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

V and VI Semester Scheme and Syllabus
2021 Scheme - Autonomous

Approved in the BoS meeting held on 25.05.2023

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 team work, 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.

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(An Autonomous Institution affiliated to VTU, Belagavi)
Yelahanka, Bengaluru-560064

Date: 14.06.2023

CIE and SEE Pattern for 2021 Scheme
(Applicable from the AY 2021-22 onwards)

Important Note:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examinations (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 marks out of 50). The student is declared as a pass in the course if he / she 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.

4 CREDIT and 3 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs to be conducted for 40 Marks (90 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10 marks, total **20 marks**.
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score 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 from each module.**

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: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score 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.

1 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 3 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 3 tests will be 120 and the same can be scale down to **60 marks.**
- Alternate Assignment Tool (AAT): 2 AATs each of 10 marks, total **20 marks.**
- Assignments: 2 assignments of each 10marks, total **20 marks.**
- CIE marks = 60 + 20 + 20 = 100 and same can be scale down to **50 marks.**
- Student has to score 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 COURSES

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 minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks and scale down to 50 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.

CoE 16/06/2023

Dean AA 16/06/2023

Principal 19/6/23

Scheme of V Semester

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2021–22Choice Based Credit System (CBCS)

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

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	21HSS51	Management and Entrepreneurship	AIML	3	0	0	0	3	3	50	50	100
2	AEC	21AEC52	Cyber and Intellectual Property law	AIML	0	2	0	0	1	1	50	50	100
3	INT	21INT53	Innovation / Entrepreneurship / Societal Internship	AIML	0	0	0	6	3	-	100	--	100
4	PE	21AM54X	Professional Elective I	AIML	3	0	0	0	3	3	50	50	100
5	PC	21CS55	Database Management System	AIML	3	0	0	0	3	3	50	50	100
6	PC	21AM56	Automated Theory	AIML	3	0	0	0	3	3	50	50	100
7	PC	21AM57	Machine Learning	AIML	3	0	0	0	3	3	50	50	100
8	PC	21CSL58A	Database Management System Laboratory	AIML	0	0	2	0	1	3	50	50	100
9	PC	21CSL58B	Operating Systems Laboratory	AIML	0	0	2	0	1	3	50	50	100
10	PC	21CSL58C	Data Communication and Networks Laboratory	AIML	0	0	2	0	1	3	50	50	100
TOTAL					15	2	6	6	22		550	450	1000

Professional Elective - Group I	
Course Code	**Course Title**
21AM541	Digital Image Processing
21 AM542	Data Communication and Networks
21 AM543	Cloud Computing and Virtualization for AI
21 AM544	Decision Support Systems
21 AM545	Soft Computing

V Semester Syllabus

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER - V

Management and Entrepreneurship (3:0:0) 3
(Effective from the academic year 2021-22)

Course Code	21HSS51	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 to:

1. Define the strategic, tactical, and operational roles and functions of management.
2. Use critical thinking to formulate and execute managerial entrepreneurial strategies, plans, and procedures.
3. Understand the Ideation Process, creation of Business Model, Feasibility Studyand sources of funding

Module – 1

Management: Significance and Scope of Management, Importance of the management and entrepreneurship in Economic growth of Nation, Impact of the entrepreneurship on Societal Problems for Sustainable Solutions. Management in the perspective of National Economy, Career, Innovations and trends. Definition, Management functions, Levels of management, Roles of manager, Managerial skills, Management & Administration.
Planning: Importance, Types, Steps and Limitations of Planning; Decision Making types and Steps in Decision Making.

(8 Hours)

Module – 2

Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management, Departmentalization.
Committees: Meaning, Types of Committees; Centralization Vs Decentralization of Authority, Responsibility. Staffing: Importance, Recruitment and Selection Process.
Directing and Controlling: Meaning and Requirements of Effective Direction.
Motivation: Nature of Motivation, **Motivation Theories** (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory). **Communication:** Meaning, Importance and Purposes of Communication. **Leadership:** Meaning, Characteristics, Behavioral Approach of Leadership. **Coordination:** Meaning, Types, Techniques of Coordination; **Controlling:** Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, and Steps in Control Process.

(8 Hours)

Module – 3

Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship. Theories of Entrepreneurship.

(8 Hours)

Module – 4

Entrepreneurial Project Development: Idea Generation and Feasibility Analysis- IdeaGeneration; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities.

(Case study/Activity to demonstrate entrepreneurial abilities)

(8 Hours)

Module – 5

Social Responsibilities of Business: Meaning of social responsibility, social responsibilities of business towards different groups, social audit, business ethics and corporate governance.

Self-study topics:

1. Sources of funding, Working capital management and Taxation benefits.
2. Market evaluations and turnaround strategies.
3. Policies governing SME's
4. Perform market survey on sectors promoted by the government and submit the reportfor the same.

   Summary: The student will explore entrepreneurial opportunities and gather all relevantdata for starting a venture.

(8 Hours)

Course outcomes:

The students will be able to:

CO1: Comprehend the fundamental concepts of Management and Entrepreneurship and opportunities in order to setup a business

CO2: Categorise the functions of Managers, Entrepreneurs and their social responsibilitiesCO3: Analyse the business environment components in developing a business plan.

CO4: Individually and in teams identify, conceptualize, and develop solutions for successful entrepreneurial management.

Textbooks:

1. P. C. Tripathi., P. N. Reddy., "Principles of Management." 6th Edition, McGraw-HillEducation, 2017.
2. Dr. Vasant Desai. "Dynamics of Entrepreneurial Development and Management",6th Edition,Himalayan Publishing House, 2019.

References:

1. Poornima. M. Charantimath., "Entrepreneurship Development Small BusinessEnterprises", Pearson Education, 2008.
2. Robert. D. Hisrich., Mathew. J., Manimala., Michael. P. Peters., Dean. A., Shepherd, "Entrepreneurship", 8th Edition,Tata McGraw Hill Publishing Co. ltd, 2012.
3. Harold Koontz, Heinz Weihrich., "Essentials of Management: An International, Innovation
   and Leadership perspective", 10th Edition, McGraw Hill Education, 2016.

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

Semester – V

Cyber and Intellectual Property Law (0:2:0)1

(Common to all Branches)

(Effective from the academic year 2021-22)

Course Code	21AEC52	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:2:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	1

Course Objectives:

This course will enable students to:

1. Understand the concept of IP, copyright, patent and its protection.
2. Explain the scope of trademarks, industrial and IC layout design.
3. Enhance their knowledge on IP management and related agreements.
4. Understand overview of Cyber law and cyber policies.
5. Identify different types of cybercrime and security measures.

Module – 1

Introduction to IP: Various forms of IP, Intellectual property verses physical property,importance of intellectual property.

Copyright: Different classes of copyright work, ownership of copyright, term of copyright, infringement of copyright.

Patent: Fundamentals of patent, condition for grant of patent, inventions those are not patentable, right of patentee, transfer of patent right, Infringement of patent right, challenges in patents. Case study on prior art search and patent drafting. (03 Hours)

Module – 2

Trademarks: Introduction to trademark, developing trademark, term of trademark,collective marks, certification trademarks, Infringement of trademark.

IC Layout Design Introduction to Semi-Conductor Integrated Circuits Layout, TheSemi-Conductor Integrated Circuits Layout Design (SICLD) Act, 2000.

Industrial Design: Design registration, Industrial design act 2000.

Case study on infringement of Industrial Design (03 Hours)

Module – 3

Creating IP: Need for creating IP, Process of development of IP and knowledge.

TRIPS (Trade-Related aspects of IPR): Need and objectives, Agreement on trip, scheme of agreements. WIPO: Objectives, functions, memberships

Treaties: Patent cooperation Treaty(PCT)**:** filing patent under PCT, Different stages and procedure in PCT filing. Paris Convention Treaty**:** filing patent under Paris convention treaty, Different procedure stages

IP Management: Defining IP management, need and importance of IP management,

. Undertaking IP intelligence, acquisition of IP, managing IP portfolio, commercialization of IP, protecting IP. Case studies on PCT filing. (03 Hours)

Module – 4

Cyber Law: introduction to Indian cyber law, need for cyber law, jurisprudence of cyberlaw, importance of cyber law.

IT Act: Objective and scope of The Indian Information Technology Act 2000.

Cyber Crimes: What constitute cyber crime, Important cybercrimes.

C**yber policies:** Need for an information security policy, information security standard-ISO, introduction to various security policies. Case study on cyber crime. (03 Hours)

Module – 5

Phishing; Sspear phishing, protecting from phishing attack, cyber stalking, how toprevent cyber stalking.

Hacking: types, Protection of computers from intrusion and types, different types ofhackers and their operation.

Data theft: IT act related to data theft, Spam E-mail, IT act related to spam mail,Software piracy, types, legal penalties, Identity theft, prevention practice

Electronic and digital signature: Role of electronic signature, types of electronicsignature, guidelines for electronic signature. Creation of digital signature, digital signature in India. (03 Hours)

Course Outcomes:

The students will be able to:

CO1: Describe the concept of copyright and patent and its protection. CO2: Explain the scope of trademarks, industrial and IC layout design. CO3 Describe Intellectual property management and related agreements.CO4: Understand overview of Cyber law and cyber policies.

CO5: Discuss different types of cybercrime and security measures.

Text Books

[1]	V Appukutty, Cyber Crime & Law, Coral Publishers, 2022
[2]	Surya Prakash Tripati, Ritendra Goel, Praveen Kumar Shukla, Introduction to information Security and Cyber Laws, Dream Tech Press,2021
[3]	Neeraj Pandey, Khushdeep Dharni, Intellectual Property Rights, PHI Learning, 2014

References

[1]	Prabhuddha Ganguli, Intellectual Property Rights, Tata Mc-Graw –Hill, 2017
[2]	S R Myneni, Patent Right Creation and Registration, Asia Law House, 2017
[3]	Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson, 3rd Edition, 2004.
[4]	Bill Nelson, Amelia Phillips, Christopher Steuart, Guide to Computer Forensics and Investigations, Cengage Learning, 4th Edition, 2010.

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Choice Based Credit System (CBCS)

SEMESTER – V

Innovation / Entrepreneurship/ Societal Internship (0:0:0:6) 3

(Common to all Branches)

(Effective from the academic year 2021-22)

Course Code	21INT53	CIE Marks	100
Teaching Hours/Week (L:T:P:PW)	0:0:O:6	SEE Marks	--
Total Number of Contact Hours	4 weeks	Exam Hours	--

Schedule:
Scheduled during the intervening period of IV and V semester

Course Outcomes: students will be able to

1. Acquire academic/ career/ personal overall skill/ knowledge development.
2. Perceive ample opportunities for professional growth and achievement with relevance to society and environment.
3. Expose to real job world environment and gain practical knowledge with experience.
4. Build leadership qualities, teamwork, collaborations, cooperation, and facility in using virtual workspace.
5. Intensify creativity, artistry, curiosity, imagination, innovation,, incubation, entrepreneurial skills and personal expression.
6. Write report on the work/ project carried out with presentation.

During the intervening period of IV and V semesters, students shall be ready for industrialexperience. Therefore, they shall choose to undergo Internship involving Innovation / Entrepreneurship/Societal related activities. Students may choose to work on innovation or entrepreneurial activities or both resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry. In case students want to undergo internship at his/her family business, he /she shall will be permitted provided, a declaration by a parent is submitted directly to the Principal of the institution.

Innovation

Innovation refers to a new or improved product or process or a combination thereof that differs marginally or significantly from the unit's previous product. An innovation center is a place where students are encouraged to implement the innovative ideas formed through imagination, brainstorming sessions, design thinking and associated activities to bring them to reality. It is a place, where creative minds are shaped.

Entrepreneurship

Entrepreneurship refers to setting up a new business or businesses, taking on financial risks inthe hope of profit. It involves investment to undertake production along with arranging inputs like land, labour, material and capital, introducing new techniques and products, identifying new sources for the enterprise, etc.

Incubation Center

An organized unit designed for innovation as well as to accelerate the growth and success of new entrepreneurial companies through mentorship and an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections.

Startup

An entity that develops a business model based on either product innovation or service innovation and makes it scalable, replicable and self-reliant.

Societal (Social) related activities

Short term internship at villages, slums or urban areas can be under social internship. The internship will be more fruitful, if students work in teams. The teams can select one or more fields to do their best in the field of agriculture, watershed management, wastelands development, non- conventional energy, low cost housing, sanitation, nutrition and personal hygiene, schemes for skilldevelopment, income generation, blood bank, government scheme such as Swachch Bharat,Accessible India, Digital India, Beti Bachao and Beti Padhao, Environment and Energy Conservation and Education, legal aid, consumer protection and allied field including Indian Red Cross Society, National Cadet Corps, Bharat Scouts and Guides.

Places for Innovation/Entrepreneurial Activities

Students shall carryout Innovation or Entrepreneurial activities or both at the Incubation Centerand Entrepreneurship Cell of the parent institution or elsewhere such as ATAL Incubation Centers [A flagship of Atal Innovation Mission (AIM), NITI Aayog for promoting the culture of innovation and entrepreneurship in India], institutes of national importance, public sector units, IT companies, government organizations, and non-governmental organizations, industries including MSME, etc. Institutes, should deter students to opt for internships at places established for commercial benefits.

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2						2			
CO2						2					2	
CO3			2	2			3	2				
CO4									3	3	2	2
CO5					2				3			2
CO6									2	3		
Average	3	2	2	2	2	2	3	2	3	3	2	2

Rubrics for Internal Evaluation (Total Marks: 100)

Indicator	Poor	Average	Good	Excellent
Acquired skills or knowledge (10 Marks) (CO1)	Not gained any skill / knowledge **or** Attended a few sessions. **0-1 Marks**	Partial skill/Knowledge gained. Only Block Diagram/ Notes/Description **2-4 Marks**	Average skill/knowledge gained. Lack of Technical/ Knowledge. **5-7 Marks**	Complete skill/ knowledge gained. All Skills Acquired. **8-10 Marks**
Presentation (10 Marks) **(CO5)**	Absence for presentation **or** Presented after the due date. **0-1 marks**	Information is lacking/unclear & communicated in such a way that the audience can not understand the purpose of the evidence of work and internship	Information is not presented in a clear manner and many details are missing related to the evidence work and internship experiences.	Information is presented in such a way that the audience can understand the purpose of the evidence of work and internship experiences.

		experiences. **2-4 Marks**	**5-7 Marks**	**8-10 Marks**
Weekly report (10 Marks) (CO6)	Weekly report not submitted **or** Few days report was submitted. **0-1 Marks**	One Weekly report submitted. **2-4 Marks**	Two weekly reports submitted. **5-7 Marks**	All three weekly reports submitted **8-10 Marks**
Practical Knowledge (10 Marks) (CO3)	Not gained any practical knowledge **or** Able to define basic concepts. **0-1 Marks**	Partial practical Knowledge gained. Less hands-on experience. **2-4 Marks**	Average practical knowledge gained. Only few models are exhibited. **5-7 Marks**	Complete practical knowledge gained. **8-10 Marks**
Societal and environmental relevance (10 Marks) (CO2)	No relevance to society or environment (At-least one relevance) **0-1 Marks**	Partial relevance to society or environment. **2-4 Marks**	Average relevance to society or environment. **5-7 Marks**	Directly Relevant to society or environment. **8-10 Marks**
Viva (10 Marks) (CO4)	Does not know any information **or** Fair leadership quality/ teamwork/ cooperation. **0-1 Marks**	Provides irrelevant information for all questions. Good leadership quality/ teamwork/ cooperation. **2-4 Marks**	Provides incomplete information for all questions. Better leadership quality/ teamwork/ cooperation. **5-7 Marks**	Provides complete information for all questions. Outstanding leadership quality/ teamwork/ cooperation. **8-10 Marks**
Report (40 Marks) (CO6)	Does not submit the report. **0 Marks**	Report submitted does not fulfill the prescribed format/submission after one weeks of the deadline. **1-24 Marks**	Report submitted partially fulfills the prescribed format/ submission after one weeks of the deadline. **25-32 Marks**	Report submitted fulfills the prescribed format / submission in par with the deadline. **33-40 Marks**

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - V

DIGITAL IMAGE PROCESSING (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM541	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 Learning Objectives: This course will enable students to:

- Understand the fundamentals of digital image processing
- Understand the image transform used in digital image processing
- Understand the image enhancement techniques used in digital image processing
- Understand the image restoration techniques and methods used in digital image processing
- Understand the Morphological Operations and Segmentation used in digital image processing

Module – 1

Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

[Text1: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2] (8 Hours)

Module – 2

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering,-Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, and Selective Filtering. [Text1: Chapter 3: Sections 3.2 to 3.6 and Chapter 4: Sections 4.2, 4.5 to4.10] (8 Hours)

Module – 3

Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, and Constrained Least Squares Filtering. [Text1: Chapter 5: Sections 5.2, to 5.9] (8 Hours)

Module – 4

Color Image Processing: Color Fundamentals, Color Models, and Pseudo-Colorimeter Processing. Wavelets: Background, Multiresolution Expansions. Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, 10 The Hit-or-Miss Transforms, and Some Basic Morphological Algorithms. [Text1: Chapter 6: Sections 6.1 to 6.3, Chapter 7: Sections 7.1 and 7.2,Chapter 9: Sections 9.1 to 9.5] (8 Hours)

Module – 5

Segmentation: Introduction, classification of image segmentation algorithms, Detection of Discontinuities, Edge Detection, Hough Transforms and Shape Detection, Corner Detection,
and Principles of Thresholding. Representation and Description: Representation, and Boundary descriptors.

[Text2: Chapter 9: Sections 9.1, to 9.7 and Text 1: Chapter 11: Sections 11.1and 11.2] (8 Hours)

Course Outcomes: At the end of the course students should be able to:

- Understand, Ascertain and describe the basics of image processing concepts through mathematical interpretation.
- Apply image processing techniques in both the spatial and frequency (Fourier)domains.
- Demonstrate image restoration process and its respective filters required.
- Design image analysis techniques in the form of image segmentation and to evaluate the Methodologies for segmentation.
- Conduct independent study and analysis of Image Enhancement techniques.

Textbooks:
1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.
2. S. Sridhar, Digital Image Processing, Oxford University Press, 2ndEdition, 2016.

Reference Books:
1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, TataMcGraw Hill 2014.
2. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – V

Data Communication and Networks (3:0:0) 3

(Effective from the academic year 2022 -2023)

Course Code	21AM542	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Build an understanding of the fundamental concepts of data communication and computer networking.
2. Analyze error detection and correction techniques along with mechanisms for Media Access control
3. Examine internet protocols and compare different routing algorithms.
4. Distinguish between connection oriented and connectionless services with respect to TCP and UDP protocols.
5. Explore the working of different application layer protocols and services.

Module – 1

Preamble:

This course provides an outline of network functions by introducing data communication and network concepts such as characteristics, functions, benefits, metrics, and attributes that describe network features and performance.

Data Communications: Data Communications Networks, Network Types, Networks Models: Protocol Layering, TCP/IP Protocol suite, The OSI model, **Physical Layer**: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance, Digital Transmission: Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding), Analog to digital conversion (only PCM), Analog Transmission: Digital to analog conversion, Switching: Introduction, Circuit Switched Networks and Packet switching.

(8 Hours)

Module – 2

Data Link Layer: Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum, Forward error correction, Data link control: DLC services, Data link layer protocols, Stop and Wait**,** Go-Back-N, Selective repeat, Point to Point protocol (Framing, Transition phases only).

Media Access control: Random Access, Controlled Access and Channelization, Ethernet: IEEE 802.3

(8 Hours)

Module – 3

Network layer : IPV4 Addresses, Internet Protocols :IPv4 and IPv6, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP.

(8 Hours)

Module – 4

Transport Layer: Introduction to Transport layer services, Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Connection-Oriented Transport TCP: TCP Segment Structure, Round- Trip Time Estimation and Timeout, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control.

(8 Hours)

Module – 5

Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, File Transfer: FTP Commands& Replies, Electronic Mail in the Internet: SMTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution.

Recap/Summary of the Course **(8 Hours)**

Course Outcomes:

The students will be able to:

CO1 Explain the fundamentals of data communication and apply the techniques to solve the given problem of frequency, signals, capacity of the channel and compute the performance of networks based on the metrics specified.

CO2 Explore Access control mechanisms and Examine the relationship between bandwidth utilization, reliability and error control using appropriate techniques.

CO3 Discuss the working of routers, Internet protocol and Analyze unicast broadcast and multicasts protocols and design the new algorithm for the given problem.

CO4 Analyze the various services offered by the transport layer and investigate the reliability, flow control and congestion control techniques for the given problems.

CO5 Identify the principles used in design of the application, discuss the application layer protocols and different techniques to improve the application performance and justify solution / architecture for the given case study /problems.

CO6 Investigate the given problem using the relevant modern tool and interpret the data , composethe report based on literature survey, results obtained and demonstrate integrity of the report with

90% uniqueness using TURNITIN software.

Textbooks:

1. Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013.

2. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017.

References:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - V

Cloud Computing and Virtualization for AI (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM543	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 students with the fundamentals and essentials of Cloud Computing.
2. Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
3. Understand the importance of protocols and standards in computing.

Module – 1

Introduction: Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research trends. Introduction to Cloud Computing

Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenges and Risks.

Migrating into a Cloud:

Introduction, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud.

(8 Hours)

Module – 2

Enriching the 'Integration as a Service' Paradigm for the Cloud Era:

An Introduction, The Onset of Knowledge Era, The Evolution of SaaS, The Challenges of SaaS Paradigm, Approaching the SaaS Integration Enigma, New Integration Scenarios, The Integration Methodologies, SaaS Integration Products and Platforms, SaaS Integration Services, Businesses-to-Business Integration (B2Bi) Services, A Framework of Sensor—Cloud Integration, SaaS Integration Appliances.

The Enterprise Cloud Computing Paradigm:

Introduction, Background, Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers Toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain.

(8 Hours)

Module – 3

Virtual Machines Provisioning and Migration Services:

Introduction and Inspiration, Background and Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context, Future Research Directions

On the Management of Virtual Machines for Cloud Infrastructures:

The Anatomy of Cloud Infrastructures, Distributed Management of Virtual Infrastructures, Scheduling Techniques for Advance Reservation of Capacity, Capacity Management to meet SLA Commitments.

(8 Hours)

Module – 4

Enhancing Cloud Computing Environments Using a Cluster as a Service:
Introduction, Related Work, RVWS Design, Cluster as a Service: The Logical Design, Proof of Concept, Future Research Directions.

Secure Distributed Data Storage in Cloud Computing:
Introduction, Cloud Storage: from LANs TO WANs, Technologies for Data Security in Cloud Computing, Open Questions and Challenges.

T-Systems' Cloud-Based Solutions for Business Applications:
Introduction, What Enterprises Demand of Cloud Computing, Dynamic ICT Services, Importance of Quality and Security in Clouds, Dynamic Data Center—Producing Business-ready, Dynamic ICT Services.

(8 Hours)

Module – 5

Managing the Cloud:
Managing and Securing Cloud Services, Governing the Cloud, Virtualization and the Cloud, Managing Desktops and Devices in the Cloud, Service Oriented Architecture and the Cloud, Managing the Cloud Environment.

Planning for the Cloud:
Banking on Cloud Economics, Starting Your Journey to the Cloud.

The Part of Tens:
Ten (Plus One) Swell Cloud Computing Resources, Ten Cloud Dos and Don'ts.
Recap/Summary of the Course.

(8 Hours)

Course outcomes:
The students will be able to:

CO1: Identify the appropriate cloud services for a given application.
CO2: Assess the comparative advantages and disadvantages of Virtualization technology.
CO3: Analyze authentication, confidentiality and privacy issues in cloud computing.
CO4: Identify security implications in cloud computing.
CO5: Understand the importance of protocols and standards in management for cloud services.

Textbooks:

1. BarrieSosinsky. "Cloud Computing Bible". Wiley India Edition. 2011

References:

2. Anthony Velte, tobyVelte, Robert Elsenpeter. "Cloud Computing – A Practical Approach". Tata McGraw-Hill Edition. 2010

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - V

Decision Support Systems (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM544	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. Reflect upon and apply basic scientific theories about hypothesis testing, falsibiability, equifinality, and predictive power as applied to environmental decision-making
2. Apply the environmental analysis cycle approach for identifying and resolving environmental problems with a focus on water-related issues
3. Use evaluation criteria, publically-available environmental data, and geographical information system methods to assess environmental problems with a large areal distribution
4. Evaluate different approaches to decision support that provides strategies for combating environmental problems and related societal issues with an analysis of advantages and disadvantages, from a natural science and social science perspective.

Module – 1

Introduction: Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research trends. Phases of Decision-Making Process, Decision-Making: The Intelligence Phase, Decision Making: The Design Phase, Decision Making: The Choice Phase, Decision Making: Implementation Phase, How decisions are supported, Personality types, gender, human cognition, and decision styles; The Decision –Makers.

(8 Hours)

Module – 2

An Overview: DSS Configuration, what is DSS? Characteristics and Capabilities of DSS, Components of DSS, The Data Management Subsystem, The Model Management Subsystem, The User Interface Subsystem, The Knowledge-Based Management Subsystem, The User, DSS Hardware, DSS Classification.

(8 Hours)

Module – 3

Introduction to DSS development, The Traditional System Development Life cycle, Alternate Development Methodologies, Prototyping: The DSS Development Methodology, DSS Technology Levels and Tools, DSS Development Platforms, DSS Development Tool Selection, Team-Developed DSS, End User-Developed DSS, Putting the System Together.

(8 Hours)

Module – 4

Group Decision Making, Communication and Collaboration, Communication Support, Collaboration Support: Computer- Supported Cooperative work, Group Support Systems, Group Support Systems Technologies, Group Systems Meeting Room and Online, The GSS Meeting Process, Distance Learning, Creativity, and Idea Generation.

(8 Hours)

Module – 5

Introduction, Organizational learning and Transformation, Knowledge management initiatives, Approaches to Knowledge management, IT in Knowledge management, Knowledge management systems implications, Role of people in Knowledge management, Ensuring success of Knowledge management.

(8 Hours)

Recap/Summary of the Course.

Course outcomes:

The students will be able to:

- CO1 Use evaluation criteria, publically-available environmental data, and geographical information system methods to assess environmental problems with a large areal distribution.
- CO2 Apply basic scientific theories about hypothesis testing, falsifiability, equifinality, and predictive power as applied to environmental decision-making.
- CO3 Evaluate different approaches to decision support that provides strategies for combating environmental problems and related societal issues with an analysis of advantages and disadvantages, from a natural science and social science perspective.

Textbooks:

1. Janaki Raman V.S, SARUKESI, "Decision Support Systems", PHI Learning.

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – V

SOFT COMPUTING (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM545	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 to:

1. Understand the concepts of Fuzzy logic and its applications.
2. Analyze the concepts of artificial neural networks and its applications.
3. Develop and solve single and multi-objective optimization problems using GAs.
4. Apply soft computing techniques to solve problems in varieties of application domains.

Module – 1

Introduction: Implication and Scope of Course and its Importance in Economic growth of Nation, Impact of the course on Societal Problems/ Sustainable Solutions/ National Economy, Career Perspective, Overview of the course in current Innovations and Research trends. What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing

Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptron's, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

(8 Hours)

Module – 2

Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification**.**

(8 Hours)

Module – 3

Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

(8 hours)

Module – 4

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

GA based Backpropagation Networks: GA based Weight Determination, K - factor determination in Columns.

(8 hours)

Module – 5

Fuzzy Classification and Pattern Recognition

Fuzzy Backpropagation Networks: LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks.

Recap/Summary of the Course

(8 hours)

Course Outcomes:

The students will be able to:

CO1	Introduce students to artificial neural networks and fuzzy theory from an engineering perspective
CO2	Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
CO3	Apply the concepts of soft computing to the real time applications
CO4	Implement the skills to gain a basic understanding of neural network theory and fuzzy logic theory.

Textbooks

1 S. Rajasekaran, and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logis and Genetic Algorithms: Synthesis, and Applications," Prentice Hall of India, 2nd Edition; 2007.

2 D. K. Pratihar, Narosa, "Soft Computing, "Prentice Hall of India, 1st Edition; 2008.

Reference Books

1 Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Willey, 3rd edition, 2010.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER –V

Database Management System (3:0:0) 3
Common to CSE/ISE/AIML
(Effective from the academic year 2021-22)

Course Code	21CS55	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 the students to:

1. Provide a strong foundation in database concepts, technology and practice.
2. Practice SQL programming through a variety of database problems.
3. Demonstrate the use of concurrency and transactions in database.
4. Develop Database applications for real world problems.

Module – 1

Preamble: Database Design 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. The current trend, unstructured data - NoSQL is unveiled too.

Introduction to Databases: Introduction, Characteristics of database approach,Advantages of using the DBMS approach, History of database applications. **Overview ofDatabase 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, attributes, roles, and structural constraints, Weak entity types, **ER** diagrams, examples, Specialization and Generalization.

Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10 RBT: L1, L2, L3

(8 Hours)

Module – 2

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.)Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

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

Textbook 1: Ch4.1 to 4.5, 5.1 to 5.3, 6.1 to 6.5, 8.1; Textbook 2: 3.5 RBT: L1, L2, L3

(8 Hours)

Module – 3

SQL: Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study:

The internet Bookshop. **Internet Applications**: The three-Tier application architecture, The presentation layer, The Middle Tier

Textbook 1: Ch7.1 to 7.4; Textbook 2: 6.1 to 6.6, 7.5 to 7.7. RBT: L1, L2, L3

(8 Hours)

Module – 4

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal 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. **Normalization Algorithms:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

Textbook 1: Ch14.1 to 14.7, 15.1 to 15.6 RBT: L1, L2, L3

(8 Hours)

Module – 5

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases**: Two-phase locking techniques forConcurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking. **Introduction to Database Recovery Protocols**: Recovery Concepts, NO-UNDO/REDO recovery based on Deferredupdate, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures

Textbook 1: 20.1 to 20.6, 21.1 to 21.7, 22.1 to 22.4, 22.7. RBT: L1, L2, L (8 Hours)

Course outcomes:

The students will be able to:

CO1: Make use of DBMS Languages to write the Queries.**(K2)**

CO2: Apply the concepts of ER modelling and relational algebra for solving a problem.**(K3)**

CO3: Analyze data requirements and design a database using RDBMS concepts.**(K4)**

CO4: Appraise the need for normalization, and transaction management in fully developed DBMS. **(K5)**

CO5: Develop an Database Application using any database tool **(K6)**

Textbooks:

1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014,McGraw Hill

References:

3. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill,
4. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementationand Management, Cengage Learning 2012.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
Choice Based Credit System (CBCS)
SEMESTER –V

AUTOMATED THEORY (3:0:0) 3

Course Code	**21AM56**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Introduce the fundamental concepts of Automata Theory, Formal Languages and compilerdesign
CLO 2. Principles Demonstrate Application of Automata Theory and Formal Languages in the field ofcompiler design
CLO 3. Develop understanding of computation through Push Down Automata and Turing MachinesCLO 4. Introduce activities carried out in different phases of Phases compiler
CLO 5. Identify the undecidability problems.

Teaching-Learning Process (General Instructions)

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

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes criticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop designthinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different approaches and encouragethe students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Automata Theory: Central Concepts of Automata theory, Deterministic Finite Automata(DFA), Non- Deterministic Finite Automata(NFA) ,Epsilon- NFA, NFA to DFA Conversion, Minimization of DFA

Introduction to Compiler Design: Language Processors, Phases of Compilers

Textbook 1: Chapter1 – 1.5, Chapter2 – 2.2,2.3,2.5 Chapter4 –4.4
Textbook 2: Chapter1 – 1.1 and 1.2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Regular Expressions and Languages: Regular Expressions, Finite Automata and RegularExpressions, Proving Languages Not to Be Regular

Lexical Analysis Phase of compiler Design: Role of Lexical Analyzer, Input Buffering , Specification of Token, Recognition of Token.

Textbook 1: Chapter3 – 3.1, 3.2, Chapter4- 4.1 **Textbook 2: Chapter3- 3.1 to 3.4**	
Teaching-Learning Process	Chalk and board, Active Learning, Demonstration
Module-3	
Context Free Grammars: Definition and designing CFGs, Derivations Using a Grammar, Parse Trees, Ambiguity and Elimination of Ambiguity, Elimination of Left Recursion, Left Factoring. **Syntax Analysis Phase of Compilers: part-1:** Role of Parser , Top-Down Parsing **Textbook 1: Chapter 5 – 5.1.1 to 5.1.6, 5.2 (5.2.1, 5.2.2), 5.4** **Textbook 2: Chapter 4 – 4.1, 4.2, 4.3 (4.3.2 to 4.3.4) ,4.4**	
Teaching-Learning Process	**Chalk and board, Problem based learning, Demonstration**
Module-4	
Push Down Automata: Definition of the Pushdown Automata, The Languages of a PDA. **Syntax Analysis Phase of Compilers: Part-2:** Bottom-up Parsing, Introduction to LR Parsing: SLR, More Powerful LR parsers **Textbook1: Chapter 6 – 6.1, 6.2** **Textbook2: Chapter 4 – 4.5, 4.6, 4.7 (Up to 4.7.4)**	
Teaching-Learning Process	Chalk & board, Problem based learning
Module-5	
Introduction to Turing Machine: Problems that Computers Cannot Solve, The Turing machine, problems, Programming Techniques for Turing Machine, Extensions to the Basic Turing Machine **Undecidability :** A language That Is Not Recursively Enumerable, An Undecidable Problem That Is RE. **Other Phases of Compilers: Syntax Directed Translation**- Syntax-Directed Definitions, Evaluation Orders for SDD's. **Intermediate-Code Generation**- Variants of Syntax Trees, Three-Address Code. **Code Generation**- Issues in the Design of a Code Generator **Textbook1: Chapter 8 – 8.1, 8.2,8.3,8.4 Chapter 9 – 9.1,9.2** **Textbook2: Chapter 5 – 5.1, 5.2, Chapter 6- 6.1,6.2 Chapter 8- 8.1**	
Teaching-Learning Process	**Chalk and board, MOOC**

Course Outcomes

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

CO 1. Acquire fundamental understanding of the core concepts in automata theory and Theory of Computation

CO 2. Design and develop lexical analyzers, parsers and code generators

CO 3. Design Grammars and Automata (recognizers) for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free) and their relative powers.

CO 4. Acquire fundamental understanding of the structure of a Compiler and Apply concepts automata theory and Theory of Computation to design Compilers

CO 5. Design computations models for problems in Automata theory and adaptation of such model in the field of compilers

Suggested Learning Resources:

Textbooks

1. John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman,“ Introduction to Automata Theory, Languages and Computation”, Third Edition, Pearson.
2. Alfred V.Aho, Monica S.Lam,Ravi Sethi, Jeffrey D. Ullman, “ Compilers Principles, Techniques and Tools”, Second Edition,Perason.

Reference:

1. Elain Rich, “Automata,Computability and complexity”, 1st Edition, Pearson Education,2018.
2. K.L.P Mishra, N Chandrashekaran , 3rd Edition , ‘Theory of Computer Science”,PHI,2012.
3. Peter Linz, “An introduction to Formal Languages and Automata “, 3rd Edition, Narosa Publishers,1998.
4. K Muneeswaran, ”Compiler Design”, Oxford University Press 2013.

Weblinks and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/106/106106049/#
2. https://nptel.ac.in/courses/106/104/106104123/
3. https://www.jflap.org/

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

Group Activities, quizzes, Puzzles and presentations

B.E ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER - V

Machine Learning (3:0:0) 3

(Effective from the academic year 2021-22)

Course Code	21AM57	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 Learning 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 Bayesian techniques for problems appear in machine learning
- Perform statistical analysis of machine learning techniques.

Module – 1

Introduction: Machine learning Landscape: what is ML?, Why, Types of ML, main challenges of ML (T2:Chapter1) Concept learning and Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Find S-Version Spaces and Candidate Elimination Algorithm –Remarks on VSInductive bias – T2: Chapter 1 T1:Chapter 1 and 2) (8 Hours)

Module – 2

End to end Machine learning Project : Working with real data, Look at the big picture, Get the data, Discover and visualize the data, Prepare the data, select and train the model, Fine tune your model Classification : MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification (T2: Chapter 2 and 3) (8 Hours)

Module – 3

Training Models: Linear regression, gradient descent, polynomial regression, learning curves, regularized linear models, logistic regression Support Vector Machine: linear, Nonlinear , SVM regression and under the hood (T2: Chapter 4 and 5)

RBT: L1, L2 (8 Hours)

Module – 4

Decision Trees Training and Visualizing DT, making prediction, estimating class, the CART training, computational complexity, GINI impurity, Entropy, regularization Hyper parameters, Regression, instability Ensemble learning and Random Forest: Voting classifiers, Bagging and pasting, Random patches, Random forests, Boosting, stacking (T2: Chapter 6 and 7)

RBT: L1, L2 (8 Hours)

Module – 5

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– exampleBayesian Belief Network – EM Algorithm Text book (T1: Chapter 6)

RBT: L1, L2 (8 Hours)

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
2. AurelienGeron, Hands-on Machine Learning with Scikit-Learn &TensorFlow , O'Reilly, Shroff Publishers and Distributors pvt.Ltd 2019

Reference Books:

1. EthemAlpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2001
3. Machine Learning using Python ,Manaranjan Pradhan, U Dinesh kumar, Wiley, 2019
4. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson,2020

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – V

Database Management System Laboratory (0:0:2) 1

(Effective from the academic year 2022 -2023)

Course Code	21CSL58A	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	24	Exam Hours	3 Hours

Course Objectives:

This course will enable the students to

1. Foundation of knowledge in database concepts, technology and practice to groom the students into well informed database application developers.
2. Strong practice in SQL programming through a variety of database problems.
3. Develop Database applications using front end tools and Database as backend.

Laboratory Exercises:

PART A

Exercise 1:

Consider the following schema for a Library Database:
BOOK (Book_id, Title, Publisher_Name, Pub_Year)
BOOK_AUTHORS (Book_id, Author_Name)
PUBLISHER (Name, Address, Phone)
BOOK_COPIES (Book_id, Programme_id, No_of_Copies)
BOOK_LENDING (Book_id, Programme_id, Card_No, Date_Out, Due_Date)
LIBRARY_PROGRAMME (Programme_id, Programme_Name, Address)

Write SQL queries to

1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.
3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.
5. Create a view of all books and its number of copies that are currently available in the Library.

Exercise 2:

Consider the following schema for Order Database:
SALESMAN(Salesman_id, Name, City, Commission)
CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)
ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)

Write SQL queries to

1. Count the customers with grades above Bangalore's average.
2. Find the name and numbers of all salesmen who had more than one customer.

3. List the entire salesman and indicate those who have and do not have customers in their cities (Use UNION operation.)
4. Create a view that finds the salesman who has the customer with the highest order of a day.
5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.

Exercise 3:

Consider the schema for Movie Database:
ACTOR(Act_id, Act_Name, Act_Gender) DIRECTOR(Dir_id, Dir_Name, Dir_Phone) MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)MOVIE_CAST(Act_id, Mov_id, Role)
RATING(Mov_id, Rev_Stars)

Write SQL queries to
1. List the titles of all movies directed by 'Hitchcock'.
2. Find the movie names where one or more actors acted in two or more movies.
3. List all actors who acted in a movie before 2000 and in a movie after 2015 (use JOIN operation).
4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
5. Update rating of all movies directed by 'Steven Spielberg' to 5.

Exercise 4:

Consider the schema for College Database:
STUDENT(USN, SName, Address, Phone, Gender)
SEMSEC(SSID, Sem, Sec)
CLASS(USN, SSID)
COURSE(Subcode, Title, Sem, Credits)
IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

Write SQL queries to
1. List all the student details studying in fourth semester 'C' section.
2. Compute the total number of male and female students in each semester and in each section.
3. Create a view of Test1 marks of student USN '1BI15CS101' in all Courses.
4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.
5. Categorize students based on the following criterion:
If FinalIA = 17 to 20 then CAT = 'Outstanding'
If FinalIA = 12 to 16 then CAT = 'Average'If
FinalIA< 12 then CAT = 'Weak'
Give these details only for 8th semester A, B, and C section students.

Exercise 5:

Consider the schema for Company Database:
EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo)
DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate)
DLOCATION(DNo,DLoc)
PROJECT(PNo, PName, PLocation, DNo)
WORKS_ON(SSN, PNo, Hours)

Write SQL queries to

1. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.
3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department.
4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).
5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.

PART B: Mini Project

Note:
Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web-based application (Mobile apps on Android/IOS are not permitted.)

For any problem selected make sure that the application should have five or more tables.
Indicative areas include: Health care.

Course Outcomes:

The students will be able to

CO1: Apply the Conceptual Design Model and Database Hierarchical Structure to construct the real world requirement.
CO2: Implement different working concepts of DBMS using SQL Queries.
CO3: Develop a Database application using any Modern tool and generate the reports for the same.

- Conduction of Practical Examination:
  1. All lab Exercises from part A are to be included for practical examination.
  2. Mini project has to be evaluated for 30 Marks.
  3. Report should be prepared in a standard format prescribed for project work.
  4. Students are allowed to pick one experiment from the lot.
  5. Strictly follow the instructions as printed on the cover page of answer script.
  6. Marks distribution: a) Part A: Procedure + Conduction + Viva: 5 + 10 +5 =20 Marks
     b) Part B: Demonstration + Report + Viva voce = 15+10+05 = 30 Marks

Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

Textbooks:

1. Database systems Models, Languages, Design and Application Programming, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – V

Operating Systems Laboratory (0:0:2) 1

(Effective from the academic year 2021 -2022)

Course Code	21CSL58B	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	3 Hours

Course Objectives:

This course will enable students to

1. Analyse the design aspects of operating system concepts through simulation.
2. Simulate and demonstrate the performance of algorithm's used to perform services in operating system.

Laboratory Exercises:

Part A: Implement using Java/Python programming Language

1. Write a program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority
2. Write a program to simulate producer-consumer problem using semaphores.
3. Write a program to simulate the concept of Dining-Philosophers problem.
4. Write a C program to simulate the MULTI PROGRAMMING WITH VARIABLE NUMBER OF TASKS (MVT) and MULTI PROGRAMMING WITH FIXED NUMBER OF TASKS (MFT) memory management techniques.
5. Write a program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit
6. Write a program to simulate deadlock avoidance using banker's algorithm.
7. Write a program to simulate deadlock detection using safety algorithm.
8. Write a program to simulate page replacement algorithms a) FIFO b) LRU c) LFU
9. Write a program to simulate paging technique of memory management.
10. Write a program to simulate the following DISK SCHEDULING ALGORITHMS a) FCFS b) SCAN c) C-SCAN

Course Outcomes:

The students will be able to

CO1: Apply the scheduling algorithms for the given problem.

CO2: Analyse the performance of processes with and without process synchronisation techniques.

CO3: Design resource allocation algorithms to detect and avoid deadlock.

CO4: Use different memory management techniques to allocate memory and analyse its performance

B.E. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Choice Based Credit System (CBCS)

SEMESTER – V

Data Communication and Networks Laboratory (0:0:2) 1

(Effective from the academic year 2022 -2023)

Course Code	21CSL58C	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	3 Hours

Course Objectives:

This course will enable students to

1. Implement the techniques and protocols of datalink, network, transport and Application layers.
2. Simulate and demonstrate the performance of wired and wireless network using NS2/NS3.

Laboratory Exercises:

Part A: Implement using Java/Python programming Language

1. Implementation of Cyclic Redundancy Check for error correction and detection.
2. Implementation Of Address Resolution Protocol
3. Write a program for congestion control using leaky bucket algorithm.
4. Implement a Client Server program using TCP/IP.
5. Write a program to find the shortest path between vertices using bellman-ford algorithm
6. Write a program to implement FTP protocol.

Part B: Simulation using NS2/NS3

7. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
8. Simulate a four node point-to-point network with the links connected as follows: n0 – n2, n1 – n2and n2 – n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents, changing the parameter and determine the number of packets sent by TCP / UDP.
9. Simulate an Ethernet LAN using n nodes (6-10), change error rate and data rate and compare throughput.
10. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.
11. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.
12. Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.

Part C: Group Assignments

13. Implement Bit stuffing and Character stuffing in data link layer framing.

14. Implementation of Hamming code algorithm
15. Implement a Datagram socket for client server application.
16. Write program to develop a DNS client server to resolve the given hostname.

17. Implementation of Go Back-N and selective repeat protocols.
18. Write a program to find the shortest path between vertices using dijkstra's algorithm.

Course Outcomes:

The students will be able to

CO1: Using NS2 design network topology as per the given problem and investigate the problem by analyzing the performance for the set of network parameters for different no of trails , tabulate the results, draw graphs to represent the observed values and arrive at valid conclusions.

CO2: Apply different techniques to ensure the reliable/ secured communication in wired / wireless communication , implement using java Programming language , verify the results and give valid conclusions

CO3: Write a report on each problem solved in the laboratory and systematically communicate withinthe stipulated time period as per the defined procedure.