermos-Emf of thermos couple with Difference of Temperature of its Two Junctions.	
10	To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.	
11	Measurement of Planck's constant using black body radiation.	
12	To determine Stefan's Constant.	

Keywords:	Thermal conductivity, Thermocouple, Newton's law of cooling, Temperature coefficient of resistance, Heat efficiency, Specific heat ratio, Mechanical equivalent of heat, Planck's constant

SignatureofConvener&Members (CBoS) :

10/6/24

PART – C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Advanced Practical Physics for students, B.L.Flint&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, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
5. Unified Practical Physics B.Sc II : R P Goyal, Shivlal Agrawal &Sons Publications

Reference Books Recommended-

1. Practical Physics by C.L. Arora
2. Practical Physics by S.L. Gupta and Vijay Kumar
3. Advanced Practical Physics for Students by B.L. Worsnop and H.T. Flint

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

Link for e-Books for Physics Practicaland Virtual labs

1. Thermal Physics and Statistical Mechanics: Laboratory Collectionhttps://egyankosh.ac.in/handle/123456789/67450
2. Virtual Lab :https://vlab.amrita.edu/index.php?sub=1&brch=194
3. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&cnt=1
4. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=801&cnt=4
5. https://srmap.edu.in/seas/physics-virtual-lab/
6. https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab https://www.pbslearningmedia.org/resource/lsps07-sci-phys-thermalenergy/thermal-energy-transfer/#.WdJiOJIrLIU

PART – D: ASSESSMENT AND EVALUATION

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

Continuous InternalAssessment(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:

10/6/24

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

PART-A: INTRODUCTION

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

1	**Course Code**	**PHSE-01**
2	**Course Title**	**Introduction to Statistical Mechanics**
3	**Course Type**	**Discipline Specific Elective**
4	**Pre-requisite** (if, any)	**As per Program**
5	**Course Learning. Outcomes(CLO)**	➢ Differentiate between macrostate and microstate and calculate their numbers ➢ Comprehend the concept of ensembles and its requirement in study of physical phenomenon ➢ Correlate and compare the classical and quantum statistical distribution laws. ➢ Apply concepts of statistical distribution laws for different physical systems.
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	**Maxwellian Distribution of Speeds In An Ideal Gas**: Distribution of speeds and velocity, experimental verification, distinction between mean, rms and most probable speeds, Doppler broadening of spectral lines, transport phenomena in gases: molecular collision, collision cross section, estimates of molecular diameter and mean free path; transport of mass , momentum and energy and inter-relationship, dependence on temperature and pressure. **Behaviour of Real Gases :**deviation from ideal gas equation, the Virial equation, Andrew's experiment on CO_2 gas; critical constants.	15
II	**Macrostate & Microstate** Macrostate, Microstate, Number of accessible microstates and Postulate of equal a priori. **Concept of Ensemble:** Concept of Gibb's ensemble, postulate of ensemble average, Micro Canonical, Canonical & Grand Canonical ensembles. Thermodynamic Probability, Postulate of Equilibrium and Boltzmann Entropy relation. Phase space, Phase trajectory, Volume element in phase space, Quantization of phase space and number of accessible microstates for free particle in 1D, free particle in 3D.	15

III	**Transition to quantum statistics:** *h* as a natural constant and its implications, cases of particle in 1D and 1Dimensional harmonic oscillator, **Quantum Statistical Distribution Laws:** In-distinguishability of particles and its consequences, Bose-Einstein & Fermi Dirac statistics. Comparison of statistical distribution laws and their physical significance. Canonical Distribution Law: Boltzmann's Canonical Distribution Law, Boltzmann's Partition Function, Proof of Equipartition Theorem (Law of Equipartition of energy) and relation between Partition function and Thermodynamic potentials.	**15**
IV	**Bose-Einstein Distribution Law and its Applications:** Bose-Einstein Statistics: Heat capacity, Bose Einstein condensation, Radiation as a photon gas, Quantum Theory of Radiation: Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law **Fermi-Dirac Distribution Law and its Applications:** Free electrons in a metal, Definition of Fermi energy, Determination of Fermi energy at absolute zero, Kinetic energy of Fermi gas at absolute zero and concept of Density of States, Specific Heat of Metals (Density of Orbitals).	**15**
Keywords	Macrostate & Microstate, ensemble, distribution laws, Bose-Einstein Statistics, Fermi-Dirac Statistics	

Name and Signature of Convener & Members of CBoS:

10/6/24

PART–C:LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended –

1. Unified Physics –II, R P Goyal, Shivlal Agrawal & Sons Publication
2. Unified Physics-II, Yugbodh Prakashan
3. Unified Physics-II, Navbodh Prakashan

Reference Books Recommended–

1. F. Reif, "Statistical Physics (In SI Units): Berkeley Physics Course Vol 5", McGraw Hill, 2017
2. B.B. Laud, "Fundamentals of Statistical Mechanics", New Age International Private Limited, 2020
3. B.K. Agarwal, M. Eisner, "Statistical Mechanics", New Age International Private Limited, 2007

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

1. MIT Open Learning - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/8-333-statistical-mechanics-i-statistical-mechanics-of-particles-fall-2013/
2. National Programme on Technology Enhanced Learning (NPTEL), https://archive.nptel.ac.in/courses/115/103/115103113/,
3. https://onlinecourses.nptel.ac.in/noc19_ph10/preview,
4. https://archive.nptel.ac.in/courses/115/106/115106126/
5. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
6. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

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.,**1out of 2** from each unit-**4x10=40Marks**	

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 (Certificate/ Diploma/ Degree/ Honors)	Semester: I/ III/ V	Session: 2024-25

1	Course Code	PHVAC-01	
2	Course Title	Renewable Energy and Energy Harvesting	
3	Course Type	Value Addition Course	
4	Pre-requisite (if any)	As per Program	
5	Course Learning Outcomes (CLO)	Objective of the course is to impart students; the knowledge of renewable energy and they are expected to learn about: ➢ Energy crisis at national and international scenario. ➢ Renewable sources of energy and their importance. ➢ Availability of renewable energy resources in India. ➢ Knowledge about energy harvesting technology.	
6	Credit Value	02 Credits	1 Credit = 15 Hours- Learning & Observation
7	Total Marks	Maximum Marks: 50	Minimum Pass Marks: 20

PART – B: CONTENT OF THE COURSE

Total No. of Teaching–learning Periods (01 Hr. per period) - 30 Periods (30 Hours)

Unit	Topics	No. of Period
I	**Fossil fuels and Alternate Sources of energy:** Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. Limitations of non-conventional energy resources. Environmental aspect of energy, World energy status, Energy scenario in India. **Geo thermal Energy**: Geothermal Resources, Geo thermal Technologies.	07
II	**Solar energy:** Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, sun tracking systems. **Hydro Energy**: Hydro power resources, hydro power technologies, environmental impact of hydro power sources.	08
III	**Biomass energy:** Biomass resources, Biomass conversion technology, biogas generation, factors affecting bio-digestion, working of biogas plant (with block diagram), biogas from plant waste, biomass energy programme in India, Biodiesel production from non-edible oil seeds. **Ocean Energy**: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.	08
IV	**Wind Energy harvesting**: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines. grid interconnection topologies. **Piezoelectric Energy harvesting:** Introduction, Physics and characteristics of piezoelectric effect, piezoelectric materials, Piezoelectric Energy harvesting applications.	07
Keywords:	Fossil fuel, Renewable energy sources, Solar energy, Biomass energy, Electromagnetic Energy Harvesting, Piezoelectric Energy harvesting.	

Signature of Convener & Members (CBoS):

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended-

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
6. J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

Reference Books Recommended-

1. Non-Conventional Energy Resources by B.H. Khan
2. Renewable Energy Sources and Emerging Technologies by D.P. Kothari, K.C. Singal, and Rakesh Ranjan
3. Solar Energy: Fundamentals, Design, Modelling and Applications by G.N. Tiwari
4. Hydropower Development in India: A Sector Assessment by Pradeep Chaturvedi
5. Biomass Conversion: The Interface of Biotechnology, Chemistry and Materials Science by Samir K. Khanal, edited by B.C. Meikap and P.K. Bhattacharya
6. Ocean Energy: Technology, Environmental Impact and Renewable Energy by Pranav Kumar and T. Balaji
7. Wind Energy: Theory and Practice by S. Rao and Dr. B.B. Parulekar
8. Piezoelectric Materials and Devices: Applications in Engineering and Medical Sciences by Arun Ghosh

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

1. http://en.wikipedia.org/wiki/Renewable_energy
2. Renewable Energy Engineering: Solar, Wind And Biomass Energy Systems - Course (nptel.ac.in)
3. Technologies For Clean And Renewable Energy Production – NPTEL+
4. NPTEL :: Mechanical Engineering - NOC:Selection Of Nanomaterials For Energy Harvesting And Storage Application
5. Wind energy Labs : Mechanical Engineering : Amrita Vishwa Vidyapeetham Virtual Lab
6. Virtual Labs (vlabs.ac.in)
7. https://youtu.be/uY3x7Tycyps

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 Examination (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **05 x1= 05** Mark; **Q2**. Short answer type- **5x2 =10Marks** Section **B**: Descriptive answer type qts.,**1 out of 2** from each unit- **4x05 =20 Marks**	

Signature of Convener & Members (CBoS):

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
COURSE CURRICULUM

PART A: INTRODUCTION			
Program: Certificate Course		Semester- I Sem	Session: 2024-25
1	Course Code	AEC 01	
2	Course Title	Environmental Studies	
3	Course Type	Ability Enhancement Course (AEC)	
4	Prerequisite (If Any)	As per requirement	
5	Course Outcome (CO)	At the end of this course, students will be able to – **CO 01:** relate the basic concept of the environment **CO 02:** explain environmental alterations **CO 03:** develop skills in environmental measurement **CO 04:** examine correction measures of the environment	
6	Credit Value	02 C	01 Credit = 15 Hrs. Teaching-Learning
7	Total Marks	Max. Marks: 50	Minimum Pass marks: 20

PART: B CONTENT OF THE COURSE		
Total No. of Teaching-Learning Periods: 30Hours/ 30Periods		
UNIT	TOPIC (Course Contents)	No. of Hours
I	**Basic Composition:** 1. Abiotic and Biotic components of the environment 2. Biodiversity—Concept, types, and measures about its protection 3. Basic concept of Bio-Geo Chemical Cycle 4. Energy Flow in an ecosystem	07
II	**Alterations in Environment:** 1. Concept and components of the pond ecosystem 2. Air pollution and measures for its control 3. Water pollution and measures for its control 4. Global warming, Climate change, and possible measures	07
III	**Measurements of Environmental Components** 1. Soil composition and methods of its analysis 2. Water analysis methods for DO, BOD, COD 3. Water analysis methods for pH, TDS, Turbidity, Salinity, and Alkalinity 4. Information about environmental factors—PM-10, PM-2.5, NO2, O3	08
IV	**Application Measures** 1. Useful microbes to control water pollution 2. Useful microbes to control soil pollution 3. Concept of Biodegradation 4. Concept of Phytoremediation	08
Key Words	**Ecosystem, Pollution, Climate Change, Biodegradation**	

Name and Signature of Convener and Members of CBOS

(Dr. Anup kr. Kanojia) Sanjana 11/06/24 (Dr. Sanjana Bhagat) 11/6/24 Dr. Shivani Sha

Dr. Ujjwala Supe Keshav (Keshav Kant Sahu)

11/6/24 Dr. Shubha Diwan Dr. Pramod Mahish NBehar 11/6/24 (Dr. Neha Behar) Amrita Panda 11/6/2024 (Dr Amrita Panda)

PART–C: Learning Resources

Text Books, Reference Books, and Others

Text Books Recommended –

1. *Ecology and Environment, 8th Edition, P.D.Sharma, Rastogi Publication, Meerut.*
2. *Environmental Biology, 2nd Edition, P,D.Sharma, Rastogi Publication, Meerut.*
3. *Environmental Biology and Toxicology, 2nd Edition, P.D.Sharma, Rastogi Publication, Meerut.*
4. *Environmental Studies, 1st Edition, S.V.S.Rana, Rastogi Publication, Meerut.*
5. *Environmental Biotechnology, 1st Edition, S. V. S. Rana, Rastogi Publication, Meerut.*

Online Resources–

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

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):	**Two sections – A & B** Section **A**: **Q1**. Objective – **05 x1= 05** Mark; **Q2**. Short answer type- **5x2 =10 Marks** Section **B**: Descriptive answer type qts.,**1out of 2** from each unit- **4x05 =20 Marks**	

Name and Signature of Convener & Members of CBoS:

Sanjana 11/06/24
(Dr. Sanjana Bhargat)

Shivani Sharma 11/6/24
(Dr. Shivani Sharma)

11.6.24
Dr. Vijayalaxmi

11/06/24
(Dr. Shubha Diwan)

Neha Behar 11/6/24
(Dr. Neha Behar)

Amrita Panda
(Dr. Amrita Panda)
11.6.2024

Dr. Pramod Kumar Malviya

(Dr. Anil Kumar Kanp)