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**BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT**

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE New Delhi)

Yelahanka, Bengaluru 560119

# Bachelor of Engineering

# Department of Artificial Intelligence & Machine Learning

## III Semester Scheme & Syllabus 2022
## Effective from the AY 2025-26

# Vision and Mission of the Department

## Vision

To emerge as a leading department in AI and ML by preparing skilled, responsible, and eco-friendly professionals who use technology to improve society.

## Mission

**M1**. To equip students with in-depth knowledge in Artificial Intelligence and Machine Learning, built upon a robust foundation in Computer Science and Engineering through industry focused curriculum with practical learning.

**M2**. To encourage research and innovation through industry partnerships and sustainable technology practices.

**M3**. To inspire students toward ethical leadership and entrepreneurship through innovative and collaborative student-led activities.

# Program Educational Objectives (PEOs)

| PEOs | |
|---|---|
| PEO1 | Graduates will thrive as IT professionals, applying AI and ML to build creative and lasting solutions. |
| PEO2 | Graduates will pursue further studies, research, and entrepreneurship, keeping up with technological advancements in various fields. |
| PEO3 | Graduates will demonstrate ethics, integrity, leadership, teamwork, and a dedication to continuous learning in their careers |

# Program Specific Outcomes (PSOs)

| PSOs | |
|---|---|
| PSO-1 | Apply foundational knowledge of Computer Science along with AI and ML techniques to design effective, real-world solutions across diverse application domains. |
| PSO-2 | Develop AI-driven innovations with a commitment to ethics, social responsibility, and sustainability |

# Scheme of III Semester

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

**(Autonomous Institute affiliated to VTU)**
**Scheme of Teaching and Examination: Effective from AY 2025 – 26**
**Choice-Based Credit System (CBCS)**
**Department of Artificial Intelligence & Machine Learning**

**UG PROGRAM: B.E. Artificial Intelligence & Machine Learning (AI & ML)** — **Semester: III**

| Sl. No | Course Category | Course Code | | Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week Credits | | | | Duration | CIE Marks | SEE Marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical / Drawing | SDA | | | | | |
| | | | | | L | T | P | S | | | | | |
| 1 | PCC/BSC | BCS301 | Mathematics for Computer Science | TD: Maths PSB: Maths | 40 | 0 | 26 | 54 | 120 | 50 | 50 | 100 | 4 |
| 2 | IPCC | BCS302 | Digital Design & Computer Organization | TD: CS PSB: CS | 40 | 0 | 26 | 54 | 120 | 50 | 50 | 100 | 4 |
| 3 | IPCC | BCS303 | Operating Systems | TD: CS PSB: CS | 40 | 0 | 26 | 54 | 120 | 50 | 50 | 100 | 4 |
| 4 | PCC | BCS304 | Data Structures and Application | TD: CS PSB: CS | 40 | 0 | 0 | 50 | 90 | 50 | 50 | 100 | 3 |
| 5 | PCCL | BCSL305 | Data Structures Lab | TD: CS PSB: CS | 0 | 0 | 26 | 04 | 30 | 50 | 50 | 100 | 1 |
| 6 | ESC | BCS306x | ESC/ETC/PLC | TD: CS PSB: CS | 40 | 0 | 26 | 24 | 90 | 50 | 50 | 100 | 3 |
| 7 | UHV | BCSK307 | Social Connect and Responsibility | Any Department | 0 | 0 | 26 | 04 | 30 | 100 | --- | 100 | 1 |
| 8 | AEC/ SEC | BCS358x | Ability Enhancement Course/Skill Enhancement Course-III | TD and PSB: CSE | If the course is a Theory: 15 | 0 | 0 | 15 | 30 | 50 | 50 | 100 | 1 |
| | | | | | If a course is a laboratory: 0 | 0 | 26 | 04 | 30 | | | | |
| 9 | MC | BNSK359 | National Service Scheme(NSS) | NSS Coordinator | 0 | 0 | 26 | 04 | 30 | 100 | - | 100 | 0 |
| | | BPEK359 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | BYOK359 | Yoga | Yoga Teacher | | | | | | | | | |
| | | BMUK359 | Music | Music Teacher | | | | | | | | | |
| | | BNCK359 | National Credit Corps (NCC) | NCC Coordinator | | | | | | | | | |
| **Total** | | | | | | | | | | **550** | **350** | **900** | **21** |
| **Non-Credit Mandatory Course (NCMC) Prescribed to lateral Entry Diploma Students** | | | | | | | | | | | | | |
| **10** | NCMC | BENGDIP1 | **English Communications Skill I** | HSS | **0** | **0** | **0** | **0** | | **100** | **-** | **100** | **2** |

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**PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

| **Engineering Science Course (ESC/ETC/PLC) (Note- Student should opt for the course which should not be similar to the course opted in 1st Year)** | | | |
|---|---|---|---|
| BCS306A | Object-Oriented Programming with Java | BDS306C | Data Analytics with R |
| BCS306B | Object-Oriented Programming with C++ | BDS306B | Python Programming for Data Science |
| **Ability Enhancement Course – III** | | | |
| BCS358A | Data analytics with Excel | BCS358C | Project Management with Git |
| BAI358B | Ethics and Public Policy for AI | BAI358D | PHP Programming |

**Professional Core Course (IPCC):** Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P ) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

**National Service Scheme /Physical Education/Yoga/Music/National Credit Corps:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga(YOG), Music and National Credit Corps (NCC) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga, Music and NCC activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

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# DEPARTMENT OF MATHEMATICS

**B.E. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

**Choice Based Credit System (CBCS)**

**SEMESTER – III**

**Mathematics III for Computer Science** (3:2:0:0) 4

(Common to CSE/ISE/AI&ML)

(Effective from the academic year 2025-26)

| | | | |
|---|---|---|---|
| Course Code | BCS301 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:2:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40(Theory) +26(Tutorial) | Exam Hours | 3 Hours |

**Course Objectives:**

1. To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
2. To provide the principles of statistical inferences and the basics of hypothesis testing with emphasis on some commonly encountered hypotheses.
3. To find the association between attributes and the correlation between two variables.

**Teaching-Learning Process**

**Pedagogy (General Instructions):**

Teachers can use the following strategies to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

## Module-1: Probability Distributions

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. Exponential distribution.

**(RBT Levels: L1, L2 and L3)** **(10 Hours)**

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**Module-2: Joint probability distribution & Markov Chain**

Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. Markov Chain: Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states.

**(RBT Levels: L1, L2 and L3)** **(10 Hours)**

**Module-3: Statistical Inference 1**

Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test of significances, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples.

**(RBT Levels: L1, L2 and L3)** **(10 Hours)**

**Module-4: Statistical Inference 2**

Sampling variables, Test of Significance for means of two small samples, students 't' distribution, Chi-square distribution as a test of goodness of fit. F-Distribution.

**(RBT Levels: L1, L2 and L3)** **(10 Hours)**

**Module-5: Curve fitting, Correlation, and Regressions**

Principles of least squares, Curve fitting by the method of least squares in the form $y= a+bx$, $y=a +bc+cx^2$ and $y=ax^b$ . Correlation, Coefficient of correlation, Lines of regression, Angle between regression lines, standard error of estimate, rank correlation.

**(RBT Levels: L1, L2 and L3)** **(10 Hours)**

**Course outcomes:**

The students will be able to:

CO1: Apply discrete and continuous probability distributions in the engineering field.

CO2: Apply discrete-time Markov chains and n-step transition probabilities for transitions between states over time.

CO3: Employ statistical methodologies in the engineering problem.

CO4: Analyze statistical data using correlation and regression methods.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student securesa minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.

- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester-End Examination:**

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

**Text books:**


1. **Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye** "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2. **Peter Bruce, Andrew Bruce & Peter Gedeck** "Practical Statistics for Data Scientists" O'Reilly Media, Inc., 2nd edition 2020.


**Reference Books:**


1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 9th Edition, 2006.
2. B. S. Grewal "Higher Engineering Mathematics", Khanna publishers, 44 th Ed., 2021.
3. G Haribaskaran "Probability, Queuing Theory & Reliability Engineering", Laxmi Publication, Latest Edition, 2006.
4. Irwin Miller & Marylees Miller, John E. Freund's "Mathematical Statistics with Applications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8 th edition, 2014.
5. S C Gupta and V K Kapoor, "Fundamentals of Mathematical Statistics", S Chand and Company, Latest edition.
6. Robert V. Hogg, Joseph W. McKean & Allen T. Craig. "Introduction to Mathematical Statistics", Pearson Education 7 th edition, 2013.
7. Jim Pitman. Probability, Springer-Verlag, 1993.
8. Sheldon M. Ross, "Introduction to Probability Models" 11 th edition. Elsevier, 2014.
9. A.M. Yaglom and I. M. Yaglom, "Probability and Information". D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi, 1983.
10. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, (Reprint), 2003.
11. S. Ross, "A First Course in Probability", Pearson Education India, 6 th Ed., 2002.
12. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 3rd Ed., 1968.
13. N.P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
14. Veerarajan T, Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.


**Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning**

- Programming Assignment
- Seminars

**B.E. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

Choice Based Credit System (CBCS)

**SEMESTER – III**

**Digital Design and Computer Organization** (3:0:2:0) 4

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | BCS302 | CIE Marks | 50 |
| Teaching Hours/Week(L: T:P:S) | 3:0:2:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40(Theory)+ 26 (Practical) | Exam Hours | 3 Hours |
| Examination nature (SEE) | Theory | | |

**Course Objectives:**

This course will enable students to:

1. Read and Write Optimize Boolean equations for logic circuits.
2. Design combinational and sequential circuits using MSI components.
3. Simulate and experimentally validate sequential logic circuits.
4. Understand the structure, function, organization and architecture of modern day computing systems.
5. Examine the internal architecture and organization of the processor with an extended discussion of computer arithmetic and the instruction set architecture.

**Preamble:** Computer System Design course is to familiarize with concepts, design, and practical use of digital circuits and components of computer system. Digital circuits are used in designing Microcontrollers, Microprocessor, Embedded system projects and exposed to hardware design which reflects the current industry requirements.

**Module – 1**

**Introduction to Digital Design:** Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, QM method (tabular), Other Hardware Description Language – Verilog/VHDL Model of a simple circuit.

**Text book 1: 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9** **(8 Hours)**

**Module – 2**

**Combinational Logic**: Introduction, Combinational Circuits, Design Procedure , Binary Adder, Subtractor, Decoders, Encoders, Multiplexers (MEV). HDL Models of Combinational Circuits , Adder, Multiplexer, Encoder. **Sequential Logic**: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.

**Text book 1: 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4.** **(8 Hours)**

**Module – 3**

**Basic Structure of Computers:** Functional Units, Basic Operational Concepts, Bus structure Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs:** Memory location and addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes.

**Text book 2: 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5**.

**(8 Hours)**

**Module – 4**

**Input/output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions.

**Text book 2: 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1** **(8 Hours)**

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| Module – 5 | |
|---|---|
| **Basic Processing Unit:** Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. **Pipelining:** Basic concepts, Role of Cache memory, Pipeline Performance.<br>**Text book 2: 7.1, 7.2, 8.1**<br>**Recap/Summary of the Course** **(8 Hours)** | |
| **PRACTICAL COMPONENT OF IPCC** | |
| **PART-A**<br>**FIXED SET OF EXPERIMENTS**<br>**Experiments Simulation packages preferred: Xilinx, Modelsim, PSpice or any other relevant experiments** | |
| 1 | Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates. |
| 2 | Design a 3- bit full adder and subtractor and simulate the same using basic gates. |
| 3 | Design VHDL/Verilog HDL to implement simple circuits using structural, Data flow and Behavioral model. |
| 4 | Design Binary Adder-Subtractor – Half adder and Half Subtractor and simulate using VHDL/Verilog HDL. |
| 5 | Design Decimal adder and simulate using VHDL/Verilog HDL. |
| 6 | Design Different types of multiplexer like 2:1, 4:1 and 8:1 and simulate using VHDL/Verilog program. |
| 7 | Design and implement various types of De-Multipler and simulate using VHDL/Verilog. |
| 8 | Design and simulate VHDL/Verilog program for implementing various types of Flip-Flops such as SR, JK and D. |
| **PART – B**<br>**OPEN ENDED EXPERIMENTS** | |
| Student is required to design and simulate VHDL/Verilog program for the following:<br>1. Application of Combinational circuits implementation.<br>2. Application of Comparators.<br>3. Application of Encoders or Decoders.<br>4. Application of Synchronous up/down counters using any Flip Flop. | |
| **Course outcomes (Course Skill Set):**<br>At the end of the course, the student will be able to:<br>CO1: Illustrate the various techniques to solve the logic/Boolean expressions<br>CO2: Experiment and simulate to realize the digital circuits.<br>CO3: Analyse the functionality of various devices in communicating with processor and I/O devices. CO4: Demonstrate the various digital circuits using hardware or software tools. | |

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**Suggested Learning Resources:**

**TextBooks**

1. M. Morris Mano & Michael D. Ciletti, Digital Design with an Introduction to Verilog Design, 6e, Pearson Education, 2018.
2. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill.William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson, 2008.

**Refernces:**

1. Donald P Leach, Albert Paul Malvino & GoutamSaha, Digital Principles and Applications, Tata McGraw Hill, 6th Edition, 2006.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

Assign the group task to Design the various types of counters and display the output accordingly Assessment Methods

- Lab Assessment
- GATE Based Aptitude Test

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**B.E. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

Choice Based Credit System (CBCS)

**SEMESTER – III**

**Operating Systems** (3:0:2:0)4

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | BCS303 | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P:S) | 3:0:2:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40(Theory) + 26(Practical) | Exam Hours | 3 Hours |
| Examination Nature | Theory | | |

**Course Objectives:**

This course will enable students to:

1. To Demonstrate the need for OS and different types of OS
2. To discuss suitable techniques for management of different resources
3. To demonstrate different APIs/Commands related to processor, memory, storage and file system management.

**Preamble**

Operating systems are the fundamental part of every computing device to run any type of software. The increasing use of computing devices in all areas of life (leisure, work), lead to a variety of operating systems. Yet all operating systems share common principles. These principles are important for computer science students in their understanding of programming languages and software built on top of the operating systems.

This course will be discussing about the Address spaces, System call interface, Process/Threads, Inter Process Communication, Deadlock, Scheduling, Main memory, Virtual memory and File systems.

**Module – 1**

**Introduction to operating systems, System structures**: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.

**Operating System Services:** User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System debugging, Operating System generation; System boot.

**Textbook 1: Chapter – 1 (1.1-1.12), 2 (2.2-2.11) (8 Hours)**

**Module – 2**

**Process Management:** Process concept; Process scheduling; Operations on processes; Inter process communication

**Multi-threaded Programming:** Overview; Multithreading models; Thread Libraries; Threading issues.

**Process Scheduling:** Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling.

**Textbook 1: Chapter – 3 (3.1-3.4), 4 (4.1-4.4), 5 (5.1 -5.5) (8 Hours)**

**Module – 3**

**Process Synchronization:** Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization;

**Deadlocks:** System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

**Textbook 1: Chapter – 6 (6.1-6.6), 7 (7.1 -7.7) (8 Hours)**

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| Module – 4 |
|---|
| **Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.<br>**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.<br><br>**Textbook 1: Chapter -8 (8.1-8.6), 9 (9.1-9.6) (8 Hours)** |
| **Module – 5** |
| **File System, Implementation of File System:** File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.<br>**Secondary Storage Structure, Protection:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix.<br>**Recap/Summary of the Course**<br><br>**Textbook 1: Chapter – 10 (10.1-10.5) ,11 (11.1-11.5),12 (12.1-12.5), 14 (14.1-14.4) (8 Hours)** |

| PRACTICAL COMPONENT OF IPCC | |
|---|---|
| **PART – A**<br>**FIXED SET OF EXPERIMENTS** | |
| 1 | Write a C program to demonstrate open (), read (), write () and close () system call. |
| 2 | Create the following types of files using shell commands and system calls<br>a. soft link (symlink system call)<br>b. hard link (link system call)<br>c. Race Condition |
| 3 | Write a C program to simulate the process system calls (fork(), exec() and wait(), create process() and terminate process() ) |
| 4 | Write a C program to implement CPU scheduling algorithms (FCFS, SJF, SRT) |
| 5 | Write a C program to simulate Bankers Algorithm for Deadlock Avoidance |
| 6 | Develop a C Program to simulate the following contiguous Memory allocation techniques i) First Fit ii) Best Fit |
| 7 | Write a C program to simulate the following page replacement Algorithms<br>i)FIFO ii) LRU |
| **PART – B**<br>**OPEN ENDED EXPERIMENTS** | |
| 1. | Write a C program to simulate Intra &; Inter–Process Communication (IPC) techniques. |
| 2. | Write a C program to simulate solutions to classical synchronization problems. |
| 3. | Write a C program to simulate solutions to critical section problems |

**Course Outcomes:**

The students will be able to:

CO 1: Describe the basics of the operating systems services, process, threads and communication.

CO 2: Apply appropriate scheduling methods for process execution and its management.

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CO 3: Illustrate suitable methods to handle deadlocks and process synchronization.
CO 4: Analyze memory management techniques and its allocation policies.
CO 5: Discuss various Implementation of File systems, security mechanism with respect to different storage management technologies.
CO 6: Apply APIs related to Process, Files and IPC to develop operating system applications.

**Textbooks:**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley- India, 2015

**Reference Books:**

1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.
4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson, 2008.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

Assessment Methods

- Case Study on Unix Based Systems (10 Marks)
- Lab Assessment (25 Marks)

**B.E. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

**Choice Based Credit System (CBCS)**

SEMESTER – III

**Data Structure and Applications (3:0:0:0) 3**

(Effective from the academic year 2025-2026)

| | | | |
|---|---|---|---|
| Course Code | BCS304 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 (Theory) | Exam Hours | 3 |

**Course Objectives:**

This course will enable students to:

1. Explain fundamentals of data structures and their applications essential for programming/problem Solving.
2. Utilize an appropriate data structure like Stack, Queues, Lists, Trees and Graphs to solve a given problem.
3. Demonstrate sorting and searching algorithms.

**Preamble:** Data Structures are a specialized means of organizing and storing data in computers in such a way that we can perform operations on the stored data more efficiently. Data structures have a wide and diverse scope of usage across the fields of Computer Science and many other fields of Engineering. Data Structures are the main part of many computer science algorithms as they enable the programmers to handle the data in an efficient way. It plays a vital role in enhancing the performance of a software.

**Module – 1**

**Introduction:** Significance and scope of Data Structures, Data Structures and Algorithms in Economic growth of Nation, Impact of Data Structures and Algorithms on societal problems, sustainable solutions, Career perspective of Data Structures and Algorithms, current innovations in Data Structures.

**Data Structures:** Definition, Classification and Operations, Dynamic memory allocation, Dynamic Arrays, Self-referential structures.

**Stacks:** Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays.

**Stack Applications:** Polish notation, Infix to postfix conversion, evaluation of postfix expression, Multiple Stacks and Queues. Programming Examples.

**Text Book: Chapter-1:1.2 Chapter-2: 2.1 to 2.7 Chapter-3: 3.1,3.2,3.6**

**Reference Book 1: 1.1 to 1.4** **(8 Hours)**

**Module – 2**

**Queues:** Definition, Array Representation, Queue Operations, Circular Queues, Circular Queues using Dynamic arrays, De-Queues, Priority Queues.

**Recursion:** Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function

**Text Book: Chapter-3: 3.3, 3.4, 3.7 Chapter-4: 4.1 to 4.4** **(8 Hours)**

**Module – 3**

**Linked Lists:** Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection.

**Linked list operations:** Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples.

**Text Book: Chapter-4: 4.5,4.7,4.8 Chapter-5: 5.1 to 5.3, 5.5** **(8 Hours)**

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**Module – 4**

**Trees:** Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Tree.

**Binary Trees:** Binary Tree Insert Operation, Binary Tree Traversals - Inorder, postorder, preorder, Level Order; Additional Binary tree operations.

**Binary Search Trees:** BST Insert and Delete operations, Application of Trees-Evaluation of Expression, Programming Examples.

**Text Book: Chapter-5: 5.7 to 5.11 Chapter-6: 6.1, 6.2** **(8 Hours)**

**Module – 5**

**Graphs:** Definitions, Terminologies, Matrix and Adjacency List Representation Of Graphs, Warshal's Algorithm, Floyds Algorithm, Breadth First Search, Depth First Search.

**Hashing:** Definition, Hashing Functions, Hash Table, Separate chaining, Collision resolution techniques: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, and Applications of Hashing.**Recap:** Summary of the Course.

**Text Book: Chapter 8: 8.1 to 8.3 Chapter 9: 9.1, 9.2 Chapter 10: 10.1** **(8 Hours)**

**Course Outcomes:**

The students will be able to:

CO1: Illustrate different types of data structures, its operations and algorithms to solve a given problem.

CO2: Apply various data structures, its operations and algorithms to solve a given problem.

CO3: Analyze a given problem to derive a solution using suitable data structures.

CO4: Develop applications using suitable data structures.

**Textbooks**


| | |
|---|---|
| 1. | Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, Universities Press, 2nd edition, 2019 |
| 2. | Seymour Lipschutz, Data Structures, Schaum's Outline Series, 1st Edition, 2014. |


**References**


| | |
|---|---|
| 1. | Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, Cengage Learning, 2nd edition, 2014. |
| 2. | Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, McGraw Hill, 2nd Edition, 2013. |
| 3. | Reema Thareja, Data Structures using C, 3 rd Ed, Oxford press, 2012. |


**Activity Based Learning (Suggested Activities in Class) / Practical Based learning**

- Problem solving on hackerearth platform

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**B.E. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

**Choice Based Credit System (CBCS)**

SEMESTER – III

**DATA STRUCTURES LABORATORY (0:0:2:0) 1**

(Effective from the academic year 2025-26)

| | | | |
|---|---|---|---|
| Course Code | BCSL305 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 0:0:2:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 26(Practical) | Exam Hours | 03 |

**Course Objectives:**

This course enables students to:

1. Develop linear data structures and their applications such as stacks, queues and lists.
2. Develop non-linear data structures and their applications such as trees and graphs sorting and searching algorithms.

**Descriptions:**

Descriptions: Design, develop, and implement the specified Data Structure as given in the list given below using C Language under LINUX /Windows environment.

| Sl. No | PART – A<br>FIXED SET OF EXPERIMENTS |
|---|---|
| 1 | Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)<br>a. Push an Element on to Stack<br>b. Pop an Element from Stack<br>c. Demonstrate Overflow and Underflow situations on Stack<br>d. Display the status of Stack<br>e. Exit<br>Support the program with appropriate functions for each of the above operations. |
| 2 | Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %( Remainder), ^ (Power) and alphanumeric operands. Design, |
| 3 | Develop and Implement a Program in C for evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^. |
| 4 | Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of integers (Array Implementation of Queue with maximum size MAX)<br>a. Insert an Element on to Circular QUEUE<br>b. Delete an Element from Circular QUEUE<br>c. Demonstrate Overflow and Underflow situations on Circular QUEUE<br>d. Display the status of Circular QUEUE<br>e. Exit<br>Support the program with appropriate functions for each of the above operations. |
| 5 | Design, Develop and Implement a menu driven Program in C for the following operations on Double Ended QUEUE of integers (Array Implementation of Queue with maximum size MAX)<br>a. Perform Insertion / Deletion at front of QUEUE<br>b. Perform Insertion / Deletion at rear of QUEUE<br>c. Display the status of Circular QUEUE<br>d. Exit<br>Support the program with appropriate functions for each of the above operations. |

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| | |
|---|---|
| 6 | Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo<br>a. Create a SLL of N Students Data by using front insertion.<br>b. Display the status of SLL and count the number of nodes in it<br>c. Perform Insertion / Deletion at End of SLL<br>d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack)<br>e. Exit |
| 7 | Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, Ph. No.<br>a. Create a DLL of N Employees Data by using end insertion.<br>b. Display the status of DLL and count the number of nodes in it<br>c. Perform Insertion and Deletion at End of DLL<br>d. Perform Insertion and Deletion at Front of DLL<br>e. Demonstrate how this DLL can be used as Double Ended Queue<br>f. Exit. |
| 8 | Develop a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers.<br>a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2<br>b. Traverse the BST in Inorder, Preorder and Post Order<br>c. Search the BST for a given element (KEY) and report the appropriate message<br>d. Exit |
| 9 | Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities<br>a. Create a Graph of N cities using Adjacency Matrix.<br>b. Print all the nodes reachable from a given starting node in a digraph using any traversal method (DFS/BFS). |
| 10 | Given a set of N employee records with a set K of Keys (4-digit) which uniquely determine the records. Assume that the records are available in the memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Develop a Program in C that uses Hash function H: K →L as H (K) = K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing. |
| | **PART – B**<br>**OPEN ENDED EXPERIMENTS** |
| | Students should develop a program for the given scenario by the course teacher on the following concepts:<br>• Stacks, Queues, Linked lists, Trees, Graphs, and Hashing |

**Course Outcomes:**

The student should be able to:

CO 1: Demonstrate the working nature of different types of data structures and their applications.

CO 2: Apply the appropriate data structure for solving real world problems.

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| Textbooks | |
|---|---|
| 1. | Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, Universities Press, 2nd edition, 2019 |
| 2. | P Reema Thareja, Data Structures using C, 3 rd Ed, Oxford press, 2012. |

**Lab Conduction**

Record 30 marks, Test 1 and Test 2 conducted for 50 marks and scaled down to 20 marks

**B.E. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

**Choice Based Credit System (CBCS)**

SEMESTER – III

**Object-Oriented Programming with Java(2:0:2:0)3**

(Effective from the academic year 2025-26)

| | | | |
|---|---|---|---|
| Course Code | BCS306A | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P: S) | 2:0:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 27 (Theory) + 13 (Practical) | Exam Hours | 03 |
| Examination type (SEE) | Theory | | |

**Note - Students who have undergone "Basics of Java Programming- 22CS36A" in first year are not eligible to opt this course**

**Course objectives:**

1. To learn primitive constructs JAVA programming language.
2. To understand Object Oriented Programming Features of JAVA.
3. To gain knowledge on: packages, multithreaded programing and exceptions.

**Preamble**

The purpose of this course is to enable learners to solve problems by breaking it down to object level while designing software and to implement it using Java. This course covers Object Oriented Principles, Object Oriented Programming in Java, Inheritance, Exception handling, Event handling, multithreaded programming and working with window-based graphics. This course helps the learners to develop Desktop GUI Applications, Mobile applications, Enterprise Applications, Scientific Applications and Web based Applications.

**Module-1**

**An Overview of Java:** Java Buzzwords, Object-Oriented Programming (Two Paradigms, Abstraction, The Three OOP Principles),

**Data Types, Variables, and Arrays:** The Primitive Types (Integers, Floating-Point Types, Characters, Booleans), Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, Introducing Type Inference with Local Variables.

**Operators:** Arithmetic Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses.

**Control Statements:** Java's Selection Statements (if, The Traditional switch), Iteration Statements (while, do-while, for, The For-Each Version of the for Loop, Local Variable Type Inference in a for Loop, Nested Loops), Jump Statements (Using break, Using continue, return).

**Text book 1: Chapter 2, 3, 4, 5** **(5 Hours)**

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**Module-2**

**Introducing Classes:** Class Fundamentals**,** Declaring Objects**,** Assigning Object Reference Variables**,** Introducing Methods**,** Constructors**,** The this Keyword**,** Garbage Collection.

**Methods and Classes:** Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Understanding static, Introducing final

**Text book 1: Chapter 6, 7** **(6 Hours)**

**Module-3**

**Inheritance:** Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance, The Object Class.

**Interfaces:** Interfaces, Default Interface Methods.

**Text book 1: Chapter 8, 9** **(6 Hours)**

**Module-4**

**Packages:** Packages, Packages and Member Access, Importing Packages.

**Exceptions:** Exception-Handling Fundamentals**,** Exception Types**,** Uncaught Exceptions**,** Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions.

**Text book 1: Chapter 9, 10** **(5 Hours)**

**Module-5**

**Multithreaded Programming:** The Java Thread Model, The Multiple Threads, Creating a Thread, Creating Multiple Threads, Using is Alive() and join(), Thread Priorities, Synchronization, Inter thread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State.

**Text book 1: Chapter 11** **(6 Hours)**

**Course outcome (Course Skill Set)**

At the end of the course, the student will be able to:

CO1: Demonstrate the fundamentals of Java programming constructs.
CO2: Apply the concepts of object-oriented features for enhancing code reusability
CO3: Illustrate the concept of packages and exception handling mechanism in solving complex problems.
CO4: Make use of multi-threading concepts in program development.
CO5: Develop solutions for given scenario using Java concepts.

**PART A**
**FIXED SET EXPERIMENTS**

| | |
|---|---|
| 1 | **Introduce the java fundamentals, data types, operators and arrays in java**<br>Develop a Java program to add TWO matrices of suitable order N (The value of N should be read from command line arguments) print an error message if N <1 else print the resultant Matrix. |
| 2 | **Demonstrating creation of java classes, objects, constructors, declaration and initialization of variables.**<br>As part of a student management system, you are tasked with designing a module to generate student performance reports. Create a Java program using classes that captures a n student's name, roll number, and marks in three subjects. The program should then calculate and display the student's total score along with their details. |
| 3 | **Introduce concepts of method overloading, constructor overloading**<br>You are building a user authentication module for a web application. The system should support different ways of user login and account creation. Implement a class User that demonstrates constructor overloading for different account creation types and method overloading for flexible login options. Create multiple constructors in the User class:<br>User(String username, String password)– Creates a standard user.<br>User(String username, String password, String email)– Creates a user with email verification |

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| | |
|---|---|
| | Methods :<br>Login(String username, String password): returns true if credentials are matching<br>Login(String username, String password, int otp): returns true if credentials and otp are matching<br>Write a Java program to Create the users and login with proper credentials. |
| 4 | **Demonstrate the core object-oriented concept of Inheritance, polymorphism**<br>Design a super class called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display staff object of all three categories. |
| 5 | **Introduction to abstract classes, abstract methods**<br>Develop a JAVA program to create an abstract class/interface Shape with abstract methods calculate Area() and calculate Perimeter(). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape. |
| 6 | **Introduce the concept of Abstraction, packages.**<br>Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR) and time converter (hours to minutes, hours to seconds) using packages. |

**PART B**
**OPEN ENDED EXPERIMENTS**

Students should develop a program for the given scenario by the course teacher on the following concepts.

a. Application of interfaces in real world scenario.
b. Built-in and user defined exception handling.
c. Creating user defined Threads.

**Textbook**

1. Java: The Complete Reference, 12th Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422

**Reference Books**

1. Programming with Java, 6th Edition, by E Balagurusamy, March 2019, McGraw Hill Education, ISBN: 9789353162337.

Thinking in Java, FourthEdition, by Bruce Eckel, Prentice Hall, 2006 (https://sd.blackball.lv/library/thinking_in_java_4th_edition.pdf)

**B.E ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

Choice Based Credit System (CBCS)

**SEMESTER – III**

**Object-Oriented Programming with C++ (**2:0:2:0**) 3**

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | BCS306B | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P:S) | 2:0:2:0 (Integrated) | SEE Marks | 50 |
| Total Number of Contact Hours | 27 (Theory) + 13(Practical) | Exam Hours | 3 Hours |
| Examination Type | Theory | | |

**Note - Students who have undergone " Introduction to C++ Programming BPLCK105D/205D" in first year are not eligible to opt this course**

**Course Objectives:**

This course will enable students to:

1. To understand object-oriented programming using C++and Gain knowledge about the capability to store information together in an object.
2. To illustrate the capability of a class to rely upon another class and functions.
3. To Create and process data in files using file I/O functions
4. To understand the generic programming features of C++ including Exception handling

**Preamble**

Object oriented programming is an approach that provides a way of modularizing programs by creating partitioned memory area for both data and functions that can be used as templates for creating copies of such modules on demand. OOP is a base for learning Programming with the rapid changes in technology, there is an increasing need to keep the academia abreast of the skill set requirement of the industry. These concepts are important for computer science students in their understanding of programming languages. This course will be discussing Objects, Classes, Polymorphism, Encapsulation, data abstraction Inheritance etc.

**Module – 1**

**An overview of C++:** What is object-Oriented Programming? Introducing C++ Classes, The General Form of a C++ Program. Classes and Objects: Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment

**(5 Hours)**

**Module – 2**

**Arrays, Pointers, References, and the Dynamic Allocation Operators:** Arrays of Objects, Pointers to Objects, The this Pointer, Pointers to derived types, Pointers to class members. **Functions Overloading, Copy Constructors:** Functions Overloading, Overloading Constructor Functions. Copy Constructors, Default Function Arguments, Function Overloading and Ambiguity.

**(6 Hours)**

**Module – 3**

**Operator Overloading:** Creating a Member Operator Function, Operator Overloading Using a Friend Function, **Overloading new and delete Inheritance:** Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes , Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes

**(6 Hours)**

| Module – 4 |
|---|
| **Virtual Functions and Polymorphism**: Virtual Functions, The Virtual Attribute is Inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding. **Templates**: Generic Functions, Applying Generic Functions, Generic Classes. The type name and export Keywords. The Power of Templates<br>**(5 Hours)** |
| **Module – 5** |
| **Exception Handling:** Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling. **The C++ I/O System Basics:** C++ Streams, The C++ Classes, Formatted I/O File I/O: and File Classes, Opening and Closing a File, Reading and Writing Text Files, Detecting EOF,<br>**(6 Hours)** |
| **Course Outcomes:**<br>The students will be able to: |
| CO1: Illustrate the basic concepts of object-oriented programming.<br>CO2: Design appropriate classes for the given real world scenario.<br>CO3: Apply the knowledge of compile-time / run-time polymorphism to solve the given problem<br>CO4: Use the knowledge of inheritance for developing optimized solutions<br>CO5: Apply the concepts of templates and exception handling for the given problem<br>CO6: Use the concepts of input output streams for file operations. |

| Practical Component | |
|---|---|
| **PART – A**<br><br>**FIXED SET OF EXPERIMENTS** | |
| **1** | You are building a feature for an e-commerce platform that displays product prices. Write a C++ program that accepts a list of product prices and displays them sorted both in ascending (low to high) and descending (high to low) order, allowing customers to choose how they want to view the prices." (Use basic programming concepts like looping constructs for menu driven programming, arrays and sorting logic etc.) |
| **2** | As part of a student management system, you are tasked with designing a module to generate student performance reports. Create a C++ program using classes that captures a student's name, roll number, and marks in three subjects. The program should then calculate and display the student's total score along with their details.<br>(Use C++ concepts like classes, constructors and methods etc.) |
| **3** | You are developing a contact management application where each contact contains details such as name, phone number, and email address. To ensure safe and accurate duplication of contact records (e.g., for backup or editing), implement a C++ class Contact that:<br>a. Includes a copy constructor to properly copy all data members from one contact object to another.<br>b. Also includes a destructor to manage clean-up when a contact object is destroyed (e.g., to release memory or display a message indicating the object is being deleted).<br>Demonstrate the creation of an original contact and a copy using the copy constructor, display their contents, and show how the destructor is automatically invoked when objects go out of scope.<br>(Use C++ concepts like classes, constructors, copy constructor, destructor etc.) |

| | |
|---|---|
| **4** | Develop a loan eligibility evaluation system for a bank. The system has two classes:<br>Customer – contains private data members such as name, account balance, and credit score.<br>Loan – is responsible for evaluating whether the customer is eligible for a loan based on specific criteria (e.g., balance ≥ ₹50,000 and credit score ≥ 750 out of 1000).<br>Since the Loan class should not directly access the private members of the Customer class, implement a friend function named checkEligibility() that can access the private data of Customer and evaluate the eligibility.<br>(Use C++ concepts like classes, constructor, Friend functions etc.) |
| **5** | You are developing a banking application that enables customers to manage their accounts efficiently. As part of the system implement the following functionality:<br>a. Implement function overloading to perform addition of both integer-based amounts (e.g., ₹500 + ₹200) and floating-point values (e.g., ₹1000.75 + ₹499.25), ensuring accuracy across transaction types like deposits and interest calculations.<br>b. Use operator overloading to redefine the unary minus (-) operator, allowing quick reversal of transaction values — for example, converting a credit transaction into a debit during a refund or correction.<br>(Use concepts like classes, function overloading and operator overloading etc.) |
| **6** | You are designing a modular calculator system where arithmetic functionalities are separated into logical units. One class provides addition functionality, another provides subtraction, and a third class inherits from both to perform a full arithmetic operation on two numbers. Implement a C++ program using multiple inheritances to demonstrate this system.<br>(Use concepts like classes, constructors, multiple inheritances etc.) |
| **7** | "You're working on a scientific computation module where different values—such as alpha, beta, and gamma—represent coefficients in a formula. These values come from different sources: a base class initializes alpha and beta, while the derived class introduces gamma. Write a C++ program using constructors in derived classes to properly initialize and display all three values, showcasing inheritance and constructor chaining."<br>(Use concepts like classes, constructors, inheritance and constructor chaining etc.) |

**PART – B**
**OPEN ENDED EXPERIMENTS**

Students should develop a program for the given scenario by the course teacher on the following concepts.

1. File operation in C++
2. Built-in & User Defined Exception Handling

**Textbooks:**

1. Herbert schildt, The Complete Reference C++, 4 th edition, TMH, 2005.

**References:**

1. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill
2. Education Pvt.Ltd., Sixth Edition 2016.
3. Bhave , " Object Oriented Programming With C++", Pearson Education , 2004.
4. A K Sharma , "Object Oriented Programming with C++", Pearson Education, 2014.

**Activity Based Learning (Suggested Activities in Class)/ Project Based Learning :**

- Group Assignment to develop small projects and demonstrate using C++

**B.E. Artificial Intelligence and Machine Learning**

Choice Based Credit System (CBCS)

**SEMESTER – III**

**Python Programming for Data Science** (2:0:2) 3

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | **BDS306B** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 2:0:2:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 28 Hours Theory + 20 Hours Practical | Exam Hours | 3 Hours |
| Examination Type | Theory | | |

**Note - Students who have undergone "Introduction to Python Programming- BPLCK105B/205B" in first year are not eligible to opt this course**

**Course Objectives:**

This course will enable students to:

1: To understand Python constructs and use them to build the programs.

2: To analyse different conditional statements and their applications in programs. 3: To learn and use basic data structures in python language.

4: To learn and demonstrate array manipulations by reading data from files

5: To understand and use different data in a data analytics context.

**Module – 1**

Introduction to python: Elements of python language, python block structure, variables and assignment statement, data types in python, operations, simple input/output print statements, formatting print statement.

**Text Book 1: Chapter 3 (3.2, 3.3, 3.4, 3.6, 3.7, 3.9 and 3.10) (6 Hours)**

**Module – 2**

Decision structure: forming conditions, if statement, the if-else and nested if-else, looping statements: introduction to looping, python built in functions for looping, loop statements, jump statement.

**Text Book 1: Chapter 4 (4.2 to 4.6) , Chapter 5 (5.1 to 5.4) (5 Hours)**

**Module – 3**

Lists: lists, operation on list, Tuples: introduction, creating, indexing and slicing, operations on tuples. sets: creating, operation in sets, introduction dictionaries, creating, operations, nested dictionary, looping over dictionary.

**Text Book 1: Chapter 7 ( 7.2 to 7.3) , Chapter 8 (8.1 to 8.4) and Chapter 9( 9.1 to 9.3, 9.7 to 9.12) (5 Hours)**

**Module – 4**

**The NumPy Library:** Ndarray: the heart of the library, Basic operations, indexing, slicing and iterating, conditions and boolean arrays, array manipulation, general concepts, reading and writing array data on files. **The pandas Library:** an introduction to Data structure,other functionalities on indexes, operations between data structures, function application and mapping.

**Text Book 2: Chapter 3 and Chapter 4 (6 Hours)**

**Module – 5**

**The pandas : Reading and Writing data:** i/o API tools, CSV and textual files, Reading data in CSV or text files, reading and writing HTML files, reading data from XML files, Microsoft excel files, JSON data, Pickle python object serialization. **Pandas in Depth : data manipulation:** data preparation, concatenating data transformation discretization binning, permutation, string manipulation, data aggregation group iteration.

**Text Book 2: Chapter 5 and Chapter 6 (6 Hours)**

**Course Outcomes:**

The students will be able to:

CO1: Describe the constructs of python programming
CO2: Use looping and conditional constructs to build programs.
CO3: Apply the concept of data structure to solve the real world problem.
CO4: Use the NumPy constructs for matrix manipulations
CO5: Apply the Panda constructs for data analytics.

Practical Component

| Sl.NO | Experiments |
|---|---|
| 1 | Develop a python program to read **n** digit integer number, and separate the integer number and display each digit. [Hint: input:5678 output: 5 6 7 8, use: floor and mod operators) |
| 2 | Develop a python program to accept 4 numbers and display them in sorted order using a minimum number of **if else** statements. |
| 3 | Develop python scripts to Calculate the mean, median, mode, variance and standard deviation of **n** integer numbers. |
| 4 | Develop a program for checking if a given **n** digit number is palindrome or not. [hint: input 1221 output: palindrome, use //and % operator with loop statement] |
| 5 | Develop a python script to display a multiplication table for given integer **n**. |
| 6 | Develop a python script to rotate right about a given position in that list and display them. [hint: input [1,4,5,-10] position: 2, output: [-10,5,4,1]] |
| 7 | DevelopWrite a python script to interchange the digits of a given integer number. [hint: input: 23456, interchange: 3 and 5 output: 25436] |
| 8 | Develop a python program to capitalize a given list of strings. [hint: [hello, good, how, simple] output: [Hello, Good, How, Simple] |
| 9 | Using a dictionary, Develop a python program to determine and print the number of duplicate wordsin a sentence. |
| 10 | Develop python program to read Numpy array and print row (sum,mean std) and column (sum,mean,std) |
| 11 | Develop a python program to read and print in the console CSV file. |
| 12 | Develop a python program to read a HTML file with basic tags, and |

| | | |
|---|---|---|
| | | construct a<br>dictionary and display the same in the console. |

**Textbooks:**

1. S. Sridhar, J. Indumathi, V.M. Hariharan "Python Programming" Pearson publishers, 1st edition 2023.
2. Fabio Nelli, "**Python Data Analytics**", Apress, Publishing, 1st Edition, 2015.

**Reference Book:**

3. Paul Deitel and Harvey deitel,"**Intro to Python for Computer Science and Datascience**", 1st edition Pearson Publisher 2020.

**Web links and Video Lectures (e-Resources**):

Nptel: Introduction to Python for Data Science
https://www.youtube.com/watch?v=tA42nHmmEKw&list=PLh2mXjKcTPSACrQxPM2_1Ojus5HX88ht7

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning.**

- Assessment Methods
  - Programming Assignment (10 Marks)

**B.E. Artificial Intelligence and Machine Learning**

Choice Based Credit System (CBCS)

**SEMESTER – III**

**Data Analytics with R** (2:0:2) 3

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | **BDS306C** | CIE Marks | 50 |
| Teaching Hours/Week (L: T:P) | 2:0:2:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 28 Hours Theory + 20 Hours Practical | Exam Hours | 3 Hours |
| Examination Type | Theory | | |

**Course Learning objectives:**

1: To Gain the knowledge of R Programming

Concepts 2: To Explain the concepts of Data Visualization

3: To Explain the concept of Statistics in R.

4: To Work with R charts and Graph

**Teaching-Learning Process (General Instructions)**

1. Chalk and board, power point presentations
2. Online material (Tutorials) and video lectures.
3. Demonstration of programing examples.

**Module-1**

**Basics of R**

Introducing R, Initiating R, Packages in R, Environments and Functions, Flow Controls, Loops,Basic Data Types in R, Vectors

**Chapter 1: 1.1 to 1.7 Chapter 2: 2.1,2.2** (**5 hours)**

**Module-2**

**Basics of R Continued**

Matrices and Arrays, Lists, Data Frames, Factors, Strings, Dates and Times

Chapter 2: 2.3,2.4,2.5,2.6,2.7.2.8.1,2.8.2 (**5 hours)**

**Module-3**

**Data Preparation** Datasets, Importing andTransformation

Chapter 3: 3.1,3.2,3.3,3.4 (**5 hours)**

**Module-4**

**Graphics using R**

Exploratory Data Analysis, Main Graphical Packages, Pie Charts, Scatter Plots, Line Plots,Histograms, Box Plots, Bar Plots, Other Graphical packages

Chapter 4: 4.1 to 4.9 (**5 hours)**

**Module-5**

Statistical Analysis using R
Basic Statistical Measures, Normal distribution, Binomial distribution, Correlation Analysis, Regression Analysis-Linear Regression Analysis of Variance

**Chapter 5: 5.1, 5.3, 5.4, 5.5, 5.6.1, 5.7** **(6 hours)**

**Course outcome (Course Skill Set)**

At the end of the course, the student will be able to :

CO1: Describe the structures of R Programming.

CO2: Illustrate the basics of Data Preparation with real world examples.

CO3: Apply the Graphical Packages of R for visualization.

CO4: Apply various Statistical Analysis methods for data analytics.

**Suggested Learning Resources:**

**Text Books:**

R Programming: An Approach to Data Analytics, G. Sudhamathy and C. Jothi Venkateswaran, MJP Publishers, 2019

Reference Books:

1..An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W.
N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16)

2. Cotton, R. (2013). Learning R: A Step by Step Function Guide to Data Analysis. 1st ed. O'Reilly Media Inc

**Web links and Video Lectures (e-Resources):**

1. URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf
2. http://www.tutorialspoint.com/r/r_tutorial.pdf
3. https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/intro.html
4. https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html
5. https://www.w3schools.com/r/r_stat_data_set.asp
6. https://rpubs.com/BillB/217355

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning.**

- Assessment Methods
  - Programming Assignment (10 Marks)

Practical Component

| Sl. No | Experiments |
|---|---|
| 1 | Demonstrate the steps for installation of R and R Studio. Perform the following:<br><br>a) Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type.<br>b) Demonstrate Arithmetic and Logical Operations with simple examples.<br>c) Demonstrate generation of sequences and creation of vectors.<br>d) Demonstrate Creation of Matrices<br>e) Demonstrate the Creation of Matrices from Vectors using Binding Function.<br>f) Demonstrate element extraction from vectors, matrices and arrays<br><br>Suggested Reading – Text Book 1 – Chapter 1 (What is R, Installing R, Choosing an IDE – RStudio, How to Get Help in R, Installing Extra Related Software), Chapter 2 (Mathematical Operations and Vectors, Assigning Variables, Special Numbers, Logical Vectors), Chapter 3 (Classes, Different Types of Numbers, Other Common Classes, Checking and Changing Classes, Examining Variables ) |

<table>
<tr><td>2</td><td>Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics:<br><br>a. Profit for each month.</td></tr>
<tr><td></td><td>b. Profit after tax for each month (Tax Rate is 30%).<br>c. Profit margin for each month equals to profit after tax divided by revenue.<br>d. Good Months – where the profit after tax was greater than the mean for the year.<br>e. Bad Months – where the profit after tax was less than the mean for the year.<br>f. The best month – where the profit after tax was max for the year.<br>g. The worst month – where the profit after tax was min for the year. Note:<br>a. All Results need to be presented as vectors<br>b. Results for Dollar values need to be calculated with $0.01 precision, but need to be presented in Units of $1000 (i.e 1k) with no decimal points<br>c. Results for the profit margin ratio need to be presented in units of % with no decimal point.<br>d. It is okay for tax to be negative for any given month (deferred tax asset)<br>e. Generate CSV file for the data.<br>Suggested Reading – Text Book 1 – Chapter 4 (Vectors, Combining Matrices)</td></tr>
<tr><td>3</td><td>Develop a program to create two 3 X 3 matrices A and B and perform the following operations<br>a) Transpose of the matrix b) addition c) subtraction d) multiplication<br>Suggested Reading – Text Book 1 – Chapter 4 (Matrices and Arrays – Array Arithmetic)</td></tr>
<tr><td>4</td><td>Develop a program to find the factorial of given number using recursive function calls. Suggested Reading – Reference Book 1 – Chapter 5 (5.5 – Recursive Programming)<br>Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)</td></tr>
<tr><td>5</td><td>Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes.<br>Suggested Reading – Reference Book 1 - Chapter 5 (5.5 – Recursive Programming)<br>Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops),<br>Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)</td></tr>
<tr><td>6</td><td>The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to:<br>a) Find the Pearson and Spearman correlation coefficients. Are they similar?<br>b) Plot the data using the plot command.<br>c) Plot the logarithm (log) of each variable and see if that makes a difference.<br>Suggested Reading – Text Book 1 –Chapter 12 – (Built-in Datasets) Chapter 14 – (Scatterplots) Reference Book 2 – 13.2.5 (Covariance and Correlation)</td></tr>
<tr><td>7</td><td>Develop R program to create a Data Frame with following details and do the following operations.
<table>
<tr><td>itemCode</td><td>itemCategory</td><td>itemPrice</td></tr>
<tr><td>1001</td><td>Electronics</td><td>700</td></tr>
<tr><td>1002</td><td>Desktop Supplies</td><td>300</td></tr>
<tr><td>1003</td><td>Office Supplies</td><td>350</td></tr>
<tr><td>1004</td><td>USB</td><td>400</td></tr>
<tr><td>1005</td><td>CD Drive</td><td>800</td></tr>
</table></td></tr>
</table>

| | |
|---|---|
| | a) Subset the Data frame and display the details of only those items whose price is greater than or equal to 350.<br>b) Subset the Data frame and display only the items where the category is either "Office Supplies" or "Desktop Supplies"<br>c) Create another Data Frame called "item-details" with three different fields itemCode, ItemQtyonHand and ItemReorderLvl and merge the two frames<br>Suggested Reading –Textbook 1: Chapter 5 (Lists and Data Frames) |
| **8** | Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements.<br>a) Assigning names, using the air quality data set. |
| | b) Change colors of the Histogram<br>c) Remove Axis and Add labels to Histogram<br>d) Change Axis limits of a Histogram<br>e) Add Density curve to the histogram<br>Suggested Reading –Reference Book 2 – Chapter 7 (7.4 – The ggplot2 Package), Chapter 24 (Smoothing and Shading ) |
| **9** | Design a data frame in R for storing about 20 employee details. Create a CSV file named "input.csv" that defines all the required information about the employee such as id, name, salary, start_date, dept. Import into R and do the following analysis.<br>a) Find the total number rows & columns<br>b) Find the maximum salary<br>c) Retrieve the details of the employee with maximum salary<br>d) Retrieve all the employees working in the IT Department.<br>e) Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file "output.csv"<br>Suggested Reading – Text Book 1 – Chapter 12(CSV and Tab Delimited Files) |
| **10** | Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon, [2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axleratio,[6] wt Weight (lb/1000)<br>[7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors<br>Develop R program, to solve the following:<br>a) What is the total number of observations and variables in the dataset?<br>b) Find the car with the largest hp and the least hp using suitable functions<br>c) Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness?<br>d) What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations.<br>e) Which pair of variables has the highest Pearson<br><br>correlation? References (Web links):<br><br>1. https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html<br>2. https://www.w3schools.com/r/r_stat_data_set.asp<br>3. https://rpubs.com/BillB/217355 |

| | |
|---|---|
| **11** | Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file.<br>Suggested Reading – Reference Book 2 – Chapter 20 (General Concepts, Statistical Inference, Prediction) |

## Department of Humanities and Social Sciences

**B.E. ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

**Choice Based Credit System (CBCS)**

SEMESTER – III

(Common to all branches)

**Social Connect and Responsibility (0:0:2:0) 1**

**(Effective for 2022 Scheme)**

| | | | |
|---|---|---|---|
| Course Code | BCSK307 | CIE Marks | **100** |
| Teaching Hours/Week (L: T:P) | 0:0:2:0 | SEE Marks | - |
| Total Number of Contact Hours | 26 Hours | Exam Hours | **-** |
| Credits | 01 - Credit | | |

**Course objectives: The course will enable the students to:**

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**Social Connect & Responsibility –All Modules Activity Based Learning**

**Module-1**

**Plantation and adoption of a tree:** Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes. **(04 Hours)**

**Module-2**

**Heritage walk and crafts corner:** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes. **(05 Hours)**

**Module-3**

**Organic farming and waste management:** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes. **(06 Hours)**

**Module-4**

**Water conservation:** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes. **(06 Hours)**

**Module-5**

**Food walk:** City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes. **(05 Hours)**

**Course outcomes (Course Skill Set):** At the end of the course, the student will be able to:

CO1: Communicate and connect to the surrounding.

CO2: Create a responsible connection with society.

CO3: Involve in the community in general in which they work.

CO4: Notice the needs and problems of the community and involve them in problem –solving.

CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.

CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

**ACTIVITIES:** Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

**PEDAGOGY:** The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

**COURSE TOPICS:** The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem

**Duration:** A total of 26 hours engagement per semester is required for the 3rd semester of the B.E./B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors have to design the evaluation system as per VTU guidelines of scheme & syllabus**.**

**Guideline for Assessment Process:** Continuous Internal Evaluation (CIE): After completion of the course, the student shall prepare with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

Excellent: 80 to 100
Good: 60 to 79
Satisfactory: 40 to 59
Unsatisfactory and fail: <39

Special Note: **NO Semester End Examination (SEE) – Completely Practical and activities-based evaluation**

Plan of Action (Execution of Activities)

| Sl.NO | Practice Session Description |
|---|---|
| 1 | Lecture session in field to start activities |
| 2 | Students Presentation on Ideas |
| 3 | Commencement of activity and its progress |
| 4 | Execution of Activity |
| 5 | Execution of Activity |
| 6 | Execution of Activity |
| 7 | Execution of Activity |
| 8 | Case study-based Assessment, Individual performance |
| 9 | Sector/ Team wise study and its consolidation |
| 10 | Video based seminar for 10 minutes by each student At the end of semester with Report. |

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

**Assessment Details for CIE (both CIE and SEE)**

| **Weightage** | **CIE – 100%** |
|---|---|
| Field Visit, Plan, Discussion | 10 Marks |
| Commencement of activities and its progress | 20 Marks |
| Case study-based Assessment Individual performance with report | 20 Marks |
| Sector wise study & its consolidation 5*5 = 25 | 25 Marks |
| Video based seminar for 10 minutes by each student at the end of semester with Report. **Activities 1 to 5, 5*5 = 25** | 25 Marks |
| **Total marks for the course in each semester** | **100 Marks** |

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

**For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.**

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field.

There should be positive progress in the vertical order for the benefit of society in general through activities.

**B.E. Artificial Intelligence and Machine Learning**

**Choice Based Credit System (CBCS)**

SEMESTER - III

**Data Analytics with Excel (0:0:2) 1**

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | **BCS358A** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Number of Contact Hours | **26** | Exam Hours | **03** |
| Examination Type | **Practical** | | |

**Course Objectives:**

This course enables students to:

1. To Apply analysis techniques to datasets in Excel
2. Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel
3. Understand and Identify the principles of data analysis
4. Become adept at using Excel functions and techniques for analysis
5. Build presentation ready dashboards in Excel

| Sl. No | Programs List |
|---|---|
| 1 | Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions. |
| 2 | Working with Data : Importing data, Data Entry & Manipulation, Sorting & Filtering. |
| 3 | Working with Data: Data Validation, Pivot Tables & Pivot Charts. |
| 4 | Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs. |
| 5 | Cleaning Data with Text Functions: use of UPPER and LOWER, TRIM function, Concatenate. |
| 6 | Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions. |
| 7 | Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis. |
| 8 | Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports. |
| 9 | Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data. |
| 10 | Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data. |

**Course Outcomes:**

The student should be able to:

**CO1:** Choose functions and productivity tools to assist in developing worksheets.

**CO2:** Create and manipulate data lists using Outline and PivotTables in Microsoft Excel.

**CO3:** Utilize Consolidation features to summarize and report results from multiple worksheets.

**CO4:** Apply Macros and Auto-filter to solve the given real-world scenario.

**Textbooks**

| | |
|---|---|
| 1. | Berk & Carey - Data Analysis with Microsoft® Excel: Updated for Office 2007®, Third Edition, © 2010 Brooks/Cole,<br>Cengage Learning, ISBN-13: 978-0-495-39178-4 |
| 2. | Wayne L. Winston - Microsoft Excel 2019: Data Analysis And Business Modelling, PHI, ISBN: 9789389347180 |
| 3. | Aryan Gupta - Data Analysis in Excel: The Best Guide. (https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel) |

**B.E. Artificial Intelligence and Machine Learning**

**Choice Based Credit System (CBCS)**

SEMESTER - III

**Ethics and Public Policy for AI (0:0:2) 1**

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | **BAI358B** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **1:0:0** | SEE Marks | **50** |
| Total Number of Contact Hours | **14** | Exam Hours | **02** |
| Examination Nature (SEE) | **Practical** | | |

**Course Objectives:**

This course will enable students to:

1. To understand Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
2. To Designing ethics for good society
3. To familiar with Tools, methods and practices for designing AI for social good
4. To familiar with Innovation and future AI
5. To understand the Case Study: Ai in health care, knowing Regulation and Governance of AI ethics

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. **Chalk and Talk**
2. **Real time Examples Natural Approaches**

**Module-1**

**An Ethical Framework for a Good AI Society:** opportunities, Risks, principles and Recommendations.
**Establishing the rules for building trustworthy AI**
Textbook1: Chapter 3, chapter 4

**Module-2**

**Translating principles into practices of digital ethics:** five risks of being Unethical
**The Ethics of Algorithms: Key problems and Solution How to**
**Design AI for Social Good:** Seven Essential Factors
Textbook1: Chapter 6, Chapter 8, Chapter 9

**Module-3**

**How to design AI for social good: seven essential factors**
**From What to How:** An Initial Review of publicly available AI Ethics tools, Methods and Research to Translate principles into Practices
Textbook1: Chapter 9, Chapter 10

**Module-4**

**Innovating with Confidence**: Embedding AI Governance and fairness in financial Services Riskmanagement framework,
**What the near future of AI could be.**
Textbook1: Chapter 20, chapter 22

**Module-5**

**Human-AI Relationship**, AI and Workforce, Autonomous Machines and Moral Decisions, **AI in HealthCare**: balancing Progress and Ethics, Regulation and Governance of AI Ethics Textbook2 : Chapter 5,Chapter 8, Chapter 9

**Course outcome (Course Skill Set)**

At the end of the course, the student will be able to :

**CO1: Describe Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI**

**CO2: Explain ethics for good society**

**CO3: Illustrate various Tools, methods and practices for designing AI for social good**

**CO$:Describe the Innovation and future AI**

**CO5: Illustrate Regulation and Governance of AI ethics in healthcare domain.**

**Suggested Learning Resources:**

**Books**


1. "Ethics, governance and Policies in Artificial Intelligence", Author-Editor : Luciano Floridi, Springer, 1st Edition 2021, vol 144, Oxford Internet Institute, University of ixford, UK, ISSN 0921-8599, e-ISSN 2542-8349 Philosophical Studies series, ISBN 978-3-030-81906-4 e-ISBN 978-3-030-81907-1, ://doi.orghttps/10.1007/978-3-030-81907-1, 2021.

"Ethics and AI: Navigating the Moral Landscape of Digital Age", Author: Aaron Aboagye,

**B.E. Artificial Intelligence and Machine Learning**

**Choice Based Credit System (CBCS)**

SEMESTER - III

**PROJECT MANAGEMENT WITH GIT (0:0:2) 1**

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | **BCS358C** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Number of Contact Hours | **26** | Exam Hours | **02** |
| Examination Nature | **Practical** | | |

**Course Objectives:**

This course will enable students to:

1. Familiar with the basic command of Git.
2. Create and manage branches.
3. Understand how to collaborate and work with Remote Repositories.
4. Familiar with version controlling commands.

| Sl. No | Experiments |
|---|---|
| 1 | **Setting Up and Basic Commands**<br>Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message. |
| 2 | **Creating and Managing Branches**<br>Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master." |
| 3 | **Creating and Managing Branches**<br>Write the commands to stash your changes, switch branches, and then apply the stashed changes. |
| 4 | **Collaboration and Remote Repositories**<br>Clone a remote Git repository to your local machine. |
| 5 | **Collaboration and Remote Repositories**<br>Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch. |
| 6 | **Collaboration and Remote Repositories**<br>Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge. |
| 7 | **Git Tags and Releases**<br>Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository. |
| 8 | **Advanced Git Operations**<br>Write the command to cherry-pick a range of commits from "source-branch" to the current branch. |
| 9 | **Analysing and Changing Git History**<br>Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message? |
| 10 | **Analysing and Changing Git History**<br>Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31." |
| 11 | **Analysing and Changing Git History**<br>Write the command to display the last five commits in the repository's history. |
| 12 | **Analysing and Changing Git History**<br>Write the command to undo the changes introduced by the commit with the ID "abc123". |

**Course outcomes:**

The students will be able to:

CO1: Use the basics commands related to Git repository
CO2: Create and manage the branches
CO3: Apply commands related to Collaboration and Remote Repositories
CO4: Use the commands related to Git Tags, Releases and advanced Git operations
CO5: Analyze and change the Git history

| | |
|---|---|
| **Textbooks** | |
| 1. | Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc. |
| 2. | Pro Git book, written by Scott Chacon and Ben Straub and published by Apress https://git- scm.com/book/en/v2 |
| **References** | |
| 1. | https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094443347369984278 2_shared/overview |
| 2. | https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774592119 26_shared/overview |

**B.E. Artificial Intelligence and Machine Learning**

**Choice Based Credit System (CBCS)**

SEMESTER - III

**PHP Programming (0:0:2) 1**

(Effective from the academic year 2025 -26)

| | | | |
|---|---|---|---|
| Course Code | **BAI358D** | CIE Marks | **50** |
| Teaching Hours/Week (L:T:P) | **0:0:2** | SEE Marks | **50** |
| Total Number of Contact Hours | **26** | Exam Hours | **02** |
| Examination Nature | **Practical** | | |

**Course Objectives:**

This course will enable students:

1. To introduce the PHP syntax, elements, and control structures
2. To make use of PHP Functions and File handling
3. To illustrate the concept of PHP arrays and OOPs

| Sl. No | Experiments |
|---|---|
| 1 | a. Develop a PHP program to calculate areas of Triangle and Rectangle.<br>b. Develop a PHP program to calculate Compound Interest. |
| 2 | Demonstrating the various forms to concatenate multiple strings ,Develop program(s) to demonstrate concatenation of strings:<br>(i) Strings represented with literals (single quote or double quote)<br>(ii) Strings as variables<br>(iii) Multiple strings represented with literals (single quote or double quote) and variables<br>(iv)Strings and string variables containing single quotes as part string contents<br>(v) Strings containing HTML segments having elements with attributes |
| 3 | a. Develop a PHP Program(s) to check given number is:<br>(i) Odd or even<br>(ii) Divisible by a given number (N)<br>(iii) Square of a another number<br>Develop a PHP Program to compute the roots of a quadratic equation by accepting the coefficients.Print the appropriate messages. |
| 4 | a. Develop a PHP program to find the square root of a number by using the newton's algorithm.<br>Develop a PHP program to generate Floyd's triangle. |
| 5 | a. Develop a PHP application that reads a list of numbers and calculates mean and standard deviation.<br>Develop a PHP application that reads scores between 0 and 100 (possibly including both 0 and 100) and creates a histogram array whose elements contain the number of scores between 0 and 9, 10 and 19, etc. The last "box" in the histogram should include scores<br>between 90 and 100. Use a function to generate the histogram. |
| 6 | a. Develop PHP program to demonstrate the date() with different parameter options.<br>Develop a PHP program to generate the Fibonacci series using a recursive function. |

| | |
|---|---|
| 7 | Develop a PHP program to accept the file and perform the following<br>(i) Print the first N lines of a file<br>(ii) Update/Add the content of a file |

| | |
|---|---|
| 8 | Develop a PHP program to read the content of the file and print the frequency of occurrence of the wordaccepted by the user in the file |
| 9 | Develop a PHP program to filter the elements of an array with key names.<br>Sample Input Data:<br>1st array: ('c1' => 'Red', 'c2' => 'Green', 'c3' => 'White', c4 => 'Black')2nd array: ('c2', 'c4')Output:<br>Array(<br>[c1] => Red [c3] => White ) |
| 10 | Develop a PHP program that illustrates the concept of classes and objects by reading and printing employee data, including Emp_Name, Emp_ID, Emp_Dept, Emp_Salary, and Emp_DOJ. |
| 11 | a. Develop a PHP program to count the occurrences of Aadhaar numbers present in a text.<br>b. Develop a PHP program to find the occurrences of a given pattern and replace them with a text. |
| 12 | Develop a PHP program to read the contents of a HTML form and display the contents on a browser. |

**NOTE: Necessary HTML elements (and CSS) can be used for designing the experiments.**

**Course outcomes (Course Skill Set):**

At the end of the course, the student will be able to:

- Apply basic concepts of PHP to develop web program
- Develop programs in PHP involving control structures
- Develop programs to handle structured data (object) and data items (array)
- Develop programs to access and manipulate contents of files

Use super-global arrays and regular expressions to solve real world problems.

**Suggested Learning Resources:**

- BOOK: Programming in HTML and PHP (Coding for Scientists and Engineers, BY DEVID R BROOKS,Springer International Publishing AG 2017
- PHP TUTORIALS: [https://www.w3schools.com/php/}
- PHP TUTORIALS: [ https://www.tutorialspoint.com/php/index.htm]
- HTML TUTORIALS: [https://www.w3schools.com/html/

**Department of Humanities and Social Sciences**

**B.E. Artificial Intelligence and Machine Learning**

**Choice Based Credit System (CBCS)**

SEMESTER – III to VI

NSS

(Common to all branches)

(Effective for the 2022 scheme)

| | | | |
|---|---|---|---|
| Course Code | **BNSK359** | CIE Marks | 100 |
| Teaching Hours/Week (L:T:P) | 0:0:2 | SEE Marks | - |
| Total Number of Contact Hours | 26 | Exam Hours | - |

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

**Course Objectives: National Service Scheme (NSS) will enable the students to:**

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**Module – 1**

**Introduction to NSS**

History and growth of NSS, Philosophy of NSS, Objectives of NSS, Meaning of NSS Logo, NSS Programs and activities, administrative structure of NSS, Planning of programs / activities, implementation of NSS programs / activities, National & State Awards for NSS College / Program Officer / Volunteers.

**(04 Hours)**

**Module – 2**

**Overview of NSS Programs**

Objectives, special camping –Environment enrichment and conservation, Health, Family, Welfare and Nutrition program. Awareness for improvement of the status of women, Social Service program, production-oriented programs, Relief & Rehabilitation work during natural calamities, education and recreations, Selection of the problem to be addressed.

(**04 Hours)**

**Module – 3**

**NSS Activities - Group Contributions to Society / community (Activity based Learning)**

Organic Farming, Indian agriculture (Past, Present, Future) Connectivity for marketing, Waste management– Public, Private and Govt. organization, 5 R's. Water conservation techniques –role of different stakeholders –implementation, preparing an actionable business proposal for enhancing the village income and approach for implementation. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

**(06 Hours)**

**Module – 4**

**National Level Activities for Society / Community at large (Activity based Learning)**

Developing Sustainable Water management system for rural areas and implementation approaches. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. **(06 Hours)**

**Module – 5**

**Individual Activities for Local Voice (Activity based learning)**

Govt. school Rejuvenation and helping them to achieve good infrastructure, Plantation and adoption of plants. Know your plants. Spreading public awareness under rural outreach programs, National integration and social harmony events. **(06 Hours)**

**Course outcomes (Course Skill Set):**

At the end of the course, the student will be able to:

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**Teaching Practice:**

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

**Assessment Details**

| **Weightage** | **CIE – 100%** |
|---|---|
| Presentation -1<br>Selection of topic, PHASE-1 | 20 Marks |
| Commencement of activity and its progress – PHASE – 2 | 20 Marks |
| Case Study based Assessment – Individual performance | 20 Marks |
| Sector wise study and its consolidation | 20 Marks |
| Video based seminar for 10 minutes by each student at the end of the course with Report | 20 Marks |

**Suggested Learning Resources:**

**Books:**

1. NSS Course Manual**,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

**DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES**
**B.E. Artificial Intelligence and Machine Learning**
**Choice Based Credit System (CBCS)**
SEMESTER – III to VI

**Sports**
(Common to all Branches)
(Effective for the 2022 scheme)

| | | | |
|---|---|---|---|
| Course Code | **BPEK359** | CIE Marks | 100 |
| Teaching Hours/Week (L: T:P) | 0:0:2 | SEE Marks | -- |
| Total Number of Contact Hours | 26 | Exam Hours | -- |

**Mandatory Course (Non-Credit)**
(Completion of the course shall be mandatory for the award of degree)

**Course Objectives:** The course will enable students to

1. Develop a healthy life style.
2. Acquire Knowledge about various stages of sports and games.
3. Focus on modern technology in sports.

**Module – 1**

**Introduction of the game:** Aim of sports and games, Brief history of the game, Nature of the game, Terminology & Modern trends of the game, Fitness & Skill tests along with Game Performance.

**(06 Hours)**

**Module – 2**

**Offensive and Defensive Techno Tactical Abilities:** Fitness, Fundamentals & Techniques of the game with the implementation of Biomechanics, Tactics- Drills for the Techno Tactical abilities, Individual and Group, Miner games- to implement the Techniques, Tactics and Motor abilities.

**(05 Hours)**

**Module – 3**

**Team tactics and Rules of the Game:** Rules and Regulations of the Game: Game rules as well as sequence of officiating, Team tactics: Offensive and Defensive team strategies and scrimmages, Practice Matches: among the group, Analysis of Techno Tactical abilities: Correction and implementation of skills and Sports Injuries and rehabilitation: First aid, PRICE treatment,

**(05 Hours)**

**Module – 4**

**Sports Training:** Introduction of Sports Training, Principles of Sports performance, how to increase and sustain the sports performance, Training Load & Recovery- How to increase the training load (volume/Intensity) and means and methods for Recovery, Periodization: Shorts, Medium and Long term,

Physiological changes: Changes in Lung capacity, heart beats etc…

**(05 Hours)**

**Module – 5**

**Organization of Sports Event:** Tournament system, Planning and preparation for the competition, Ground

preparation and Equipment's, Organizing an event among the group.

**(05 Hours)**

The above 5 modules are common to all the sports events / games, we are offering the following games**: 1. Baseball, 2. Kabaddi, 3. Table Tennis, and 4. Volleyball.**

**Course outcomes:**

The students will be able to:

1. Understand the importance of sports and games, inculcate healthy habits of daily exercise & fitness, Self-hygiene, good food habits, Create awareness of Self-assessment of fitness.
2. Develops individual and group techno tactical abilities of the game.
3. Increases the team combination and plan the strategies to play against opponents.
4. Outline the concept of sports training and how to adopt technology to attain high level performance.
5. Summarize the basic principles of organising sports events and concept of technology implemented to organise competitions in an unbiased manner.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation and video analysing.
- Practical classes in outdoor and indoor as per requirement.

**CIE: 100 Marks**

- CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks– A practical test conducted at the end of the semester in which the student has to give fitness and skill tests and his performance in game will be assessed.

**Textbooks**


1. Barbara Bushman, "ACSM's complete guide to Fitness & Health", 2011, Human Kinetics USA
2. **Pankaj Vinayak Pathak, *Sports and Games - Rules and Regulation* , 2019, Khel Sahitya Kendra.**
3. Hardayal Singh, *"Sports Training, General Theory & Methods"*, 1984 "Netaji Subhas, National Institute of Sports".
4. ~~Keith A. Brown~~ "International Handbook of Physical Education and Sports Science", 2018, (5 Volumes) Hardcover.


**References**


1. Tudor O Bompa, *"Periodization Training for Sports"*, 1999, Human Kinetics, USA
2. Michael Boyle, " New Functional Training for Sports " 2016, Human Kinetics USA
3. Michael Kjaer , Michael Rogsgaard, Peter Magnusson, Lars Engebretsen & 3 more, "Text book of Sports Medicine: Basic Science and Clinical Aspects of Sports Injury and Physical Activity", 2002, Wiley Blackwell.
4. Scott L. Delp and Thomas K. Uchida, "Biomechanics of Movement: The Science of Sports, Robotics, and Rehabilitation", 2021, The MIT Press
5. MCARDLE W.D. "Exercise Physiology Nutrition Energy And Human Performance" 2015, LWW IE (50)

**Department of Humanities and Social Sciences**

**B.E. Artificial Intelligence and Machine Learning**

**Choice Based Credit System (CBCS)**

SEMESTER – III to VI

**Yoga**

(Common to all Branches)

(Effective for the 2022 scheme)

| | | | |
|---|---|---|---|
| Course Code | **BYOK359** | CIE Marks | 100 |
| Teaching Hours/Week (L:T:P) | 0:0:2 | SEE Marks | - |
| Total Number of Contact Hours | 26 | Exam Hours | - |

**Course Objectives:**

This course will enable students to:

6. Understand the importance of practicing yoga in day-to-day life.
7. Be aware of therapeutic and preventive value of Yoga.
8. Have a focussed, joyful and peaceful life.
9. Maintain physical, mental and spiritual fitness.
10. Develop self-confidence to take up initiatives in their lives.

**Module – 1**

**Introduction to Yoga:** Introduction, classical and scientific aspects of yoga, Importance, Types, Healthy Lifestyle, Food Habits, Brief Rules, Sithalikarana Practical classes. **(04 Hours)**

**Module – 2**

**Ph Physical Health:** Introduction, Pre-requisites, Asana-Standing, Sitting, Supine and Prone, Practical classes. **(06 Hours)**

**Module – 3**

**Psychological Health:** Introduction Thought Forms, Kriya (Kapalabhati), Preparation to Meditation, Practical classes. **(06 Hours)**

**Module – 4**

**Therapeutic Yoga:** Mudra Forms, Acupressure therapy, Relaxation techniques Practical classes. **(06 Hours)**

**Module – 5**

**Spirituality & Universal Mantra:** Introduction, Being Human, Universal Mantra, Universal LOVE, Benefits of practice of Spirituality in day-to-day life, practical classes. **(04 Hours)**

**Course Outcomes:**

Students will be able to:

1. Understand the requirement of practicing yoga in their day-to-day life.
2. Apply the yogic postures in therapy of psychosomatic diseases
3. Train themselves to have a focussed, joyful and peaceful life.
4. Demonstrate the fitness of Physical, Mental and Spiritual practices.
5. Develops self-confidence to take up initiatives in their lives.