# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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

Avalahalli, Yelahanka, Bengaluru 560064

## Bachelor of Engineering

## Department of Artificial Intelligence and Machine Learning

## VII and VIII Semester Scheme and Syllabus
## 2021 Scheme - Autonomous

Approved in the BoS meeting held on 26th July 2024.

# Vision and Mission of the Department

## Vision of the Department

To develop professionals equipped to build sustainable and intelligent solutions that effectively interact with the natural intelligence towards creating a digitally empowered environment for future generations, safeguarding social ethics.

## Mission of the Department

- To enable students with the spirit and power of interdisciplinary acumen by integrating a world of knowledge into a world of intelligent systems and subsystems.
- Boost academic outcome through place-based education and collaborations with established research labs and industries.
- Encourage entrepreneurship efforts among students and develop them into great leaders.

# Program Educational Objectives (PEOs)

1. Possess essential professional engineering skills that make them confident to develop high-quality AI solutions for various application domains under realistic constraints.
2. Demonstrate the importance of life-long learning through professional development, computing practises, and specialized certifications.
3. Engage and succeed in their professional careers through teamwork, ethical behaviour, proactive involvement, and effective communication.

# Program Specific Outcomes (PSOs)

1. Ability to apply acquired skills to build optimized solutions adhering to principles and practices of Computational Intelligence.
2. Employ ethical strategies and policies in project and product development.

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**BMS Institute of Technology and Management**
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560064

**Ref.:** BMSIT&M/Exam/2023-24/ 103 **Date:** 21.09.2024

**CONTINUOUS INTERNAL EVALUATION**
**AND**
**SEMESTER END EXAMINATION PATTERN**
(Applicable to UG students of 2021 Batch, effective from the Academic year 2024-25 onwards)

The UG students admitted during 2021-22 are hereby informed to note the following with reference to Continuous Internal Evaluation and Semester End Examination pattern:

The weightage for Continuous Internal Evaluation (CIE) is 50%, and for Semester End Examinations (SEE), it is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 out of 50), while for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50). A student will be declared to have passed the course if they secure at least 40% (40 out of 100) in the combined total of the CIE and SEE.

The details below summarize the CIE and SEE Pattern for the courses of 2021 scheme of various credits:

## 4 CREDIT COURSES

### I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- **Internal Assessment (IA) Tests:** 2 IAs to be conducted for **40 Marks** (90 minutes each). Total of 2 tests will be 80 and the same can be scale down to **30 Marks.**
- **Alternate Assessment Tool (AAT):** 2 AATs each of **10 Marks**, total **20 Marks.** Any Two AATs can be used from the list. If it is project based, one AAT shall be given.
- **Total CIE Marks** = 30 + 20 = **50 Marks**
- Student has to score a minimum of **20 Marks** (40%).

### II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

- SEE is conducted for 100 Marks (3 hours).
- **Question Paper Pattern:**
  - **Part - A:** Comprises 20 objective type questions carrying 1 Mark each with a total 20 Marks.
  - **Part - B:** There will be **5 modules**. Each module will have **TWO questions carrying 16 marks** each. There will be a maximum of three sub section for each question. **Student has to answer any ONE full question.**

- **SEE Marks = 20 + 80 = 100 marks and can be scale down to 50 marks.**

## 3 CREDIT COURSES

### I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- **Internal Assessment (IA) Tests:** 2 IAs to be conducted for **40 Marks** (90 minutes each). Total of 2 tests will be 80 and the same can be scale down to **30 Marks.**
- **Alternate Assessment Tool (AAT):** 2 AATs each of **10 Marks**, total **20 Marks.** Any Two AATs can be used from the list. If it is project based, one AAT shall be given.
- **Total CIE Marks** = 30 + 20 = **50 Marks**
- Student has to score a minimum of **20 Marks** (40%).

### II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

- SEE is conducted for 100 Marks (3 hours).
- **Question Paper Pattern:**
  - **Part - A:** Comprises 20 objective type questions carrying 1 Mark each with a total 20 Marks.
  - **Part - B:** There will be **5 modules**. Each module will have **TWO questions carrying 16 marks** each. There will be a maximum of three sub section for each question. **Student has to answer any ONE full question.**

- **SEE Marks = 20 + 80 = 100 marks and can be scale down to 50 marks.**

## 2 CREDIT COURSES

### I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 2 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 2 tests will be 80 and the same can be scale down to **30 marks.**
- **Alternate Assessment Tool (AAT):** 2 AATs each of 10 marks, total **20 marks.** Any Two AATs can be used from the list. If it is project based, one AAT shall be given.
- **Total CIE Marks** = 30 + 20 = **50 Marks**
- Student has to score a minimum of 20 marks (40%).

### II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (2 hours).

**Question Paper Pattern:**

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 100 questions each of 01 marks. The same is scale down to 50 marks. Minimum SEE Marks: 40% (i.e. 20 Marks out of 50)

## 1 CREDIT COURSES

### I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- **Internal Assessment (IA) Tests:** 2 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 2 tests will be 80 and the same can be scale down to **30 marks.**
- **Alternate Assessment Tool (AAT):** 2 AATs each of 10 marks, total **20 marks.** Any Two AATs can be used from the list. If it is project based, one AAT shall be given.
- **Total CIE marks** = 30 + 20 = **50 Marks**
- Student has to score a minimum of **20 Marks** (40%).

### II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

- SEE is conducted for **50 Marks** (1 hours).
- **Question Paper Pattern:**
  - The pattern of the question paper is MCQ.
  - SEE question paper will be set for 50 questions each of 01marks. The same is scale down to **50 Marks**.

## 1 CREDIT LABORATORY COURSE / PROFESSIONAL CORE LABORATORY / ABILITY ENHANCEMENT COURSE

### I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- **Cumulative Assessment (CA)** of each experiment is 20 Marks (Conduction 10 marks + Records 5 marks +Viva 5marks). The average of all the experiments to be taken for **20 Marks.**
- **Open Ended Experiments (OE) 10 Marks.**
- **2 IAs Test** to be conducted for 100 marks. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.: 60 marks and Viva: 20 marks. The average of 2 IA marks is scale down to **20 Marks**.
- **CIE marks** =20 (CA) +10 (OE) + 20 (IA test) = **50 Marks**.
- Student has to score a minimum of **20 Marks** (40%).

### II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

- SEE is conducted for 100 Marks.
- Examinations to be conducted jointly by Two examiners.
- All the experiments are to be included for practical examination.
- General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks.

**Learning Activities for AATs:**

A faculty member may choose the following AATs based on the needs of the course:

1. Course project
2. Literature review
3. MOOC
4. Case studies
5. Tool exploration
6. GATE-based aptitude test
7. Open book tests
8. Industry integrated learning
9. Analysis of Industry / Technical / Business reports
10. Programming assignments with higher Bloom level
11. Group discussions
12. Industrial / Social / Rural projects

CoE 21/09/2024

Dean AA 21.09.24

Principal 21/9/2024

**Copy To:**

1. The Vice-Principal, Deans, HoDs, and Associate HoDs
2. All faculty members and students of 2021 batch.
3. Examination Section

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## (Autonomous Institute affiliated to VTU)

## Scheme of Teaching and Examination: Effective from AY 2021 – 22

## Choice Based Credit System (CBCS)

**UG PROGRAM: BE Artificial Intelligence and Machine Learning (AIML)** | **Semester: VII**

| Sl. No | Course Category | Course Code | Course Title | Teaching Dept. | Teaching Hours /Week | | | | Credits | Examination | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | PW | | Duration In Hours | CIE Marks | SEE Marks | Total Marks |
| 1 | HS | 21HSS71 | Research Methodology | AIML | 2 | 0 | 0 | 0 | 2 | 3 | 50 | 50 | 100 |
| 2 | AEC | 21AM72 | Generative AI LAB | AIML | For Theory Course: 1 | 0 | 0 | 0 | 1 | 1 | 50 | 50 | 100 |
| | | | | | For Practical Course: 0 | 0 | 2 | 0 | | 2 | | | |
| 3 | PE | 21AM73X | Professional Elective – III | AIML | 3 | 0 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 4 | PE | 21AM74X | Professional Elective – IV | AIML | 3 | 0 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 5 | OE | 21AM75X | Open Elective - II | AIML | 3 | 0 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 6 | PW | 21AMP76 | Project Work phase I | AIML | 0 | 0 | 0 | 10 | 5 | - | 100 | - | 100 |
| | | | | **TOTAL** | **12** | **0** | **0** | **10** | **17** | | **350** | **350** | **700** |

| Professional Elective - Group III | | Professional Elective - Group IV | | Open Elective - Group II | |
|---|---|---|---|---|---|
| Course Code | Course Title | Course Code | Course Title | Course Code | Course Title |
| 21AM731 | High Performance Computing | 21AM741 | Social Network Analytics | 21AM751 | Principles of Machine Learning |
| 21AM732 | Blockchain Technology | 21AM742 | Human Computer Interface | 21AM752 | Big data Analytics |
| 21AM733 | Quantum Computing | 21AM743 | Augmented Reality and Virtual Reality | 21AM753 | Fundamentals of DBMS |
| 21AM734 | Computer Network and Security | 21AM744 | Data Mining and Data Warehousing | 21AM754 | Software Engineering |

| VII semester (2021 Scheme) Open Elective Courses offered to AIML / CSE / ISE Students - Group II | | | |
|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** | **Teaching Department and QP setting Department** |
| 1. | 21ME752 | Fundamentals of Automotive Technology | ME |
| 2. | 21ME753 | Digital Transformation in Industry | ME |
| 3. | 21ME754 | Organizational Behavior | ME |
| 4. | 21EC751 | Biomedical Engineering | ECE |
| 5. | 21EC753 | Unmanned Aerial Vehicles (UAV) | ECE |
| 6. | 21EC754 | Automotive Electronics | ECE |
| 7. | 21ET752 | Multimedia Communications | ETE |
| 8. | 21ET753 | Optical Fibers Networks | ETE |
| 9. | 21EE751 | AI in Power Systems | EEE |
| 10. | 21EE754 | Battery Management Systems | EEE |
| 11. | 21CV751 | Environmental Protection and Management | CV |
| 12. | 21CV752 | Green Buildings | CV |
| 13. | 21CV755 | Sustainable Development Goals | CV |
| 14. | 21HS751 | German Language I | HSS |
| 15. | 21HS752 | Japanese Language I | HSS |

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## (Autonomous Institute affiliated to VTU)

## Scheme of Teaching and Examination: Effective from AY 2021 – 22

## Choice Based Credit System (CBCS)

**UG PROGRAM: BE Artificial Intelligence and Machine Learning (AIML)** — **Semester: VIII**

| Sl. No | Course Category | Course Code | Course Title | Teaching Dept. | Teaching Hours /Week | | | | Credits | Examination | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | PW | | Duration In Hours | CIE Marks | SEE Marks | Total Marks |
| 1 | PE | 21AM81X | MOOC Professional Elective Courses | AIML | 3 | 0 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 2 | INT | 21INT82 | Research/Industrial Internship | AIML | 0 | 0 | 0 | 14 | 7 | 3 | 50 | 50 | 100 |
| 3 | PW | 21AM83 | Project Work phase II | AIML | 0 | 0 | 0 | 20 | 10 | 3 | 100 | 100 | 200 |
| | | | | **TOTAL** | **3** | **0** | **0** | **34** | **20** | - | **200** | **200** | **400** |

| **MOOC Professional Elective Courses** | | | |
|---|---|---|---|
| **Sl. No.** | **Course Name** | **Course Code** | **NPTEL Course ID** |
| **1** | Reinforcement Learning | 21AM81A | https://onlinecourses.nptel.ac.in/noc24_cs102/preview |
| **2** | Introduction to Internet of Things | 21AM81B | https://onlinecourses.nptel.ac.in/noc24_cs115/preview |
| **3** | Design & Implementation of Human Computer Interfaces | 21AM81C | https://onlinecourses.nptel.ac.in/noc24_cs126/preview |
| **4** | Getting Started with Competitive Programming | 21AM81D | https://onlinecourses.nptel.ac.in/noc24_cs103/preview |
| **5** | Essential Mathematics for Machine Learning | 21AM81E | https://onlinecourses.nptel.ac.in/noc24_ma87/preview |
| **6** | Artificial Intelligence Search Methods For Problem Solving | 21AM81F | https://onlinecourses.nptel.ac.in/noc24_cs88/preview |
| **7** | Distributed Optimization and Machine Learning | 21AM81G | https://onlinecourses.nptel.ac.in/noc24_cs86/preview |
| **8** | Medical Image Analysis | 21AM81H | https://onlinecourses.nptel.ac.in/noc24_bt53/preview |
| **9** | Next Generation Sequencing Technologies : Data Analysis and Applications | 21AM81I | https://onlinecourses.nptel.ac.in/noc24_bt64/preview |
| **10** | Software Testing | 21AM81J | https://onlinecourses.nptel.ac.in/noc24_cs91/preview |
| **11** | MBA COURSE-Operations And Supply Chain Management | 21AM81K | https://onlinecourses.nptel.ac.in/noc24_mg106/preview |

# Syllabus of VII Semester

**BMS Institute of Technology and Management, Bengaluru 560064**
**Choice Based Credit System (CBCS)**
**SEMESTER - VII**

**Research Methodology** (2:0:0)2
(Effective from the academic year 2024-25 for 2021 Scheme)

| | | | |
|---|---|---|---|
| Course Code | 21HSS71 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 2:0:0 | SEE Marks | 50 |
| Total Number of Lecture Hours | 26 | Exam Hours | 03 |

**Course objectives:**

This course will enable students to

- Give an overview of the research methodology, research problem.
- Gain knowledge on research design.
- Design of sampling survey and measurement & scaling.
- Understand data collection and data preparation.
- Familiarize interpretation and writing research reports.

**Module – 1**

**Introduction:** Importance of Research and Development (R&D) for development of Nation, Introduction to research and research methodology.
Meaning of Research, objectives of Research, Types of research, Research Approaches, Significances of Research, Research Process, Criteria of Good Research.

**Defining the Research Problem:** What is a Research Problem? Selecting the Research Problem, Necessity of Defining the Problem, Techniques Involved in Defining a problem. **(6 Hours)**

**Module – 2**

**Research Design:** Meaning of Research Design, need for Research design, Feature of a Good design, Important concepts relating to Research Design: Dependent, independent and extraneous variable, Control, Confounded relationship. Research Design in case of exploratory research studies, in case of descriptive and diagnostic research studies Basic Principles of Experimental Designs.

**(5 Hours)**

**Module – 3**

**Design of sampling survey**: Sample Design: Objective, sampling units and frame, size of sample, parameter of interest, selection of proper sample design, pilot survey and budgetary constraints. Sampling errors, non-sampling errors, Sample survey vs. census survey, on-probability samplings.

**Measurement and scaling:** Quantitative and qualitative data, Classification of measurement scales. Goodness of measurement scales: Techniques of developing measurement tools, scaling, Scale classification bases, scaling techniques. **(5 Hours)**

**Module – 4**

**Data Collection:** Experiments and Surveys, collection of primary data: observation method, Interview method. Collection of data through questionnaires, Collection of data through schedules. Collection of secondary data. Selection of appropriate method for data collection, case study method.

**Data Preparation:** Questionnaire checking, editing, coding, tabulation, data cleaning, data adjusting, problems in preparation process, missing values and outliers, type of analysis.

**(5 Hours)**

**Module – 5**

**Interpretation and Report Writing**

Meaning of Interpretation, Techniques of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of Research Report, Types of Reports: Technical report, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research. **(5 Hours)**

**Course outcomes:**

The students will be able to:

CO1: Describe research methodology and research problem.
CO2: Illustrate research design and various types.
CO3: Discuss sampling survey and measurement.
CO4: Summarise data collection and preparation.
CO5: Explain techniques of interpret research reports.

**Text Book:**

1. CR Kothari and Gaurav Garg, **Research Methodology**, New Age International Publishers, 2020.

**References:**

1. Panneerselvam R, Research Methodology, Prentice Hall of India, New Delhi, 2004.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U K, An introduction to Research Methodology, RBSA Publishers, 2002**.**
3. Ranjit Kumar, Research Methodology, 4th Edition, SAGE Publications Ltd. 2014.

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**CIE Components** (50 Marks)

The pattern of the CIE question paper is MCQ.

Three Unit Tests each of 40 Marks, MCQ type (duration 01 hour). Sum of the three Internal Assessments Tests Marks will be out of 120 Marks and scaled down to 30 Marks.

Two Assignment : 20 Marks
Two AATs : 20 Marks

Sum of the Assignment and AATs will be out of 40 Marks and scaled down to 20 Marks .

Internal Assessments Tests : 30 Marks
Assignment and AAT : 20 Marks
Total CIE Marks : 50 Marks

**SEE Components** (50 Marks)

- The pattern of the SEE question paper is MCQ.
- SEE question paper will be set for 100 questions of each of 01 marks.

**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).
- The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a 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.

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Generative AI Lab (0:0:2:0) 1**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM72 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 0:0:2:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 15 | Exam Hours | 3 Hours |

**Course Objectives:**

This course will enable students to:

- Understand the principles and concepts behind generative AI models, including architecture of ChatGPT
- Explain the knowledge gained to implement generative models using Prompt design frameworks.
- Apply various Generative AI applications for increasing productivity.
- Develop and Operationalizing Large Language Modes-based Apps.

**Preamble:**

The advancement of artificial intelligence (AI) has resulted in the emergence of a remarkable field known as Generative AI. Generative AI is a type of AI technology that allows machines to generate new content, data, or outputs that are like human-created content. It uses large datasets to learn the underlying structure and characteristics of the data, enabling it to produce original and contextually relevant outputs. Generative AI models can generate various data types, including text, images, sounds, animations, and 3D models, and it can create entirely new data based on the patterns it has learned.

**Descriptions**

Design, develop, and implement the specified programs as given in the list given below using Python Language under LINUX / Windows environment.

| SL. No. | Program List |
|---|---|
| 1. | Text Generation with GPT-2: Experiment with OpenAI's GPT-2 model for generating diverse and coherent text based on prompts. |
| 2. | Image Synthesis using DALL-E: Dive into image generation with OpenAI's DALL-E, creating unique and imaginative visuals based on textual descriptions. |
| 3. | Music Composition with Magenta: Explore Magenta, a project by Google, to generate music compositions using machine learning techniques. |
| 4. | Code Generation with OpenAI Codex: Try your hand at code generation using OpenAI Codex, which is proficient in understanding and generating programming code. |
| 5. | Artistic Creations with StyleGAN: Use StyleGAN for artistic projects, generating visually striking images with control over specific visual attributes. |
| 6. | Story Writing with ChatGPT: Engage in creative writing by utilizing ChatGPT for generating dialogues, narratives, and even collaborative storytelling. |
| 7. | Facial Image Generation with StyleGAN: Experiment with StyleGAN for creating realistic and diverse facial images, exploring the nuances of facial feature synthesis. |
| 8. | Language Translation with Marian MT: Implement language translation using Marian MT, a multilingual transformer model, for translating text between different languages. |

**Course outcomes:**

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

CO1: Apply prompt engineering skills to real-world scenarios, such as information retrieval, question-answering, or text generation.

CO2: Apply the learned skills and techniques through the models that involve the future with ChatGPT.

CO3: Apply different architectures used in large language models, such as transformers, and understand their advantages and limitations.

**Textbooks**

1. **Modern Generative AI with ChatGPT and OpenAI Models:** Leverage the Capabilities of OpenAI's LLM for Productivity and Innovation with GPT3 and GPT4, by Valentina Alto, Packt Publishing Ltd, 2023.
2. **Generative AI for Cloud Solutions:** Architect modern AI LLMs in secure, scalable, and ethical cloud environments, by Paul Singh, Anurag Karuparti ,Packt Publishing Ltd, 2024.

**Reference Books**

1. The Artificial Intelligence and Generative AI Bible: [5 in 1] The Most Updated and Complete Guide | From Understanding the Basics to Delving into GANs, NLP, Prompts, Deep Learning, and Ethics of AI ,Kindle Edition by Alger Fraley .
2. "Ripples of Generative AI: How Generative AI Impacts, Informs and Transforms Our Lives" by Jacob Emerson, ISBN-10: 1088221610 Publisher: Artificial Intelligence, 2023
3. "Demystifying Prompt Engineering: AI Prompts at Your Fingertips (A Step-By-Step Guide)" **,Ki**ndle Edition ,by Harish Bhat

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

1. https://onlinecourses.swayam2.ac.in/imb24_mg116/preview
2. https://www.cloudskillsboost.google/paths/118
3. Google Cloud Skills Boost – course on **Beginner: Introduction to Generative AI Learning Path** https://www.cloudskillsboost.google/paths/118

# Professional Electives – Group III

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**High Performance Computing (4:0:0:0) 4**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code: | 21AM731 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

**Course Objectives:**

This course will enable students to:

- Understand the basic concepts of Modern processors and Optimization Technique.
- Explain the different algorithm.
- Introduce Basics of parallelization and OpenMP
- Understand the parallel programming with modern C, C++ and new version of FORTRAN
- Explain the features of Distributed-memory parallel programming with MPI

**Preamble:** High performance computing (HPC) is the practice of aggregating computing resources to gain performance greater than that of a single workstation, server, or computer. HPC can be run on-premises, in the cloud, or as a hybrid of both.

**Module – I**

**Modern processors:** Stored-program computer Architecture, General purpose cache based microprocessor Architecture, Memory hierarchies, Multi core Processors, Multithreaded Processors, Vector processors.

**Basic optimization techniques for serial code:** Scalar Profiling, Common sense Optimizations, Simple measures, larg
e impact, The role of compilers, C++ optimizations.

**Textbook 1: Chapter 1 and 2 (Sections 1.1 to 2.5) (08 Hours)**

**Module – II**

**Data access optimization:** Balance analysis and light speed Estimates-Storage Order, Algorithm classification and access optimizations, The Jacobi algorithm, Algorithm classification and access optimizations, Sparse matrix-vector multiply.

**Parallel computers:** Taxonomy of parallel computing Paradigms, Shared-memory Computers, Distributed memory computers, Hierarchical systems-Networks.

**Textbook 1: Chapter 3 and 4 (Sections 3.1 to 4.5) (08 Hours)**

**Module – III**

Basics of parallelization: Why parallelize, Parallelism, Parallel scalability

Shared-memory parallel programming with OpenMP: Short Introduction to OpenMP, Case study OpenMP Jacobi algorithm, Advanced OpenMP: Wavefront parallelization.

**Textbook 1: Chapter 5 and 6 (Sections 5.1 to 6.3) (08 Hours)**

**Module – IV**

**Efficient OpenMP programming:** Profiling OpenMP program, Performance pitfalls, Parallel sparse matrixvector multiply.

**Locality optimizations on ccNUMA architectures:** Locality of access on ccNUMA, ccNUMA optimization of sparse MVM, Placement pitfall, ccNUMA issues with C++.

**Textbook 1: Chapter 7 and 8 (Sections 7.1 to 8.4) (08 Hours)**

**Module – V**

**Distributed-memory parallel programming with MPI:** Message passing, A short introduction to MP,MPI parallelization of a Jacobi solver.

**Efficient MPI programming:** MPI performance tools, Communication parameters, Synchronization, serialization, contention, Reducing communication overhead, Understanding intranode point-to-point communication.

**Textbook 1: Chapter 9 and 10 (Sections 9.1 to 10.5) (08 Hours)**

**Course outcomes:**

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

CO1: To understand the architecture, memory hierarchy and compilers.
CO2: To describe the algorithms in optimization and parallel systems.
CO3: To apply parallelization in shared memory OpenMP.
CO4: To analyze the openMP programs and locality optimization.
CO5: To analyze the MPI and MPI performance tools

**Textbooks**

1. Georg Hager, Gerhard Wellein "**Introduction to High Performance Computing for Scientists and Engineers**", CRC Press, 2011.

**Reference Books**

1. Peter Pacheco-An Introduction to Parallel Programming-Morgan Kaufmann (2011)
2. Michael W. Berry, Kyle A. Gallivan, Efstratios Gallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, Faisal Saied, "High-performance scientific computing: algorithms and applications", Springer, 2012.
3. Victor Eijkhout, "Introduction to High Performance Scientific Computing", MIT Press, 2011.
4. Charles Severance ,Kevin Dowd ,"High Performance Computing",2021

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

- **https://nptel.ac.in/courses/106103115**
- **https://www.interaction-design.org/courses/hci-foundations-of-ux-design**

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Blockchain Technology (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM732 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

**Course Objectives:**

This course will enable students to:

- Get acquainted with the concept of Block chain and Distributed ledger system
- Learn and Explore blockchain platforms such as Ethereum, Hyperledger to build blockchain applications.
- Learn the cryptographic principles behind blockchain and understand concepts like consensus, crypto-currency, smart contracts, use cases
- Develop simple decentralized applications using blockchain .

**Preamble:** The purpose of this course is to introduce the foundation of blockchain technology. Blockchain is an emerging technology platform for developing decentralized applications and data storage, over and beyond its role as the technology underlying the cryptocurrencies. The basic of this platform is that it allows to create a distributed and replicated ledger of events, transactions, and data generated through various IT processes with strong cryptographic guarantees of tamper resistance, immutability, and verifiability. The global blockchain market size is expected to grow from USD 3.0 billion in 2020 to USD 39.7 billion by 2025. The objective of this course is to provide conceptual understanding of how blockchain technology can be used to innovate and improve business processes

**Module – I**

**Blockchain:** Distributed Systems, Introduction to blockchain, Features of Blockchain, Application of blockchain technology, types of blockchain ,CAP Theorem and blockchain, Benefits and Limitations of Blockchain

**Textbook 1: Chapter 1** **(08 Hours)**

**Module – II**

Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem of decentralization, Smart Contract, Decentralized organizations, Decentalized autonomous organizations, Decentralized Autonomous Corporations , Decentralized Autonomous Societies, Decentralized Applications , Platforms for Decentralization.

Cryptography: Cryptography, Authentication, Integrity, cryptographic primitives, Symmetric Cryptography, Data Encryption Standard, Advanced Encryption Standard , Assymetric Cryptography, public and private keys,Hash Functions ,ECDSA

**Textbook 1: Chapter 2 , Chapter 3** **(08 Hours)**

**Module – III**

Bitcoins and Alternative Coins:Bitcoin, Transactions, Blockchain, Bitcoin Payments

Alternative coins: Theoretical Foundations, Bitcoin Limitations, Namecoin, Litecoin, Prime coin, Zcash, smart contracts, Definition, Ricardian Contracts

Ethereum : Introduction, Ethereum Blockchain, Elements of the ethereum Blockchain

**Textbook 1: Chapter 4, Chapter 5, Chapter 6, Chapter 7** **(08 Hours)**

**Module – IV**

**Ethereum :** Precompiled contracts, Accounts, Block,Ether, messages, Minin, Clients and Wallets, Ethereum Network

**HyperLedger:** Projects, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth Lake,Corda

**Blockchain-** Outside of currencies: Internet of things, Government, health, Finance

**Textbook 1: Chapter 7, Chapter 9, Chapter 11** **(08 Hours)**

**Module – V**

**Blockchain Application Development**: Decentralized Applications, Blockchain Application development, interacting with the Bitcoin Blockchain, Interacting programmatically with ethereum- sending transaction, Interacting Programmatically with ehereum- creating smart contract, Interacting programmatically with ethereum- executing smart

**Textbook 2: Chapter 5** **(08 Hours)**

**Course outcomes:**

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

CO1: Explain the fundamental concepts and working platforms of blockchain technology. L2

CO2: Make use of blockchain technologies for operational aspects of crypto currencies L3

CO3: Analyze the use of smart contracts and its use cases L4

CO4: Test for simple blockchain applications.

**Textbooks**

1. **Mastering Blockchain ,**Imran Bashir, Packt> Publishers, 2017
2. **Beginning Blockchain ,** Bikramadithya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Apress Publishers, Print year 2023

**Reference Books**

1. BlockChain Applications , by Harshadeep Bahga, Vijay Madaisetti, Published by Harshadeep Bahga, Vijay Madaisetti
2. Blockchain for Beginners, by Yatish R, Tejaswini, Publisher: Shroff/X-Team,2019

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

1.https://blockgeeks.com/guides/what-is-blockchain-technology/

2. https://onlinecourses.nptel.ac.in/noc20_cs01/preview

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Quantum Computing (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM733 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

**Course Objectives:**

This course will enable students to:

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and the relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation
- To learn the basics of quantum information and the theory behind it.

**Preamble:** Quantum computing is fast emerging as one the key disruptive technologies of our times. It is a fundamentally new computing paradigm that has the potential to efficiently solve certain challenging problems which cannot be solved efficiently in a classical setting. This The course will provide an introduction to Quantum Computation, starting with basic concepts such as superposition and entanglement, to discussing the quantum circuit model of computation and basic Quantum algorithms that demonstrate the power of computing with quantum bits. We will also introduce the idea of quantum error correction to mitigate the effects of noise in today's quantum devices.

**Module – I**

**FUNDAMENTAL CONCEPTS:**

Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms – Experimental Quantum Information Processing – Quantum Information

**Textbook 1: Chapter 1 (Sections 1.1-1.6) (08 Hours)**

**Module – II**

**QUANTUM MECHANICS AND OVERVIEW OF COMPUTATIONAL MODELS:**

Quantum Mechanics: Linear Algebra – Postulates of Quantum Mechanics – Application: Super dense Coding – Density Operator – The Schmidt Decomposition and Purifications – EPR and the Bell Inequality.

**Textbook 1: Chapter 2 (Sections 2.1-2.6) (08 Hours)**

**Module – III**

**QUANTUM COMPUTATION:**

Quantum Circuits: Quantum Algorithms – Universal Quantum Gates – Quantum Circuit Model of Computation – Simulation

**Textbook 1: Chapter 4 (Sections 4.1 to 4.7) (08 Hours)**

**Module – IV**

**QUANTUM SEARCH ALGORITHMS:**

The quantum search algorithm, Quantum search as a quantum simulation, Quantum counting, Speeding up the solution of NP-complete problems, Quantum search of an unstructured database, Optimality of

the search algorithm, Black box algorithm limits.

**Textbook 1: Chapter 6 (Sections 6.1-6.7) (08 Hours)**

**Module – V**

**QUANTUM INFORMATION:**

Quantum noise and quantum operations: Quantum operations, Examples of quantum noise and quantum operations, Applications of quantum operations, Limitations of the quantum operations formalism. Distance measures for quantum information: How close are two quantum states.

**Textbook 1: Chapter 8, 9 (Sections 8.1-8.5, 9.1-9.3) (08 Hours)**

**Course outcomes:**

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

**CO1:** Understand and explain the various essentials of quantum computation. (PO1, PO2, PO3).

**CO2:** Analyze the working of quantum transformations and quantum gates. (PO1, PO2, PO3)

**CO3:** Describe the principle of working of some of the quantum algorithms and conduct simulations using open-source quantum simulators. (PO1, PO2, PO3, PO5)

**CO4:** Investigate the applications of quantum computing algorithms in real-world applications. (PO1, PO2, PO3).

**CO5:** Appraise the knowledge and potential in quantum computing to build a successful career, work in teams, and communicate their ideas effectively. (PO5,PO6,PO8,PO9,PO10,PO12)

**Textbooks**

1. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010

**Reference Books**

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning
- Certification course
- Field study
- Project Based Learning

**Web links / e – resources:**

1.https://nptel.ac.in/courses/106106232

2.https://onlinecourses.nptel.ac.in/noc21_cs103/preview

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Computer Network and Security (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | **21AM734** | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

**Course Objectives:**

This course will enable students to:

- Demonstration of Network layer protocols
- Discuss transport layer services and understand UDP and TCP protocols
- Explain routers, IP and Routing Algorithms in network layer
- Illustrate concepts of Networking, Security.

**Preamble:** Understanding computer networks is crucial as it forms the backbone of modern information technology. It provides the basic framework for how devices communicate and share data. Many AI applications, such as distributed machine learning and edge computing, involve multiple nodes working together across a network Knowledge of computer networks allows AI engineers to design scalable architectures, ensuring that their AI systems can grow and perform efficiently as demand increases Understanding computer networks helps AI engineers optimize data flow and ensure the reliability of communication between distributed AI systems. Use AI and machine learning to automate network configuration, management, and troubleshooting. Develop AI-based systems for detecting and preventing cyber threat. Work on intrusion detection systems (IDS) and intrusion prevention systems (IPS) using machine learning.

**Module – I**

Network Layer: Network Layer Services, IPv4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, NAT; Network Layer Protocols: Internetwork Protocol: Datagram format, Fragmentation, Options, Security of IPV4 Datagrams; ICMPv4: Messages, Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP;

**Textbook1: Chapter 18,19**

**(08 Hours)**

**Module – II**

Unicast Routing: Introduction: General Idea, Least Cost Routing; Routing Algorithms: Distance Vector, Link-State Routing , Path-Vector Routing; Unicast Routing Protocols: Internet Structure, Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4); Multicast Routing: Introduction: Unicasting, Multicasting, Broadcasting; MULTICASTING BASICS: Multicast Addresses, Delivery at Data-Link Layer, Collecting Information about Groups, Multicast Forwarding, Two Approaches to Multicasting;

**Textbook1: Chapter 20,21**

**(08 Hours)**

**Module – III**

INTRADOMAIN MULTICAST PROTOCOLS: Multicast Distance Vector (DVMRP), Multicast Link State (MOSPF)); INTERDOMAIN MULTICAST PROTOCOLS: IGMP: Messages, Propagation of Membership Information, Encapsulation; Next Generation IP: IPV6 Addressing, The IPV6 Protocol;

**Textbook1: Chapter 21,22**

**(08 Hours)**

**Module – IV**

Transmission Control Protocol: Introduction: Services, Port Numbers, User Datagram Protocol (UDP): User Datagram, UDP Services, UDP Applications; TCP Services, TCP Features, Segment, A TCP Connection, Windows in TCP; Flow Control, Error Control, TCP Congestion Control; TCP Timer and Options; Stream Control Transmission Protocol (SCTP): Services, Quality of Services: Flow Control

**Textbook1: Chapter 24**

**(08 Hours)**

**Module – V**

Network Security: Overview of Network Security: Elements of Network Security, Classification of Network Attacks, Security Methods, Symmetric-Key Cryptography: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Public-Key Cryptography: RSA Algorithm, Diffie-Hellman Key-Exchange Protocol, Authentication: Hash Function, Secure Hash Algorithm (SHA), Digital Signatures,

**Textbook2: Chapter 10**

**(08 Hours)**

**Course outcomes:** At the end of the course the student will be able to:

CO1: Explain the importance of the services and addressing mechanisms in the Network Layer.

CO2: Apply routing concepts and protocols by implementing unicast and multicast routing strategies.

CO3: Analyse the performance of intradomain and interdomain multicast protocols, and the structure of the next-generation IP (IPv6).

CO4: Examine and compare transport layer protocols.

CO5: Assess various network security methods in preventing network attacks.

**Question Paper Pattern:**

- The question paper will have ten questions.
- Each full Question consisting of 20 marks
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from eachmodule.

**Textbooks:**


1. Behrouz A. Forouzan, Data Communications and Networking, Tata McGraw-Hill, 5th Edition (Chapters 14,15.3,16,17,18.1,18.4,19,20,21,22.1,22.2,24,30)
2. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.


**Reference Books:**


1. Alberto Leon-Garcia and Indra Widjaja, "Communication Networks–Fundamental Concepts andKey architectures", Tata McGraw- Hill, 2nd Edition.
2. William Stallings, "Data and Computer Communication", Pearson Education, 8th Edition.


**Alternate Assessment Tools (AATs) suggested:**

1. Experiential Learning
2. Certification course
3. Field study
4. Project Based Learning

**Web links / e – resources:**

1. https://elcom-hu.com/Subjects/Computer/Compulsory/Communication/Data-Communications-and-Network-5e.pdf
2. https://ptgmedia.pearsoncmg.com/images/9780133814743/samplepages/9780133814743.pdf

# Professional Electives – Group IV

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Social Network Analysis (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM741 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

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

- Understand the need of network analysis, social network measures and models.
- Illustrate various network models in analysis of social networks.
- Analyze the importance of link analysis and community structures in the World Wide Web.
- Apply the methods of Anomaly Detection in Networks.
- Apply the machine learning concepts in network analysis with respect to different applications or case studies.

**Preamble:** This course delves into the analysis of massive networks fundamental to modelling complex social, technological, and biological systems. With the rise of online social networks and abundant data in social sciences, tackle computational, algorithmic, and modelling challenges. We'll cover research on the structure of large networks, models, and algorithms that capture their properties. Students learn practical methods for analysing large-scale network data and reasoning about network structure and evolution. Topics include information diffusion, network robustness and fragility, web algorithms, prediction and recommendation in online social networks, and representation learning for large networks.

**Module – I**

**Introduction:** What is Social Network Analysis, why do we study Social Networks, Application of Social Network Analysis, Preliminaries, Three levels of Social Network Analysis, Graph Visualization Tools.
**Network Measures:** Network Basics, Node Centrality, Assortative, Transitivity and Reciprocity, Similarity, Degeneracy.

**Textbook 1: Chapter 1 and 2** **(08 Hours)**

**Module – II**

**Network Growth Models**: Properties of Real-World Networks, Random Network Model, Ring Lattice Network Model, Watts–Strogatz Model, Preferential Attachment Model, Price ‘s Model, Local-world Network Growth Model, Network Model with Accelerating Growth, Aging in Preferential Attachment.

**Textbook 1: Chapter 3** **(08 Hours)**

**Module – III**

**Information Networks and the World Wide Web:** The Structure of the Web, Link Analysis and Web Search
**Textbook 2: Chapter 13 and 14** **(08 Hours)**

**Module – IV**

**Community Structure in Networks:** Applications of Community Detection, Types of Communities, Community Detection Methods.
**Anomaly Detection in Networks:** Outliers versus Network-based Anomalies, Challenges, Anomaly Detection in Static Networks, Anomaly Detection in Dynamic Networks.
**Textbook 1: Chapter 5 and 8** **(08 Hours)**

**Module – V**

**Graph Representation Learning:** Machine Learning Pipelines, Intuition behind, Representation Learning, Benefits of Representation Learning, Criterion for Graph Representation Learning, Graph Representation Learning Pipeline, Representation Learning Methods.

**Applications and Case Studies:** Malicious Activities on OSNs, Sock puppets in OSNs, Collusion on Online Social Networks, Modelling the Spread of COVID-19, Recommender Systems

**Textbook 1: Chapter 9 and 10** **(08 Hours)**

**Course outcomes:**

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

**CO1 :** Investigate the need for Social Network Analysis and various measures
**CO2:** Determine the various Network growth models
**CO3:** Use the concept of structure of Web and community structure in Network analysis.
**CO4:** Analyze the various anomaly detection methods in network
**CO5:** Exhibit the machine learning concepts with various applications

**Textbooks**

1. Tanmoy Chakraborty: "**Social Network Analysis**", First edition, Wiley, 2021.
2. David Easley and Jon Kleinberg: "**Networks, Crowds, and Markets: Reasoning about a Highly Connected World**", Cambridge University Press, 2010

**Reference Books**

1. Stanley Wasserman and Katherine Faust:"**Social Network Analysis. Methods and Applications**", Cambridge University Press, 1994
2. David Easley and John Kleinberg: "**Networks, Crowds, and Markets:Reasoning About a Highly Connected World**", Cambridge University Press, 2010
3. Network Science by Albert – Laszlo Barabasi ( https://networksciencebook.com/ )

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

- **https://onlinecourses.nptel.ac.in/noc22_cs117/preview**
- **https://visiblenetworklabs.com/guides/social-network-analysis-101/**

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Human Computer Interface (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM742 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

**Course Objectives:**

This course will enable students to:

- Equip students with the skills necessary to design and evaluate user-friendly interfaces.
- Emphasize the importance of user-centered design processes.
- Explore innovative interaction techniques and their applications.
- Address accessibility and ensure technology is inclusive for all users.

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**Preamble:** Human-Computer Interaction (HCI) is a multidisciplinary field focused on the design, evaluation, and implementation of interactive computing systems for human use and the study of major phenomena surrounding them. It aims to improve the interactions between users (humans) and computers by making computers more user-friendly and receptive to the user's needs.

**Module – I**

**Introduction:** The User Interface: Introduction, Importance of the User Interface, Importance and benefits of Good Design History of Human Computer Interface.

**Characteristics of Graphical and Web User Interface:** Graphical User Interface, popularity of graphics, concepts of Direct Manipulation, Graphical System advantage and disadvantage, Characteristics of GUI. Web User Interface, popularity of web, Characteristics of Web Interface, Merging of Graphical Business systems & the Web, Principles of User Interface Design

**Textbook 2: Chapter 1 and 2** **(08 Hours)**

**Module – II**

**Design Process:** Interaction design basics: Introduction, What is design?, The process of design, User focus, Scenarios, Navigation design, Screen design and layout.

**HCI in the software:** Introduction, The software life cycle, Usability engineering, Iterative design and prototyping, Design Rationale.

**Textbook 1: Chapter 5 and 6** **(08 Hours)**

**Module – III**

**Design rules:** Introduction, Principles to support usability, Standards, guidelines, Golden rules and heuristics, HCI patterns.

**Implementation support:** Introduction, Elements of windowing systems, Programming the application, Using toolkits, User interface management systems.

**Textbook 1: Chapter 7 and 8** **(08 Hours)**

**Module – IV**

**Models and Theories:** Cognitive Models: Introduction, Goal and task hierarchies, Linguistic models, The challenge of display-based systems, Physical and device models, cognitive architectures.

**Communication and collaboration models:** Introduction, Face-to-Face communication, Conversation, Text-based communication, Group working.

**Textbook 1: Chapter 12 and 14** **(08 Hours)**

**Module – V**

**Advanced Topics in HCI: Groupware:** Introduction, Groupware systems, computer-mediated communication, meeting and decision support systems, shared applications and artifacts. frameworks for groupware.

**Ubiquitous Computing and Augmented Reality:** Introduction, Ubiquitous computing applications research, virtual and augmented reality, information and data visualization.

**Textbook 1: Chapter 19 and 20** **(08 Hours)**

**Course outcomes:**

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

CO1: Understanding user interfaces that enhance user experience and usability.
CO2: Apply cognitive psychology principles to improve user interaction with systems.
CO3: Analyse design processes and usability testing.
CO4: Develop accessible and inclusive technology solutions.

**Textbooks**

1. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale - **Human - Computer Interaction**, Pearson Education, Third Edition, 2009.

**Reference Books**

1. Wilbert O. Galitz ,Wiley - The Essential Guide to User Interface Design , Indian Edition 2007.
2. Ben Shneiderman, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Pearson, 5th Edition.
3. Donald A. Norman, The Design of Everyday Things, Basic Books, Revised Edition
4. The Encyclopaedia of Human-Computer Interaction, 2nd Ed. https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

1. https://archive.nptel.ac.in/courses/106/103/106103115/
2. https://archive.nptel.ac.in/courses/106/106/106106177/

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**AUGMENTED REALITY AND VIRTUAL REALITY (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM743 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

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

1. Gain a foundational understanding of Augmented Reality (AR) and Virtual Reality (VR).
2. Acquire essential technical skills needed for AR and VR development, including programming, 3D modelling, and using game development engines like Unity.
3. Understand how AR systems track objects and estimate their positions.
4. Gain knowledge of 3D computer graphics fundamentals, rendering techniques, and the tools and libraries available for 3D modelling and rendering in AR.
5. Learn design principles and interaction techniques specific to AR, including software architecture, design patterns, and user interface design.

**Preamble:**
Augmented reality is an interactive experience in which a real-world environment is enhanced with computer-generated visual elements, sounds, and other stimuli. It can provide a user with a heightened, more immersive experience than they would experience otherwise, which adds to the user's enjoyment or understanding. virtual Reality (VR) is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings. AR blends virtual content with the real world, enhancing the user's perception of reality in the physical world. VR completely immerses users in a simulated environment, totally disconnecting them from the physical world. The course also focuses on Calibration and Registration, Understanding Unity, Pose Estimation and Tracking, Computer Vision for AR and Designing AR Systems.

**Module – 1**

**Introduction to Augmented Reality:** History of AR, AR Scenarios, the future of AR, Applications of AR.

**Virtually Everything for Everyone:** What is Virtual reality?, Differences between virtual reality and Augmented reality, Applications versus games, Types of VR experiences, types of HMD, How virtual reality works?, Technical Skills that are important to VR.

**Textbook 1: Chapter 1 and Textbook 2: Chapter 1** **(08 Hours)**

**Module – 2**

**Understanding Unity, Content and scale**: Technical requirements, Installing Unity, Getting started with unity, Creating a simple diorama.

**Setting up your project for VR**: Introducing the Unity XR platform, Choosing your target VR Platform and toolkits, Enabling virtual reality for your platform, Building and run your project, Building for Oculus Quest

**Textbook 2: Chapter 2, Chapter 3** **(08 Hours)**

**Module – 3**

**Pose Estimation and Tracking:** Pose Tracking in AR, Classifications of Tracking, Stationary Tracking System, Mobile Sensor-Based Tracking, Optical Tracking, Hybrid Tracking, Marker-Based Tracking and AR, Diminished Reality, Marker-less Tracking and AR.
**Textbook 1: Chapter 3 (Sections 3.2 to 3.10) (08 Hours)**

**Module – 4**

**3D Graphics in AR:** Basics of 3D Computer Graphics, 3D Rendering, 3D Model Importers/Loaders, 3D modeling software's, Available Graphics libraries.
**Textbook 1: Chapter 5 (08 Hours)**

**Module – 5**

**Designing AR Systems:** Design principles for AR, Designing interactions for AR, Software Architecture and Design Patterns for AR, Designing AR interfaces, Examples of AR Interfaces.
**Textbook 1: Chapter 6 (08 Hours)**

**Course Outcomes:**

The students will be able to: **(List the COs as per the course requirements)**

CO1: Understand the AR/VR applications and usage, HMDs, and necessary technical skills.

CO2: Demonstrate understanding of technical requirements and VR development basics with oculus integration

CO3: Analyze various pose tracking techniques, 3D graphics and design interactions and principles in AR.

CO4: Build and deploy AR and VR projects on target platforms, such as Oculus Quest, using appropriate toolkits and development practices

**Textbooks**

1. Chetankumar G Shetty, "Augmented Reality: Theory, Design and Development", McGrawHill Publications 2020.
2. Jonathan Linowes -"Unity 2020 Virtual Reality Projects" Third Edition Packt> Paperback – 30 July 2020

**Reference Books**

1. Jonathan Linowes, Krystian Babilinski, "Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit and Vuforia", Paperback – Import,Packt Publishing Limited, 9 October 2017.
2. Schmalstieg/Hollerer, "Augmented Reality: Principles & Practice", Paperback–12, Pearson Education India, October 2016.
3. Chitra Lele, "Artificial Intelligence Meets Augmented Reality: Redefining Regular Reality", Paperback – 1, BPB Publications, January 2019.

**Alternate Assessment Tools (AATs) suggested:**

- **Design and development of AR/VR model**
- **MOOC course**

**Web links / e – resources:**

- https://nptel.ac.in/courses/106/106/106106138/
- https://nptel.ac.in/courses/121/106/121106013/
- https://nptel.ac.in/courses/106/102/106102065/
- https://nptel.ac.in/courses/106/106/106106090/
- https://nptel.ac.in/courses/106/103/106103224/

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Data Mining and Data Warehousing (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM744 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

**Course Objectives:**
This course will enable students to:
- Understand the concepts of data warehousing and modeling the data warehouses.
- Empathize with the basic concepts of data mining and applications of data mining.
- Understand and illustrate the concepts of pattern / association analysis.
- Explain the concepts of classification and clustering of data points in data mining, compare among them.

**Preamble:** In the realm of modern information technology, the course on Data Mining and Data Warehousing serves as guiding light into the intricacies of extracting valuable insights from vast datasets. Data mining is the study of algorithms for finding patterns in large data sets. It is an integral part of modern industry, where data from its operations and customers are mined for gaining business insight. It is also important in modern scientific endeavors. This course is an interdisciplinary topic involving databases, machine learning and algorithms. The course will cover the modeling of multidimensional data in the data warehouses and data mining tasks using basic algorithms like association rules, classification and clustering from the given data.

**Module – I**

**Data Warehousing:** Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading.
**Data Cube:** A multidimensional data model, Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.
**Textbook 2: Chapter.4.1,4.2** **(08 Hours)**

**Module – II**

**Data warehouse implementation:** Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.
**Data Mining:** What is data mining? What kinds of data can be mined; what kinds of applications are targeted? Major issues in data mining, Data objects and attribute type, measuring data similarity and dissimilarity.
**Textbook 2: Chapter.4.4**
**Textbook 2: Chapter 1: 1.2,1.3,1.6,1.7 & Chapter 2: 2.1,2.4** **(08 Hours)**

**Module – III**

**Association Analysis:** Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns.
**Textbook 1: Chapter 6.1 to 6.7 (Excluding 6.4)** **(08 Hours)**

**Module – IV**

**Classification:** Basic concepts, Decision Trees Induction, Bayesian Classifiers, Rule Based Classifiers, Model evaluation and selection: Metrics for Evaluating Classifier Performance, Holdout Method and Random Subsampling, Cross-Validation, Bootstrap. Techniques to improve classification accuracy.
**Textbook 2: Chapter 8: 8.1, 8.2, 8.3, 8.4, 8.5** **(08 hours)**

**Module – V**

**Clustering Analysis:** Introduction, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods.
**Textbook 2: Chapter 10: 10.1, 10.2, 10.3, 10.4, 10.5** **(08 Hours)**

**Course outcomes:**

CO1: Demonstrate the concepts of data warehousing and querying mechanisms.
CO2: Illustrate the importance of data mining and its applications.
CO3: Apply suitable pattern analysis algorithm for the given problem.
CO4: Analyze the suitable classification /clustering algorithm for the prediction or clustering of data points.
CO5: Integrate insights gained from case studies to propose innovative approaches and solutions to contemporary issues in data mining and warehousing

**Textbooks**

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: **Introduction to Data Minin**g, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: **Data Mining -Concepts and Techniques**, 3rd Edition, Morgan Kaufmann Publisher, 2012.

**Reference Books**

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
2. Michael.J.Berry, Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012.
3. Building the Data Warehouse by William H. Inmon, Fourth Edition, Wiley Publications (https://www.amazon.in/Building-Data-Warehouse-W-Inmon/dp/0764599445)

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

1. https://nptel.ac.in/courses/106105174
2. https://onlinecourses.swayam2.ac.in/cec24_cs12/preview

# Open Electives – Group II

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Principles of Machine Learning (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM751 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

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

- Define machine learning and understand the basic theory underlying machine learning.
- Differentiate supervised, unsupervised and reinforcement learning
- Understand the basic concepts of learning and decision trees.
- Understand neural networks and Bayesian techniques for problems appear in machine learning
- Understand the instant based learning and reinforcement learning

**Preamble:**
Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. We cover topics such as Bayesian networks, decision tree learning, statistical learning methods, unsupervised learning and reinforcement learning. The course covers theoretical concepts such as inductive bias, Bayesian learning methods. Short programming assignments include hands-on experiments with various learning algorithms. This course is designed to give a graduate-level student a thorough grounding in the methodologies, technologies, mathematics and algorithms currently needed by people who do research in machine learning.

**Module – I**

**Introduction**: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning.

**Concept Learning**: Concept learning task, Concept learning as search, Find-S algorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

**Text Book1: Chapter 1.1 – 1.3, 2.1-2.5, 2.7** **(08 Hours)**

**Module – II**

**Decision Tree Learning:** Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

**Text Book1: Chapter 3.1-3.7** **(08 Hours)**

**Module – III**

Artificial Neural Networks: Introduction, Neural Network representation, Appropriate problems, Perceptrons, Backpropagation algorithm.

**Text book 1: Chapter: 4.1 – 4.6** **(08 Hours)**

**Module – IV**

**Bayesian Learning**: Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting probabilities, MDL principle, Naive Bayes classifier, Bayesian belief networks, EM algorithm .

**Text book 1: Chapter 6.1 – 6.6, 6.9, 6.11, 6.12** **(08 Hours)**

**Module – V**

**Instance Based Learning:** Introduction, k-nearest neighbor learning, locally weighted regression, radial basis function, cased-based reasoning.

**Reinforcement Learning:** Introduction, Learning Task, Q Learning.

**Text book 1: Chapter 8.1-8.5, 13.1-13**.3 **(08 Hours)**

**Course Outcomes:**

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

CO1: Choose the learning techniques and investigate concept learning
CO2: Identify the characteristics of decision tree and solve problems associated with it.
CO3: Apply effectively neural networks for appropriate applications
CO4: Apply Bayesian techniques and derive effectively learning rules
CO5: Investigate instant based learning and Reinforcement learning

**Textbooks**

1. Tom M. Mitchell**, Machine Learning,** India Edition 2013, McGraw Hill Education**.**

**Reference Books**

1. Ethem Alpaydın, Introduction to machine learning, second edition, MIT press.
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition. by Aurélien Géron. Released September 2019. Publisher(s): O'Reilly Media, Inc

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

- **https://onlinecourses.nptel.ac.in/noc23_cs18/preview**
- **https://www.tensorflow.org/resources/learn-ml**

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Big data Analytics (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM752 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

**Course Objectives:**

This course will enable students :

- To Provide a strong foundation in database concepts, technology, and practice.
- To Practice SQL programming through a variety of database problems.
- To Understand the relational database design principles.
- Demonstrate the use of concurrency and transactions in database.

**Preamble:** This course will introduce the characteristics of Big Data and its application in Big Data Analytics. Big data analytics describes the process of uncovering trends, patterns, and correlations in large amounts of raw data to help make data-informed decisions. The features, benefits, limitations and applications of Hadoop will be discussed. You will explore the components of Hadoop ecosystem, map reduce and learn how to use Hive, HBase and Pig to process Big Data. In this course, you will also learn how to leverage MongoDB to deliver insights into Big Data.

**Module – I**

**Introduction to Big Data and Analytics**: Classification of Digital Data, Structured and Unstructured Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Why Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop Environment ,Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments - Basically Available Soft State Eventual Consistency - Top Analytics Tools

**Textbook 1: Chapter 1,2,3** **(08 Hours)**

**Module – II**

**Introduction TO Technology Landscape and Hadoop**: NoSQL, Comparison of SQL and NoSQL, Hadoop -RDBMS Versus Hadoop - Distributed Computing Challenges – Hadoop Overview - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem

**Textbook 1: Chapter 4,5** **(08 Hours)**

**Module – III**

**Introduction to MONGODB and MAPREDUCE Programming**: MongoDB: Why Mongo DB - Terms used in RDBMS and Mongo DB - Data Types - MongoDB Query Language MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression

**Textbook 1: Chapter 6,8** **(08 Hours)**

**Module – IV**

**Introduction to HIVE**: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub- Query – Joins – Aggregations - Group by and Having - RCFile Implementation - Hive User Defined Function - Serialization and Deserialization.

**Textbook 1: Chapter 9** **(08 Hours)**

**Module – V**

**Introduction to PIG**:
PIG- Introduction - Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution - Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive

**Textbook 1: Chapter 10** **(08 Hours)**

**Course outcomes:**
At the end of the course the student will be able to:
**CO1**: Understand Big Data and its analytics in the real world
**CO2**: Demonstrate Hadoop ecosystem for data analytics
**CO3**: Examine of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm
**CO4**: Implementation of Big Data Analytics using HIVE to solve data intensive problems
**CO5**: Apply data analytics solutions using PIG

**Textbooks**

1. Seema Acharya, Subhashini Chellappan, "**Big Data Analytics**", 2nd ed, Wiley India Pvt Ltd , 2019

**Reference Books**

1. Hurwitz JS, Nugent A, Halper F, Kaufman M. Big data for dummies. John Wiley & Sons; 2013.
2. Tom White, "Hadoop: The Definitive Guide", O'Reilly Publications, 2011.
3. Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

- **https://onlinecourses.nptel.ac.in/noc22_cs65/preview**
- **https://data-flair.training/blogs/hadoop-tutorial/**

**DEPARTMENT OF ARTIFICAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS) applicable for 2022 Scheme**
**SEMESTER –VII**

**Fundamentals of DBMS (3:0:0) 3**
**(Effective from the academic year 2024-25)**

| | | | |
|---|---|---|---|
| Course Code | 21AM753 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P) | 3:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 |

**Course Objectives:**

This course will enable students :

1. To Provide a strong foundation in database concepts, technology, and practice.
2. To Practice SQL programming through a variety of database problems.
3. To Understand the relational database design principles.
4. Demonstrate the use of concurrency and transactions in database.

**Preamble:** Database Management Systems course is intended to deliver students the elementary concepts of a database management system and equips them to design and implement a database application built over those concepts. It also introduces advanced level areas like transaction processing, concurrency control and recovery management.

**Module – 1**

**Introduction to Databases:** Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

**Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

**Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams .

**Text Book : Chapter 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10 (8 Hours )**

**Module – 2**

**Relational Model:** Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

**SQL:** SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

**Text Book : Chapter 5.1 to 5.3, Ch 6.1 to 6.5 (8 Hours)**

**Module – 3**

SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema Change Statements in SQL.

**Text Book : Chapter 7.1 to 7.5 (8 Hours)**

**Module – 4**

**Introduction to Normalization using Functional and Multivalued Dependencies: I**nformal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys,

Second and Third Normal Forms, Boyce- Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

**Text Book : Chapter 14.1 to 14.7** **(8 Hours)**

**Module – 5**

**Transaction Processing:** Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions

**Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering

**Text Book : Chapter 20.1 to 20.3, Ch 21.1 to 21.2** **(8 Hours)**

**Course Outcomes:**

The students will be able to

CO1: Describe the basic elements of a relational database management system
CO2: Design entity relationship for the given scenario.
CO3: SQL to find solutions to a broad range of queries
CO4: Analyse various normalization forms for the given application.
CO5: Analyse and implement transaction processing, concurrency control protocols in databases.

**Textbooks:**

1. **Fundamentals of Database Systems**, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson

**Reference Books:**

1. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://onlinecourses.nptel.ac.in/noc21_cs04/
3. https://nptel.ac.in/courses/106/106/106106093/

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**
**Choice Based Credit System (CBCS)**
SEMESTER – VII

**Software Engineering (3:0:0:0) 3**
(Effective from the academic year 2024 -25)

| | | | |
|---|---|---|---|
| Course Code | 21AM754 | CIE Marks | 50 |
| Teaching Hours/Week (L:T:P:S) | 3:0:0:0 | SEE Marks | 50 |
| Total Number of Contact Hours | 40 | Exam Hours | 3 Hours |

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

- Outline software engineering principles and processes involved in building software by following professional and ethical laws.
- To gain knowledge of the development of software projects by applying phases of SDLC
- Outline the various levels of software evaluation and software evolution to meet the changes.
- Gain knowledge on Agile software exploring the methodologies and practices of Agile development

**Preamble:** In today's digital age, software engineering is an essential component of technological innovation and societal growth. As the world becomes more reliant on complex software systems to power business, education, healthcare, entertainment, and everyday life, the demand for experienced software engineers grows. This field applies ideas from computer science, engineering, and project management to create, maintain, and upgrade software systems that are dependable, efficient, and user-friendly.

Learning software engineering provides students with a solid foundation in software development processes, system design, and project management. It promotes critical thinking, problem-solving skills, and the capacity to adapt to fast changing technology. Students learn how to create software that satisfies user requirements, adheres to quality standards, and survives the test of time.

As future software engineers, students embark on a journey of continual learning and creativity, ready to contribute to technological growth and societal improvement.

**Module – I**

**Introduction:** Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies.

**Software Processes:** Models: Waterfall Model, Incremental Model, and Spiral Model. Process activities.

**Requirements Engineering:** Requirements Engineering Processes. Requirements Elicitation and Analysis. Functional and non-functional requirements. The Software Requirements Document. Requirements Specification. Requirements validation. Requirements Management.

**Textbook 1: Chapter 2 (Sections 2.1.1 – 2.1.3)**
**Textbook 1: Chapter 4 (Sections 4.1,4.2,4.3,4.5,4.6,4.7) (08 Hours)**

**Module – II**

**System Models:** Context models (Sec 5.1). Interaction models (Sec 5.2). Structural models (Sec 5.3). Behavioral models (Sec 5.4). Model-driven engineering (Sec 5.5). Design and Implementation: Introduction to RUP (Sec 2.4), Design Principles (Chap 7). Object-oriented design using the UML (Sec 7.1). Design patterns (Sec 7.2). Implementation issues (Sec 7.3). Open-source development (Sec 7.4).

**Textbook 1: Chapter 5 (Sections 5.1 to 5.5)**
**Textbook 1: Chapter 7 (Sections 7.1 to 7.4) (08 Hours)**

**Module – III**

**Software Testing:** Development testing, Test-driven development, Release testing, and User testing. Test Automation.

**Software Evolution:** Evolution processes. Program evolution dynamics. Software maintenance. Legacy system management.

**Textbook 1: Chapter 8 (Sections 8.1 to 8.4)**

**Textbook 1: Chapter 9 (Sections 9.1 to 9.4) (08 Hours)**

**Module – IV**

**Project Planning:** Software pricing. Plan-driven development. Project scheduling: Estimation techniques. Quality management: Software quality. Reviews and inspections. Software measurement and metrics. Software standards

**Textbook 1: Chapter 23 (Sections 23.1 to 23.5)**

**Textbook 1: Chapter 24 (Sections 24.1 to 24.4) (08 Hours)**

**Module – V**

**Agile Practices:** The Agile Alliance: The Manifesto of the Agile Alliance, Principles

**Overview of Extreme Programming:** The Practices of Extreme Programming: Customer Team Members, User Stories, Short Cycles, Acceptance Tests, Pair Programming, Test-Driven Development, Collective Ownership, Continuous Integration, Sustainable Pace, Open workspace, The Planning Game, Simple Design, Refactoring, Metaphor.

**Textbook 2: Chapters 1 and 2 (08 Hours)**

**Course outcomes:**

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

CO1: Understand the principles of the software engineering process and its phases.
CO2: Outline the nature of software systems based on process and system models.
CO3: Explain the software testing and evolution processes.
CO4: Demonstrate project planning process and quality management.
CO5: Understand the principles of Agile Practices

**Textbooks**

1. Ian Sommerville: **Software Engineering**, 9th Edition, Pearson Education, 2017.
2. Robert C. Martin: **Agile software development principles patterns and practices**, 1st Edition, Pearson Education,2002

**Reference Books**

1. Roger S. Pressman: Software Engineering-A Practitioner approach, 7th Edition, Tata McGraw Hill.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

**Alternate Assessment Tools (AATs) suggested:**

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)
- Model presentation
- Video

**Web links / e – resources:**

1. https://onlinecourses.nptel.ac.in/noc19_cs69/preview (IIT, Kharagpur)
2. https://onlinecourses.swayam2.ac.in/cec20_cs07/preview (University of Madras)