



GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING FOR WOMEN
(Autonomous)

(Approved by AICTE, New Delhi and Permanently Affiliated to Andhra University, Visakhapatnam)
Madhurawada :: Visakhapatnam – 530 048

COURSE STRUCTURE

(Applicable for the Academic Year 2024-25 onwards)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
[ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING]

B. Tech. (Computer Science and Engineering – AI&ML)

SCHEME AND SYLLABI

(With effect from 2024-25 Admitted Batch)



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I Year - I Semester								
Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24BM11RC01	BS	Calculus and Differential Equations	3	0	30	70	100	3
24BP11RC01	BS	Engineering Physics	3	0	30	70	100	3
24EC11RC04	ES	Elements of Electronics Engineering	3	0	30	70	100	3
24CT11RC01	ES	Fundamentals of Computers	3	0	30	70	100	3
24CT11RC02	ES	Problem Solving using C	3	0	30	70	100	3
24BP11RC02	BS	Engineering Physics Lab	0	3	50	50	100	1.5
24CT11RC03	ES	Computer Engineering Workshop	0	3	50	50	100	1.5
24CT11RC04	ES	Problem Solving using C Lab	0	3	50	50	100	1.5
Total Credits								19.5
I Year - II Semester								
Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24BM11RC02	BS	Linear Algebra and Vector Calculus	3	0	30	70	100	3
24BC11RC01	BS	Green Chemistry	3	0	30	70	100	3
24HE11RC01	HSS	English	3	0	30	70	100	3
24EC11RC05	ES	Digital Logic Design	3	0	30	70	100	3
24CT11RC06	ES	Python Programming	3	0	30	70	100	3
24HE11RC02	BS	Communication Skills Lab	0	3	50	50	100	1.5
24CT11RC07	ES	Python Programming Lab	0	3	50	50	100	1.5
24CT11RC08	ES	Web Technologies Fundamentals Lab	0	3	50	50	100	1.5
Total Credits								19.5



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COURSE STRUCTURE

II Year - I Semester								
Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24BM11RC05	ES	Discrete Mathematical Structures	3	0	30	70	100	3
24HM11RC01	HSS	Managerial Economics	3	0	30	70	100	3
24CT11RC09	PC	Data Structures	3	0	30	70	100	3
24CT11RC10	PC	Object Oriented Programming Through Java	3	0	30	70	100	3
24CT11RC12	PC	Database Management Systems	3	0	30	70	100	3
24CT11RC14	PC	Data Structures Lab	0	3	50	50	100	1.5
24CT11RC15	PC	Object Oriented Programming Through Java Lab	0	3	50	50	100	1.5
24CT11RC16	PC	Database Management Systems Lab	0	3	50	50	100	1.5
24CT11SC01	SC	Skill Development Course-I: (Continuous Integration and Continuous Delivery using DevOps)	1	2	50	50	100	2
24HM11MC01	MC	Professional Ethics and Human Values	2	0	-	100	100	0
24AI11SW01	MC	Social Activity/Life Skills	0	0	-	-	-	0
Total Credits								21.5
II Year - II Semester								
Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24BM11RC06	BS	Probability & Statistics	3	0	30	70	100	3
24CT11RC11	PC	Computer Organization	3	0	30	70	100	3
24CT11RC18	PC	Design and Analysis of Algorithms	3	0	30	70	100	3
24CT11RC19	PC	Data Warehousing & Data Mining	3	0	30	70	100	3
24IA11RC01	PC	Artificial Intelligence	3	0	30	70	100	3
24CT11RC21	PC	Algorithms Lab Through C++	0	3	50	50	100	1.5
24AI11RC01	PC	Data Mining Lab using Python	0	3	50	50	100	1.5
24CT11SC02	SC	Skill Development Course-II: MERN Stack Development	1	2	50	50	100	2
24BC11MC01	MC	Environmental Science	2	0	-	100	100	0
Total Credits								20



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III Year - I Semester								
Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24CT11RC20	PC	Formal Languages and Automata Theory	3	P	30	70	100	3
24CT11RC13	PC	Operating Systems	3	0	30	70	100	3
24CT11RC23	PC	Machine Learning	3	0	30	70	100	3
	PE	Professional Elective-I	3	0	30	70	100	3
	OE	Open Elective-I	3	0	30	70	100	3
24CT11RC17	PC	Operating Systems Lab	0	3	50	50	100	1.5
24CT11RC25	PC	Machine Learning Lab	0	3	50	50	100	1.5
24HE11SC01	SC	Skill Development Course III: Soft Skills	1	2	50	50	100	2
24AI11IN01	INT	Internship-I			-	100	100	2
24AI11MC01	MC	Design Thinking, Innovation and Entrepreneurship	2	0	-	100	100	0
Total Credits								22
III Year - II Semester								
Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24CT11RC22	PC	Computer Networks	3	0	30	70	100	3
24AI11RC02	PC	Big Data Analytics	3	0	30	70	100	3
24AI11RC03	PC	Deep Learning Techniques	3	0	30	70	100	3
	PE	Professional Elective-II	3	0	30	70	100	3
	OE	Open Elective-II	3	0	30	70	100	3
24CT11RC24	PC	Computer Networks Lab	0	3	50	50	100	1.5
24AI11RC04	PC	Big Data Analytics Lab	0	3	50	50	100	1.5
24AI11RC05	PC	Deep Learning Techniques Lab	0	3	50	50	100	1.5
24AI11SC01	SC	Skill Development Course IV: MLOps with Cloud Platform	1	2	50	50	100	2
24EC11SC02		Skill Course IV: IoT Applications						
24HM11MC02	MC	IPR & Patents	2	0	-	100	100	0
Total Credits								21.5



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IV Year - I Semester

Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
	HSS	HSS Elective	3	0	30	70	100	3
	PE	Professional Elective-III	3	0	30	70	100	3
	PE	Professional Elective-IV	3	0	30	70	100	3
	PE	Professional Elective-V	3	0	30	70	100	3
	OE	Open Elective-III	3	0	30	70	100	3
	OE	Open Elective-IV	3	0	30	50	100	1.5
24AI11SC02	SC	Skill Development Course-V: Generative AI and Prompt Engineering	1	2	50	50	100	2
24AI11IN02	INT	Internship-II			-	100	100	2
Total Credits								22

IV Year - II Semester

Course Code	Category	Course Title	Hours per Week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
24AI11PR01	PW	Project Work			100	100	200	14
Total Credits								14



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COURSE STRUCTURE

Professional Electives of CSE AI&ML	
24CT11PE01	API and Micro Services
24CT11PE02	Ethical Hacking
24CT11PE03	Generative AI Models
24CT11PE04	Mobile Application Development
24CT11PE05	Soft Computing
24CA11PE01	Computer Vision
24CA11PE02	Cyber Security and Digital Forensics
24CA11PE03	Fog and Edge Computing
24CA11PE04	NoSQL Databases
24IA11PE01	Data Science
24IA11PE02	Principles of Compiler Design
24IA11PE03	Natural Language Processing
24AI11PE01	AI Chatbots
24AI11PE02	Modern Cryptography and Network Security
24AI11PE03	Reinforcement Learning
24AI11PE04	Software Engineering

Open Electives (OE) FOR CSE AI&ML	
Course Code	Course Title
24EE11EL01	Basics of Electrical Wiring
24EE11EL02	Fundamentals of Power Electronics
24EE11EL03	Fundamentals of Utilization of Electrical Energy
24EE11EL04	Linear Control Systems
24EE11EL05	Sustainable Energy Sources
24EC11EL01	Basic VLSI Design
24EC11EL02	Basics of Signal Processing
24EC11EL03	Data Communication
24EC11EL04	Microprocessor & Controllers with Interfacing
24CS11EL01	Human Machine Interaction
24CS11EL03	Software Project Management
24IT11EL01	Introduction to Blockchain Technology
24IT11EL02	Introduction to Cloud Computing
24IT11EL03	Information Retrieval and Search Engines



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HSS ELECTIVES	
Course Code	Course Title
24HM11EL01	Accounting and Finance for Engineers
24HM11EL02	Human Relations at Work
24HM11EL03	Industrial Management and Startup Eco System
24BM11EL01	Operation Research
24HM11EL04	Organisational Behaviour

B.Tech Minor in CSE (AI&ML)	
24AI11MN01	Artificial Intelligence and Machine Learning
24AI11MN02	Big Data and Hadoop
24AI11MN03	Fundamentals of Business Analytics
24AI11MN04	Introduction to Deep Learning
24AI11MN05	Reinforcement Learning Techniques
24AI11MN06	Big Data and Hadoop Lab
24AI11MN07	Machine Learning Techniques Lab

B. Tech. Honours in CSE (AI&ML)	
24CT11HN01	Quantum Computing
24CT11HN02	Social Media Analytics
24CA11HN01	High Performance Computing
24AI11HN01	Business Analytics
24CA11HN02	Data Visualization
24AI11HN02	Evolutionary Computing

- ❖ MOOCs course must be of minimum 12 weeks duration in any of the courses approved by the department from time to time and are advanced for both Minors and Honors

CALCULUS AND DIFFERENTIAL EQUATIONS

I Year B. Tech. I Semester

[Common to EEE, ECE, CSE, IT, CSE (AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24BM11RC01

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Examine the functional dependency and utilize Taylor's theorem to expand the function of two variables. (L3)
- CO2:** Determine extrema of multivariable functions. (L5)
- CO3:** Utilize double and triple integrals to evaluate areas of plane curves and the volumes of solids. (L5)
- CO4:** Solve the first order differential equations and higher order differential equations with constant coefficients, apply the techniques to solve problems related to various engineering fields. (L3)
- CO5:** Find the Laplace Transforms of various functions and apply it to solve ordinary differential Equations with initial conditions. (L3)

UNIT-I:

8 Lectures

Partial Differentiation: Functions of two or more variables: Introduction - Partial derivatives - Total derivative - Change of variables - Jacobians – Functional dependence - Taylor's theorem for function of two variables. [Sections: 5.1, 5.2, 5.5, 5.6, 5.7, 5.9 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Examine the functional dependencies using the Jacobian. (L3)
2. Make use of Taylor's theorem to write series expansion of function of two variables. (L3)

UNIT-II:

7 Lectures

Applications of Partial Differentiation: Maxima and minima of function of two and three variables - Constrained maximum/minimum problems using Lagrange's method of multipliers. [Sections: 5.11, 5.12 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Determine the critical points, maxima and minima of functions several variables. (L5)

UNIT-III:

11 Lectures

Integral Calculus: Introduction - Double integrals - Change of order of integration - Double integrals in polar Coordinates - Triple integrals - Change of variables.

Applications: Area enclosed by plane curves - Volumes of solids. [Sections: 7.1 – 7.7 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Evaluate double integrals and triple integrals in Cartesian and polar coordinates also over the given region. (L5)
2. Evaluate the double integrals by change of order of integration. (L5)
3. Evaluate double and triple integrals by change of variables. (L5)
4. Determine the areas and volumes using multiple integrals. (L5)

UNIT-IV:

11 Lectures

Differential Equations and its Applications: Exact differential equations - Equations reducible to exact equations - Solutions of higher order linear ordinary differential equations with constant coefficients - Method of variation of parameters.

Applications: Orthogonal Trajectories - Newton's law of cooling - Law of Natural growth and decay. [Sections: 11.11, 11.12, 12.3, 12.6, 12.8, 13.1 – 13.8 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Solve the first-order differential equations and higher order Linear differential equations with constant coefficients. (L3)
2. Apply the techniques to solve problems related to various engineering fields. (L3)

UNIT-V:

11 Lectures

Laplace Transforms: Introduction - Existence conditions - Transforms of elementary functions - Properties of Laplace transforms - Transforms of derivatives - Transforms of integrals - Multiplication by t - Division by t - Evaluation of integrals by Laplace transforms - Laplace transforms of Unit step function, Unit impulse function and Laplace transforms of periodic functions - Inverse Laplace transforms - Convolution theorem - Second shifting theorem.

Applications: Laplace Transforms to ordinary differential Equations. [Sections: 21.1 – 21.5, 21.7 – 21.15, 21.17, 21.18 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Find the Laplace transform of the function. (L1)
2. Find the Inverse Laplace transform of a function. (L1)
3. Make use of convolution theorem to find the Inverse Laplace transform of a function. (L3)
4. Apply Laplace transform to solve ordinary differential equations. (L3)

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers, 2024.

Reference Books:

1. R K Jain and SRK Iyengar, Advanced Engineering Mathematics, Narosa Publishers, 5th Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2011.
3. Peter V. O'Neil, Advanced Engineering Mathematics, 7th edition, Cengage Learning, 2011.
4. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson, 2017.

Web References:

1. <https://nptel.ac.in/courses/111104125>
2. <https://nptel.ac.in/courses/111105160>

ENGINEERING PHYSICS

I Year B. Tech. I Semester

[Common to ECE, EEE, CSE (AI&ML)]

Course Code: 24BP11RC01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1:** Apply the principles of interference, diffraction, and polarization in wave optics, and utilize optical instruments for practical applications. (L3)
- CO2:** Familiarize the basic concepts of Thermodynamics relevant to engineering applications. (L2)
- CO3:** Outline the knowledge of basic principles of Electromagnetism and EM Waves. (L2)
- CO4:** Describe the basic principles of lasers, optical fibres and their use in technological applications. (L2)
- CO5:** Understand the basic principles of Quantum mechanics, Quantum computing. (L2)

UNIT-I

10 Lectures

Interference: Principle of superposition, Young's Experiment (qualitative treatment), Coherence, Interference in thin films (reflected light), Newton's Rings, Michelson's Interferometer and its applications (thickness of thin sheet, determination of wavelength).

Diffraction: Introduction, Differences between Interference and Diffraction, Differences between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and Quantitative treatment)

Polarization: Introduction - types of Polarization. Polarization by reflection, Brewster's law, refraction and double refraction in uniaxial crystals, Nicol Prism, Quarter wave plate and Half wave plate, Applications of Polarization.

Text Book 1: 5.16,5.17,5.18, 5.20, 6.1, 6.2, 6.8.(1-3), 6.11, 6.13, 6.14.1, 6.14.3, 7.1, 7.2, 7.3, 7.4, 7.5, 8.1, 8.2,8.5, 8.6,8.11,8.12, 8.16,8.20.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the principles of interference patterns and apply Michelson's Interferometer to measure physical quantities such as thickness and wavelength. (L2)
2. Distinguish between interference and diffraction and perform qualitative and quantitative analysis of Fraunhofer diffraction at a single slit. (L2)
3. Apply polarization concepts through various optical devices to explore and solve problems related to polarized light. (L3)

UNIT-II

7 Lectures

Thermodynamics: Heat and Work, First law of thermodynamics and its applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of Entropy, Entropy and disorder, Third law of thermodynamics (statement only). [TextBook-1: 16.3,16.5.1,16.6,16.8,16.11,16.12,16.14,16.16,16.17, 16.17.1, 16.18]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply the first and second laws of thermodynamics to analyse energy transformations and process efficiencies. (L3)
2. Understand the Carnot cycle and its efficiency and calculate entropy changes to explain thermodynamic processes. (L2)
3. Differentiate between reversible and irreversible processes and relate entropy to disorder. (L2)
4. State the third law of thermodynamics and understand its implications for materials at absolute zero. (L2)

UNIT-III

11 Lectures

Electromagnetism: Concept of electric flux, Gauss' law, applications of Gauss' law (wire, sheet, sphere), Magnetic Field, Gauss' law in magnetostatics, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation, qualitative treatment), Electromagnetic wave equations, Introduction to EM waves, The Biot-Savart's law, magnetic field near a long wire, magnetic field for a circular Current loop, Ampere's law. [TextBook-1: 2.12,2.14,2.18, 3.5, 3.8, 3.9,3.12, 3.13,3.14, 3.10, 3.12, 3.3,3.4]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply Gauss's law and Faraday's law of induction to solve problems involving electric and magnetic fields. (L3)
2. Use Maxwell's equations to understand electromagnetic wave phenomena. (L2)
3. Analyse magnetic fields using Biot-Savart's law, Ampere's law, and apply the magnetostatic field distributions. (L3)

UNIT-IV

10 Lectures

Lasers: Characteristics of laser beam, Spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser (homojunction), Applications of lasers.

Optical fibres: principle of propagation of light in optical fibres, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagation, Classification of fibres based on refractive index profile and modes, Losses in optical fibres- scattering and bending losses, Fibre optics in communication- Block diagram, Applications of optical fibres. [TextBook-1: 24.12, 24.2, 24.5,24.6, 24.7, 24.11.1, 24.11.3, 24.11.5.1, 24.13, 10.2, 10.3, 10.4, 10.5, 10.6, 10.10, 10.11, 10.19,10.20 (only for list of applications)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the principles of laser operation, including spontaneous and stimulated emission, and analyse various types of lasers such as Ruby, He-Ne, and Semiconductor lasers. (L2)
2. Describe the fundamentals of optical fibre technology, including light propagation, acceptance angle, numerical aperture, and classification of fibres. (L2)
3. Apply these concepts to fibre optics communication systems and explore their practical applications. (L2)

UNIT-V

10 Lectures

Quantum Physics: de Broglie concept of matter waves, Heisenberg's uncertainty principle, Schrödinger time independent wave equation, Physical significance of wave function, particle in a one-dimensional box.

Quantum Computing Quantum bits, Introduction to Pauli spin matrices, Bloch sphere, Entanglement, Qubit Vs classical bit, Single Qubit gates, Quantum Teleportation – Basic Idea. [Textbook-1 20.5, 20.11, 20.17, 20.18, 20.22; Textbook -3 Sec 1.8, 1.9, 1.10.1]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the concepts quantum mechanics such as the de Broglie wavelength and Heisenberg's uncertainty principle and use the Schrödinger equation (L2).
2. Describe the fundamentals of quantum computing (L2)

Textbooks:

1. M. N. Avadhanulu, P. G. Kshirsagar, and T. V. S. Arun Murthy, A textbook of Engineering Physics, 11th edition, S. Chand and Company Ltd., 2019.
2. H. K. Malik and A. K. Singh, Engineering Physics, 2nd Edition, McGraw Hill Education Pvt Ltd, 2018.
3. P.K. Palanisamy, Engineering Physics, SCITECH Publications, 2011.

Reference Books:

1. Modern Engineering Physics by A.S. Vasudeva S. Chand and Company Ltd., 2010
2. University Physics by Young and Freedman Pearson Education, 2010.
3. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information Cambridge University Press, 10 th Ed., 2010

Web References:

1. <https://nptel.ac.in/courses/115105537> (Wave optics)
2. <https://nptel.ac.in/courses/115106122> (Electromagnetism)
3. <https://nptel.ac.in/courses/112102255> (Thermodynamics)
4. <https://nptel.ac.in/courses/115107095> (Fiber Optics)
5. <https://nptel.ac.in/courses/104104085> (Lasers)
6. <https://nptel.ac.in/courses/104104082> (Quantum Computing)
7. <https://www.intechopen.com/online-first/73811> (Quantum Computing)
8. <https://lewisla.gitbook.io/learning-quantum/quantum-circuits/single-qubit-gates>.(Quantum Computing)
9. <https://profmcrz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum-information-nielsen-chuang.pdf> (Quantum Computing)

ELEMENTS OF ELECTRONICS ENGINEERING

I Year B. Tech. I Semester

[CSE(AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24EC11RC04

Course Outcomes: At the end of the Course, the student shall be able to

- CO1: Outline the concepts of semiconductor devices. (L2)
- CO2: Understand the characteristics of different semiconductor diodes and their applications. (L2)
- CO3: Apply various biasing techniques for design of BJT circuits. (L3)
- CO4: Apply hybrid models to understand the operation of BJT amplifier. (L3)
- CO5: Understand the characteristics of FET. (L2)

UNIT-I

8 Lectures

Introduction to Electronics and Semiconductors: Energy band theory, Conduction in Insulators, Semiconductors and metals, Classification of semiconductors, Properties of intrinsic and extrinsic semiconductor, Carrier concentration in an intrinsic semiconductor, Drift, and diffusion currents. [Textbook 1: Chapter -1 Section 1.6, 1.7, 1.8; Chapter -2 Section 2.2, 2.3, 2.9; Chapter -19 Section 19.5]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain the energy band theory of solids (insulators, semiconductors, and metals) based on their band structures (L2)
2. Describe the transport phenomena in semiconductors (L2)

UNIT-II

11 Lectures

Semi-Conductor Diode: Theory of PN junction, Open circuited PN junction, V-I characteristics of a PN diode, Diode current equation, basics on junction capacitance, Break down in PN diode, Applications of PN diodes. Zener diode, Zener regulator, Tunnel diode, Schottky diode.

Rectifying circuits: Half wave and full wave rectifiers, Bridge rectifiers, Efficiency, Ripple and regulation of each rectifier, Capacitor filters. [Textbook 2: Chapter 4 Section 4.1 – 4.5, 4.8; Chapter 5 Section 5.3, 5.4, 5.7; Chapter 8 Section 8.2 – 8.4, 8.6]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain the formation of PN junction and represent the band structure, interpret the Volt-ampere characteristics (L2)

2. Describe the operation of rectifiers, and evaluate their performance metrics like ripple factor and regulation characteristics (L2)
3. Explain the working principles of special diodes such as Zener diode, tunnel diodes and Schottky barrier diodes. (L2)

UNIT-III

11 Lectures

Bi-Polar Junction Transistor: Introduction, construction, Operation of PNP and NPN Transistors, transistor configurations, Input and Output Characteristics of CE configuration, Comparison of CE, CB, and CC Configurations.

Transistor Biasing and thermal stabilization: Junction Biasing for Saturation, Cutoff and Active Region, Biasing circuits analysis, fixed bias, collector to base bias, emitter bias, voltage divider bias, thermal runaway. [Textbook 2: Chapter 6 Section 6.1 - 6.3, 6.6-6.9, 6.11, Chapter 10 Section 10.4 - 10.8]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Describe the characteristics of transistor in CE, CB, and CC configurations. (L2)
2. Understand the principals of transistor biasing and compensation methods (L2)
3. Identify the characteristics of different transistor biasing techniques (L3)

UNIT-IV

8 Lectures

Transistor Amplifiers: CE, CB, CC amplifier configurations –Multistage amplifier – A Two Stage RC coupled amplifier – frequency response curve and bandwidth. [Textbook 2: Chapter -11 Section 11.9, 11.11, 11.12, 11.16, 11.17, 11.20]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Represent transistor with its equivalent h parameter model (L2)
2. Apply hybrid models to obtain the performance of transistor amplifiers (L3)

UNIT-V

10 Lectures

Field Effect Transistors: Construction of JFET and its drain, transfer characteristics, pinch off Voltage, Drain Saturation Current, parameters of JFET, Construction of MOSFET – Enhancement and Depletion Modes, drain and transfer characteristics. [Textbook 2: Chapter -7 Section 7.1 – 7.5, 7.11, 7.12]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Comprehend the characteristics of BJT and FET(L2)
2. Explain the construction of JFET and MoSFETs (L2)
3. Describe the characteristics of JFET and MoSFET (L2)

Textbooks:

1. Jacob Millman, Christos C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, McGRAW-HILL. 1972
2. Sanjeev Gupta, Electronic Devices and Circuits, 2nd Edition, Dhanpat Rai Publications, 2005.

Reference Books:

1. Thomas L. Floyd, Electronic Devices, 9th Edition, Prentice Hall, 2012.
2. B. V. Rao and K. Raja Rajeswari, Electronic Devices and Circuits 2nd Edition, Pearson Education., 2010.
3. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008
4. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 7th Edition, Prentice Hall, 1998

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_ee80/preview
2. <https://be-iitkgp.vlabs.ac.in/>

FUNDAMENTALS OF COMPUTERS

I Year B. Tech. I semester
[Common to CSE, CSE (AI&ML), IT]

L	T	P	C
3	0	0	3

Course Code: 24CT11RC01

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Identify different I/O devices and their usage. (L3)
- CO2: Compare different computer memory with their efficiency. (L3)
- CO3: Relate different computer software's and programming languages for solving problems. (L2)
- CO4: Summarize the use of operating system, database system, and computer network in the field of computing in engineering. (L2)
- CO5: Infer the methods and applications of artificial intelligence (AI), machine learning (ML) and data science. (L3)

UNIT-I

10 Lectures

Introduction to Computers: Computers, Stored Program Concept, Classification of Computers, Evolution and Development of Computers, Application Areas of Computers, Features/Characteristics of Computers, Basic Organization of a Computer.

Input and Output Devices: Input Devices, Output Devices, Soft Copy Devices, Hard Copy Devices, Voice Response Systems, Biometric Devices [TextBook-1: Chapter 1 (S-1.1 – S-1.7)]

https://oer-studentresources.gesci.org/wp-content/courses/Computer/CS-F1-Introduction-to-computers/evolution_and_development_of_computers.html (Development of Computers) [TextBook-1: Chapter 2 (S-2.1 – S-2.6)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Outline characteristics and classification of computers (L2)
2. Demonstrate different configurations of software and hardware used in computer (L2)
3. Model the computer by organizing different computer peripherals such as I/O, CPU, etc. (L3)

UNIT-II

10 Lectures

Computer Memory: Introduction, Memory Organization, Memory Hierarchy, Sequential and Random Access, Processor Registers, Cache Memory, Primary Memory, Secondary Storage Devices, Magnetic Tapes, Floppy Disks, Hard Disks, External Hard Disks, Optical Disks, USB Flash Drives, Memory Cards, Mass Storage Devices. [TextBook-1: Chapter 3 (S-3.1 – S-3.16)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Summarize computer memory hierarchy. (L2)
2. Classify different memory with respect to speed and cost. (L2)
3. Illustrate different external storage devices and its applications. (L2)

UNIT-III

10 Lectures

Computer Software: Introduction to Computer Software, Classification of Computer Software, System Software, Application software, Graphics Software, Multimedia Software, Database Management Software, Firmware, Middleware, Procuring Computer Software.

Problem Solving using Computers: Introduction, Program Development Life Cycle, Program Design Tools, Programming Languages, Generations of Programming Languages, Categorization of High-level Languages, Some Popular High-level Languages, Apps. [TextBook-1: Chapter 6 (S-6.1 – S-6.7), TextBook-1: Chapter 7 (S-7.1 – S-7.7)]

<https://www.builder.ai/glossary/app#:~:text=An%20app%20is%20a%20type,enhance%20productivity%20and%20streamline%20communication> (Apps)

Learning Outcomes:

At the end of the unit, the student will be able to

1. Compare different computer software's (L2)
2. Summarize different programming languages for solving problems. (L2)
3. Contrast Structured Programming Language, Logic-oriented Programming Language, and Object-oriented Programming. (L2)

UNIT-IV

10 Lectures

Fundamental Operating Systems: Introduction, History of Operating Systems, Functions of Operating Systems, Types of Operating Systems, Providing User Interface, Popular Operating Systems

Database Systems: File-Oriented Approach, Database-oriented Approach, Database Views, Three-schema Architecture, Database Models, Components of Database Management, Retrieving Data Through Queries.

Computer Networks: Introduction to Computer Networks, Types of Networks, Physical Components of a Network, Wired Media, Wireless Media, Networking Devices, Network Topologies, Wireless Networks. [TextBook-2: Chapter 11 (S-11.1 / P-238 – S-11.11 / P-258), TextBook-1: Chapter 9 (S-9.1 – S-9.7), Chapter 10 (S-10.1 – S-10.8)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain fundamentals of operating systems. (L2)
2. Illustrate database system applications and its design concepts. (L2)

3. Outline fundamentals of computer networks and its applications. (L2)

UNIT-V

8 Lectures

Introduction to Artificial Intelligence & Machine Learning (AI&ML) and Data Science: Introduction to AI & ML, and Data Science, Use Cases in Business and Scope, Modelling Concepts, CRISP-DM Method.

1. <https://community.aws/content/2drbbXokwrIXivItJ8ZeCk3gT5F/introduction-to-artificial-intelligence-and-machine-learning?lang=en> (Artificial Intelligence)
2. <https://www.javatpoint.com/machine-learning-models> (Machine Learning)
3. <https://www.techtarget.com/searchenterpriseai/feature/Top-12-machine-learning-use-cases-and-business-applications> (Machine Learning)
4. <https://www.heavy.ai/learn/data-science> (Data Science)
5. <https://www.sv-europe.com/crisp-dm-methodology/> (CRISP-DM Method)

Learning Outcomes:

At the end of the unit, the student will be able to

1. Outline the main methods and applications of artificial intelligence (AI) concepts. (L2)
2. Outline the main methods and applications of machine learning (ML) concepts. (L2)
3. Outline the main methods and applications of data science concepts. (L2)

Textbooks:

1. Reema Thareja, Fundamentals of Computers, Second Edition, Oxford University Press, 2019.
2. E Balagurusamy, Fundamentals of Computers, Tata McGraw Hill Education Private Limited, 2009

Reference Books:

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 4th Edition, McGraw-Hill, 2002.
2. Andrew S. Tanenbaum, Modern Operating Systems, 2nd edition, PHI, 1995.

Web References:

1. https://oer-studentresources.gesci.org/wp-content/courses/Computer/CS-F1-Introduction-to-computers/evolution_and_development_of_computers.html (Development of Computers)
2. <https://www.builder.ai/glossary/app#:~:text=An%20app%20is%20a%20type,enhance%20productivity%20and%20streamline%20communication> (Apps)
3. <https://www.geeksforgeeks.org/what-is-an-operating-system/> (Operating System)
4. <https://www.javatpoint.com/computer-network-tutorial> (Computer Network)
5. <https://community.aws/content/2drbbXokwrIXivItJ8ZeCk3gT5F/introduction-to-artificial-intelligence-and-machine-learning?lang=en> (Artificial Intelligence)
6. <https://www.javatpoint.com/machine-learning-models> (Machine Learning)

7. <https://www.techtarget.com/searchenterpriseai/feature/Top-12-machine-learning-use-cases-and-business-applications> (Machine Learning)
8. <https://www.heavy.ai/learn/data-science> (Data Science)
9. <https://www.sv-europe.com/crisp-dm-methodology/> (CRISP-DM Method)

PROBLEM SOLVING USING C

I Year B. Tech. I semester

[Common to CSE, CSE (AI&ML), IT, ECE]

L	T	P	C
3	0	0	3

Course Code: 24CT11RC02

Course Outcomes: At the end of the Course, the student shall be able to

- CO1: Explain the basic constructs of C through the use of simple applications. (L2)
- CO2: Demonstrate the utilization of arrays and strings in the development of C programs. (L2)
- CO3: Utilize functions and pointers to construct various applications in C. (L3)
- CO4: Apply concepts of structures and unions to build and implement C applications. (L3)
- CO5: Develop applications using sequential and random-access file processing techniques. (L3)

UNIT-I

10 Lectures

Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output. [TextBook-1: Chapter 2 (S-2.1 – S-2.12)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Outline the Basic Structure and Components of C Programs. (L2)
2. Demonstrate Variables, Data Types, Operators, and Expressions. (L2)
3. Illustrate Input and Output Operations. (L2)

UNIT-II

11 Lectures

Decision Making, Branching, Looping: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else.. if ladder, switch statement, the (? :) operator, the goto statement, The while statement, the do statement, the for statement, Jumps in Loops.

Arrays & Strings: One, Two-dimensional Arrays, multi-dimensional Arrays, Character Arrays. Declaration and Initialization of Strings, reading and writing of strings, string handling functions. [TextBook-1: Chapter 3 (S-3.1 – S-3.8), TextBook-2: Chapter 13,14,15,16 (PP:215-283)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Classify Decision Making and Branching (L2)
2. Interpretation of Looping Constructs (L2)
3. Summarize Arrays and Strings (L2)

UNIT-III

10 Lectures

Function and Dynamic Memory Allocation: Functions: Designing structured programs, declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, passing arrays to functions, recursion.

Introduction to Pointers, Pointer Arithmetic, Pointers for Inter-Function Communication, passing pointers to functions, call by reference, Dynamic Memory Allocation. [TextBook-1: Chapter 4 (S-4.1 – S-4.11), Chapter 5 (S-5.1 – S-5.12)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Utilize Functions (Understand and Implement Functions, Utilize Various Function Types, Advanced Function Techniques) (L3)
2. Experiment with Pointers (Basic Pointer Operations, Pointers and Data Structures) (L3)
3. Explain Advanced Pointer Usage (Pointers in Functions, Pointers to Complex Data Types) (L2)

UNIT-IV

9 Lectures

Structure and Unions: Defining a structure and union, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, definition and usage of union, structures and unions using functions, size of structures and bit-fields. The Type Definition (Type def), Enumerated Types. [TextBook-1: Chapter 6 (S-6.1 – S-6.9)]

Learning Outcomes:

1. At the end of the unit, the student will be able to
2. Define Structures and Build C programs using Structures. (L3)
3. Explain Complex Data Structures. (L2)
4. Explain Unions and Bit-Fields. (L2)

UNIT-V

8 Lectures

File handling: Introduction to Files, Modes of File operations, Text and Binary Files, Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments, user defined header files. [TextBook-2: Chapter 19 (PP:325-348)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Outline File Operations. (L2)
2. Summarize Error Handling and Random Access. (L2)
3. Utilize Command Line Arguments. (L3)

Text Books:

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, 2nd Edition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9.
2. Yashavant P. Kanetkar, “Let Us C”, 16th Edition, 2019, BPB Publications, ISBN: 978-93-8728-449-4.

Reference Books:

1. N. B. Venkateswarlu, E. V. Prasad, “C and Data Structures”, 1st Edition, S. Chand Publishing, 2010, ISBN: 978-93-525-3356-5.
2. Pradip Dey, Manas Ghosh, “Programming in C”, 2nd Edition, 2018, Oxford University Press, ISBN: 978-01-9949-147-6.
3. Jacqueline A. Jones and Keith Harrow, “Problem Solving with C”, Pearson Education. ISBN: 978-93-325-3800-9.
4. E. Balagurusamy, “Programming in ANSI C”, 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.

Web References:

1. <https://nptel.ac.in/courses/106105171>
2. <https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/lecture-notes/>
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384323703937433634517_shared/overview
4. <https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html>

ENGINEERING PHYSICS LAB

I Year B. Tech. I semester

[CSE(AI&ML)]

L	T	P	C
0	0	3	1.5

Course Code: 24BP11RC02

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

- CO1:** Interpret the physical parameters based on optical phenomena. (L2)
- CO2:** Verify the behaviour of double refraction in birefringent material like quartz. (L2)
- CO3:** Demonstrate the concepts of diffraction through experiments. (L3)
- CO4:** Calibrate instruments like low range voltmeters and ammeters. (L3)
- CO5:** Design temperature sensors based on diodes and thermistors. (L3)

List of Experiments: (Any TEN of the following experiments shall be conducted)

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Thickness Given Paper Strip or hairline by Wedge Method.
3. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer in minimum deviation position
5. Determination of Refractive Index of Ordinary ray and Extra-ordinary ray in quartz prism
6. Laser- Diffraction – determination of wavelength of laser source using diffraction grating
7. Determination of wavelength of laser source using Fraunhofer single slit diffraction
8. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
9. Study of Intensity Variation of the Magnetic Field along the axis of circular Current Carrying conductor using Stewart and Gee apparatus
10. Calibration of Low Range Voltmeter using Potentiometer Bridge
11. Calibration of Low Range Ammeter using Potentiometer Bridge
12. Determination of dielectric constant of material using charging discharging method with a parallel plate capacitor
13. Determination of energy band gap of semiconductor using PN junction diode in reverse bias
14. Determination of thermo electric coefficients for thermistor
15. Determination of Planck's constant using LED.

Textbooks:

1. Practical physics by CL Arora, S.chand publishing company, 1995.
2. Advanced Practical Physics For Students by B.l.worsnop And H.t.flint, 1923

Web References:

1. http://lo-au.vlabs.ac.in/laser-optics/Newtons_Rings_Wavelength_of_light/
2. http://ov-au.vlabs.ac.in/optics/Spectrometer_Refractive_Index/
3. http://ov-au.vlabs.ac.in/optics/Diffraction_Grating/
4. http://htv-au.vlabs.ac.in/heat-thermodynamics/Characteristics_of_Thermistor/
5. <https://bop-iitk.vlabs.ac.in/exp/energy-band-gap/simulation.html>

COMPUTER ENGINEERING WORKSHOP

I Year B. Tech. I semester
[Common to CSE, CSE (AI&ML), IT]

Course Code: 24CT11RC03

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Identify the peripherals of a computer. (L3)
- CO2: Demonstrate the installation process of operating systems like MS Windows, LINUX. (L3)
- CO3: Make use of MS-Office suite that comprises of various applications to create documents, organizes & analyses data and captivating presentations. (L3)
- CO4: Categorize various UNIX/LINUX Commands to work on a modern operating system. (L3)
- CO5: Experiment with GIT Commands and make use of LaTeX to prepare research articles. (L3)

Module-1: Hardware Concepts

1. Identify the peripherals of a computer, components in a CPU and its functions.
2. Draw the block diagram of the CPU along with the configuration of each peripheral.
3. Disassemble and assemble the PC back to working condition.

Module-2: Software Installations

1. Install operating systems like LINUX and MS windows on a personal computer.
2. The system should be configured as dual boot with both MS windows and LINUX.

Module-3: Office Suite

1. Creating Documents: Formatting Fonts/Texts, page layout, Applying Text effects, Character Spacing, Borders and Colours, Inserting Header and Footer, equation editor.
2. Spreadsheet Orientation: Accessing, overview of toolbars, saving spreadsheet files, Using help and resources. Creating a Scheduler, Gridlines, Format Cells, Summation, auto fill, Formatting Text, Renaming and Inserting worksheets, Hyper linking.
3. Excel Calculation: Calculating Average, Cell Referencing, Excel Formula, std. deviation, Charts, Count Function, Sorting, Conditional formatting, Excel Advanced-sumif, VLOOKUP, and Pivot Table.
4. Creating Power Point: Student should work on basic power point utilities and tools to create basic power point presentation. PPT Orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting Images, Tables and charts.
5. Software as a service (SaaS): Usage of online office suite.

Module-4: Unix / Linux Commands

1. Study and practice on file system, handling files with commands, syntax, usage, application.
2. Practice on vi editor.
3. Study and practice on shells/shell programming with relevant programming constructs, syntax, usage, application.

Module-5: GIT Commands and LaTeX

1. Installation of GIT, Branch in Git Basic GIT Commands.
2. Installation of LaTeX and preparing research articles by creating overleaf account.
3. Introduction to Scratch Programming - Introduction, Stage, Sprite, Script, Block Palette.

Reference Books:

1. IT Essentials: PC Hardware and Software Companion Guide, Third Edition, David Anfinson, Ken Quamme.
2. UNIX concepts and applications by Sumitabha Das, TMH Publications.
3. Shell programming by Yashwanth Kanetkar.

Web References:

1. <https://www.javatpoint.com/>

PROBLEM SOLVING USING C LAB

I Year B. Tech. I semester

[Common to CSE, CSE (AI&ML), IT, ECE]

Course Code: 24CT11RC04

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1:** Outline the use of basic constructs of C for simple applications. (L2)
- CO2:** Develop C programs for simple applications using Arrays and Strings. (L3)
- CO3:** Illustrate concepts such as functions, recursion, and pointers with suitable examples. (L2)
- CO4:** Build C programs involving Structures and Unions. (L3)
- CO5:** Develop applications using sequential and random-access file processing. (L3)

Module-1:

1. Write a C program to demonstrate Format Specifiers and Input/Output Statements.
2. Write a C program to demonstrate various Data Types.

Module-2:

1. Write a C program to demonstrate various Operators including Bitwise Operator.
2. Write a C program to demonstrate Arithmetic Expressions and Type Casting.

Module-3:

1. Write a C program to demonstrate decision making statements.
2. Write a C program to demonstrate iterative statements.
3. Write a C program to demonstrate break and continue Statement.

Module-4:

1. Write a C program to demonstrate arrays (one-dimensional and two-dimensional).
2. Write a C program to demonstrate string handling functions using built-in and user defined functions.

Module-5:

1. Write a C program to demonstrate user defined functions.
2. Write a C program to demonstrate nested functions.

Module-6:

1. Write a C program to demonstrate arithmetic expressions using pointers.
2. Write a C program to demonstrate Pointers to Arrays.
3. Write a C program to demonstrate manipulate strings using pointers.
4. Write a C program to demonstrate dynamic memory allocation.

Module-7:

1. Write a C program to demonstrate Call-by-value, Call-by-reference.
2. Write a C program to demonstrate recursive function.
3. Write a C program to demonstrate Functions with Storage Classes (Static).

Module-8:

1. Write a C program to demonstrate structures.
2. Write a C program to demonstrate structures within structures.
3. Write a C program to demonstrate pointer to a structure.
4. Write a C program to demonstrate unions.

Module-9:

1. Write a C program to demonstrate I/O operations on files.
2. Write a C program to demonstrate concatenating two files.
3. Write a C program to demonstrate copy content of one file to another file.

Case Study: Select any one application mentioned below.

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

1. Develop a library management system to add, delete, and search for books efficiently.
2. Develop an ATM system to check balance, deposit money, and withdraw funds.
3. Develop a C program to calculate salary increments using a lookup table which stores the percentage of increment based on the current salary.
4. Develop a voting system where users can vote for candidates and view results.
5. Develop a basic calculator for arithmetic operations like addition, subtraction, multiplication, and division.
6. Develop a contact management system to store and manage details like name, phone number, and email.
7. Develop a banking system supporting multiple users for account management and transactions.
8. Develop a C program to calculate SGPA and CGPA based on students' marks across semesters.
9. Develop a registration page in C using file handling to securely store usernames and passwords.
10. Develop an encryption and decryption algorithm to securely transform and restore data by using the GNU C Library: crypt.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, 2nd Edition, 2015, Pearson Education India, ISBN: 978-93-3254-944-9.
2. Yashavant P. Kanetkar, “Let Us C”, 16th Edition, 2019, BPB Publications, ISBN: 978- 93- 8728-449-4.
3. E. Balaguruswamy, “Programming in ANSI C”, 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.
4. Pradip Dey, Manas Ghosh, “Programming in C”, 2nd Edition, 2018, Oxford University Press, ISBN: 978-01-9949-147-6.
5. N.B. Venkateswarulu, “C programming”, 1st Edition, S.Chand Publishing, 2017, ISBN: 978-93-525-3356-5.
6. Jacqueline A Jones and Keith Harrow, “Problem Solving with C”, Pearson Education. ISBN: 978-93-325-3800-9.

Web References:

1. <https://nptel.ac.in/courses/106105171>
2. <https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/pages/lecture-notes/>
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384323703937433634517_s_hared/overview
4. <https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html>

LINEAR ALGEBRA AND VECTOR CALCULUS

I Year B. Tech. II Semester

[Common to EEE, ECE, CSE, IT, CSE (AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24BM11RC02

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Test for consistency and solve linear system of equations, also determine unknown currents in the electrical circuits. (L5)
- CO2:** Find the Eigen values and Eigen vectors of a matrix and apply Cayley- Hamilton theorem to find the inverse of a matrix. (L3)
- CO3:** Reduce quadratic form to canonical form and examine the nature of quadratic form. (L4)
- CO4:** Interpret the meaning and evaluate gradient of a scalar valued, curl and divergence of vector valued functions. (L5)
- CO5:** Apply line integrals, surface integrals, volume integrals and their relations using Green's theorem, Stoke's theorem, Gauss Divergence theorems in various engineering applications. (L3)

UNIT-I:

10 Lectures

Matrix Algebra: Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations – Gauss elimination and Gauss Jordan methods, LU Factorization method.

Applications: Finding the current in electrical circuits. [Sections: 2.7, 2.10, 28.6 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Find the rank of a matrix. (L1)
2. Test for consistency and solve a system of linear equations. (L4)
3. Apply Gauss elimination and Gauss Jordan methods, LU factorization to solve linear systems. (L3)
4. Determine unknown currents in electrical circuits. (L5)

UNIT-II:

10 Lectures

Eigen Values and Eigen Vectors: Eigen Values and Eigen Vectors of a real Matrix – Properties - Cayley- Hamilton theorem (without proof) - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem – Pseudo inverse of a matrix, Singular value decomposition. [Sections: 2.13 - 2.15 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Find eigenvalues and corresponding eigenvectors of a matrix. (L1)
2. Apply Cayley-Hamilton theorem to find powers and the inverse of a matrix. (L3)
3. Calculate the Pseudo Inverse of a matrix. (L3)
4. Calculate the singular values of a matrix. (L3)

UNIT-III:

9 Lectures

Quadratic Forms: Inner Product – Orthogonal Vectors – Orthogonal matrix – Diagonalization of a Matrix-Quadratic Forms - Reduction of Quadratic Form to Canonical Form (Orthogonal Transformation) - Nature of a Quadratic Form. [Sections: 2.16 - 2.18 of Textbook]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Make use of Eigen values and eigen vectors to diagonalize the matrix. (L3)
2. Reduce the Quadratic form to canonical form examine the nature of a quadratic form. (L4)

UNIT-IV: Vector Differentiation

9 Lectures

Introduction - Scalar and Vector point functions, General rules for vector differentiation - Vector operator ∇ applied to scalar point functions- Gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e., ∇f , $\nabla \cdot \vec{F}$, $\nabla \times \vec{F}$), Irrotational and Solenoidal fields, Vector Identities. [Sections: 8.1, 8.4 - 8.9 of Text Book]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Find the gradient of a scalar point function, divergence and curl of a vector point function. (L1)
2. Determine the directional derivative of scalar point function. (L5)

UNIT-V: Vector Integration

10 Lectures

Integration of vectors - Line integral – Circulation - work done - surface integral-flux - Green's theorem in the plane - Stoke's theorem - Volume integral - Gauss Divergence theorem (All theorems without proofs). [Sections: 8.10 - 8.16, 8.18 of Text Book]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Determine the work done in a moving particle along a path. (L5)
2. Interpret surface and volume integrals. (L2)

3. Apply vector integral theorems to multiple integral. (L3)

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 45th Edition, Khanna Publishers, 2024.

Reference Books:

1. David Poole, Linear Algebra- A modern introduction, 4th edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2011.
3. Peter V. O'Neil, Advanced Engineering Mathematics, 7th edition, Cengage Learning, 2011.
4. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson, 2017.

Web References:

1. <https://nptel.ac.in/courses/111107112>

GREEN CHEMISTRY

I Year B. Tech. II semester
[Common to CSE (AI&ML), ECE]

L	T	P	C
3	0	0	3

Course Code: 24BC11RC01

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** To develop knowledge about water and its treatment for industrial and potable purpose. (L3)
- CO2:** Utilize the theory of construction and discharge reactions of various types of batteries are used in commercial society. (L3)
- CO3:** Explain the importance of working principle, fabrication of electrodes and other components, advantages, disadvantages and environmental aspects of fuel cells. (L4)
- CO4:** Classify the corrosion mechanism of metals and factors influenced by rate and extent of corrosion and categorize the reasons for corrosion control methods. (L4)
- CO5:** Apply green chemistry technology processes the knowledge for solving existing challenges faced in various engineering and societal areas. (L5)

UNIT-I

10 Lectures

Water-Technology: Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water –Reverse Osmosis Method Electro-dialysis. Chemical analysis of water. [TB1: Chapter1]

Learning Outcomes:

At the end of the unit the student will be able to

1. Explain the principles of reverse osmosis (L4)
2. Compare the quality of drinking water with BIS and WHO standards (L4)
3. Illustrate problems associated with Boiler Troubles (L2)
4. Demonstrate the estimation of hardness of water (L3)

UNIT-II

10 Lectures

Batteries: Primary batteries: The Chemistry-Types: Zinc-carbon (Leclanche type), zinc alkaline

(Duracell), zinc/air batteries; Lithium primary cells and lithium-ferrous sulphide cells.

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel cadmium, nickel-zinc, nickel-metal hydride batteries, lithium-ion batteries, ultrathin lithium polymer cells. Advanced Batteries for electric vehicles, requirements of the battery – sodium-beta and redox batteries. [TB1: Chapter6]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Deduct the working mechanism of various types of cells (L5)
2. Illustrate difference between primary and secondary cells (L2)
3. List the environmental applications of Various types of batteries (L4)
4. Utilize the manufacturing methods of advanced batteries for electric vehicles (L3)

UNIT-III

8 Lectures

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells- Membranes and Fuels, Electrochemical Sensors and Optical fibres. [TB1: Chapter 6]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain the fundamental theories of fuel cells (L2)
2. Classify types of fuel cells (L4)
3. Make use of the various components fabrication of fuel cells (L3)
4. Distinguish the advantages, disadvantages and environmental aspects of fuel cells(L4)

UNIT-IV

10 Lectures

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion. Corrosion Controlling Methods, Protective Coatings, Electroplating and Electroless Plating, Paints, Varnishes, Lacquers, Enamels. [TB1: Chapter 7]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Explain the Mechanism of corrosion (L4)
2. List the various types of Corrosion (L4)

3. Describe the Factors Effecting Corrosion (L5)
4. Differentiate between Paints Lacquers Enamels (L4)

UNIT-V

10 Lectures

Green-Chemistry and Technology: Introduction and significance of green chemistry, Goals of green chemistry, 12 principles of green chemistry, toxicity of chemicals, concept of zero pollution technologies; Aqueous phase method, Super critical fluid method, Phase transfer catalytic method, atom economy, functional toxicity vs non- functional toxicity, functional group approaches to green chemistry, Elimination of toxic functional group, optimization of frameworks for the design of greener synthetic pathways -Green synthesis of Adipic acid and Paracetamol- energy minimization-Microwave synthesis, ultra sound assisted method Bio catalyzed reaction and Only explanation with examples Processes involving solid catalysts – zeolites, ion exchange resins, applications of Green Chemistry, Green solvents, green fuels & propellants. [TB2: Chapter- 2,3,4&5]

Learning Outcomes:

At the end of the unit the student will be able to

1. Processes involving Green Chemistry and apply the knowledge for solving existing
2. Challenges faced in various engineering and societal areas (L-5)
3. Differentiate between functional toxicity vs non- functional toxicity (L-4)
4. Explain the green chemistry, 12 principles (L-2)

Textbooks:

1. Engineering Chemistry – PC Jain and M. Jain –15th Edition, Dhanpath Rai and Sons, New Delhi.
2. Anastas, P. T., Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press Inc., New York, 1998.

Reference Books:

1. M. Aulice Scibioh and B. Viswanathan ‘Fuel Cells – principles and applications’, University Press India (2006).
2. A Textbook of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi
3. Handbook of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

Web References:

1. <https://archive.nptel.ac.in/course.html>
2. <https://nptel.ac.in/courses/engineering>

ENGLISH
I Year B. Tech II Semester
[Common to ECE, EEE & CSE(AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24HE11RC01

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Develop moral values and inner peace(L3), Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts. (L3)
- CO2:** Identify the impact of different social backgrounds (L3), recognize the poet's insights. (L4)
Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts. (L3)
- CO3:** Analyse socio-cultural context(L4), Establish effective interpersonal and communication skills(L3), Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts(L3)
- CO4:** Focus on value of education(L4), Relate to the poet's nostalgia(L4), Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts (L3)
- CO5:** Determine the central idea of the text(L3), Identify one's resilience(L3), Demonstrate the use of LSRW skills, Vocabulary and basic grammar concepts (L3)

UNIT-I

10 Lectures

Prose:	Swami Vivekananda: The Secret of Work
Poetry:	Grenville Kleiser: Stay Calm
Grammar & Vocabulary:	Synonyms & Antonyms
Listening:	Listening for Context and Specific Information
Speaking:	Introducing Oneself and Others
Writing:	Basics of writing

Learning Outcomes:

At the end of the unit, the student will be able to

1. Interpret the spiritual growth and capacity building of the individual in the 21st century. (L3)
2. Use appropriate synonyms and antonyms to communicate effectively. (L3)
3. Listen and understand for specific information in the audio(L2)
4. Establish connections between oneself and others(L3)
5. Apply appropriate punctuation marks for clarity and organization of written text (L3)

UNIT-II

10 Lectures

Prose:	Katherine Mansfield: The Doll's House
Poetry: Rabindranath Tagore:	Where the Mind Is Without Fear
Grammar & Vocabulary:	Phrasal Verbs
Listening:	Listening for Main Idea and Supporting Ideas
Speaking:	Getting Someone's Attention and Interrupting
Writing:	Formal Letters

Learning Outcomes:

At the end of the unit, the student will be able to

1. Relate to the world through adult & child's points of view (L3)
2. Identify the sense of self dignity & rationality in the poem (L4)
3. Utilize appropriate phrasal verbs for effective communication(L3)
4. Listen & identify main and supporting ideas in the audio(L3)
5. Practice conversational etiquette(L3)
6. Write formal letters(L3)

UNIT-III

10 Lectures

Prose:	O. Henry: The Last Leaf
Poetry:	Rudyard Kipling: If
Grammar & Vocabulary:	Idiomatic Expressions
Listening:	Listening for Global Comprehension
Speaking:	Asking for Information and Giving Information
Writing:	Note-Making

Learning Outcomes:

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

1. Analyze strategies to face challenges in life (L4)
2. Develop one's own personality (L3)
3. Use idiomatic expressions in oral & written communication (L3)
4. Listen & Interpret the audio for Global Comprehension (L3)
5. Ask & provide information (L3)
6. Practice note making study skills(L3)

UNIT-IV

10 Lectures

Prose:	Francis Bacon: Of Studies
Poetry:	Toru Dutt: Our Casuarina Tree
Grammar & Vocabulary:	Remedial Grammar I
Listening:	Listening to Make Inferences
Speaking:	Expressing Opinions, and Agreeing and Disagreeing with Opinions
Writing:	Essay Writing

Learning Outcomes:

At the end of the unit, the student will be able to

1. Prioritize the habits of continuous learning(L4)
2. Recognize the significance of Indian philosophy (L4)
3. Identify and correct common errors in English grammar and usage(L3)
4. Draw inferences from the audio(L3)
5. Articulate one's own opinions(L3)
6. Develop different types of essays (DEAN)(L3)

UNIT-V

8 Lectures

Prose:	Mark Twain: Whitewashing the Fence
Poetry:	William Ernest Henley: Invictus
Grammar & Vocabulary:	Remedial Grammar II
Listening:	Listening for Key Ideas
Speaking:	Telephone Etiquette
Writing:	E-mail Etiquette

Learning Outcomes:

At the end of the unit, the student will be able to

1. Discover the humour & moral lessons in the text (L3)
2. Show resilience in adverse situations. (L3)
3. Modify sentences with appropriate grammar, vocabulary and usage (L3)
4. Identify key ideas (L3)
5. Practice telephone Etiquette (L3)
6. Apply the knowledge of E-mail Etiquette (L3)

Text Books:

1. English for Engineers: Theory to practice. Board of Editors, Orient Black Swan Publishers, India.2024.

Reference Books:

1. English Grammar in Use by Raymond Murphy
2. Oxford English Grammar Course by Michael Swan
3. Word Power Made Easy by Norman Lewis
4. Cambridge Vocabulary for IELTS by Pauline Cullen
5. The Elements of Style by William Strunk Jr. and E.B. White
6. English Vocabulary in Use by Michael McCarthy and Felicity O'Dell
7. Practical English Usage by Michael Swan
8. The Only Grammar Book You'll Ever Need by Susan Thurman
9. Advanced English Grammar: A Linguistic Approach by Ilse Depraetere and Chad Langford

DIGITAL LOGIC DESIGN

I Year B. Tech. II semester

[Common to ECE, CSE, CSE(AI&ML), IT]

Course Code: 24EC11RC05

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Represent different number systems & binary codes and perform conversions & binary arithmetic. (L2)
- CO2:** Apply different simplification methods for minimizing Boolean functions. (L3)
- CO3:** Model various combinational circuits using gates and PLD's. (L3)
- CO4:** Outline the concept of latches and flip-flops. Construct sequential logic circuits like counters and registers using flip-flops. (L3)
- CO5:** Categorize Mealy & Moore models and Design Synchronous Sequential machines. (L3)

UNIT-I

9 Lectures

Number systems: Number systems, Base conversion methods, Representation of signed numbers and Binary Arithmetic.

Codes: Binary, Non binary, Decimal, Alphanumeric, XS-3, Gray. Error detecting and error correcting codes.

Logic Gates: AND, OR, NOT, NAND, NOR, XOR, EX-NOR. [Textbook1: Chapter1, Chapter 2: section 2.1 to 2.8]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the advantages of using different number systems. (L2)
2. Describe the usefulness of different binary codes. (L2)
3. Summarize the error detection and correction concepts. (L2).

UNIT-II

10 Lectures

Minimization of Boolean Functions: Fundamental postulates of Boolean algebra, Basic theorems, Simplification of Boolean equations, Min terms, Max terms, Standard form of Boolean functions. Simplification of functions using Karnaugh map method (2,3,4,5 variables) Don't care conditions, AOI implementation, NAND and NOR Realizations. [Textbook1: Chapter 2: Sections 2.11 to 2.19,2.21,2.22,2.23, Chapter 3: sections 3.2 to 3.6,3.7]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply basic laws and theorems to simplify Boolean expressions and construct logic circuits. (L3)
2. Understand concepts of sum-of-products and product-of-sums representations. (L2)
3. Apply K- Map for minimizing logic functions and build logic circuits. (L3)

UNIT-III

12 Lectures

Combinational Logic-Circuit Design-I: Logic design of combinational circuits: Adders and Subtractors: Binary, BCD, Excess-3 and Look-ahead-carry adder, Code converters, Multiplexers, De multiplexers, Encoders, Decoders and priority encoders, Realization of Boolean functions using multiplexers and Decoders.

Combinational Logic-Circuit Design-II: Design of 4-bit comparator, Parity checker/Generator. Basics of PLDs: Basic structure of PROM, PAL, PLA, Realization of Boolean functions with PLDs and their merits and demerits. [Textbook1: Chapter 4: section 4.1 to 4.27, Chapter 5 Sections 5.1 to 5.11]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply Boolean algebra for describing combinational digital circuits (L3)
2. Describe standard combinational circuits such as adders, subtractors, comparators etc. (L2)
3. Develop the digital circuits using PLDs (L3)

UNIT-IV

10 Lectures

Sequential Circuits: Classification of sequential circuits, SR-latch, Gated latches, Flip flops: RS, JK, D, T and Master slave flip flops, Excitation tables, flip flop conversion from one type to another. Design of counters: Ripple counters, Synchronous counters, asynchronous counters, up-down counters, Johnson counter, ring counter. Design of registers: Buffer registers, Shift registers, Bi directional shift registers, Universal shift register. [Textbook1: Chapter 6]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the principle of Flip-Flops and Latches. (L2)
2. Summarize the concepts of Shift Registers and Counters. (L2)
3. Construct different sequential logic circuits using Flipflops. (L3)

UNIT-V

7 Lectures

Analysis and Design of Synchronous Sequential Machines: Moore and Mealy machine models, State Equations, State Table, State diagram, State reduction & assignment, Synthesis of synchronous sequential circuits- sequence detector and generator. [Textbook1: Chapter 7 Sections 7.1 to 7.5]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand Moore and Mealy machine models (L2)
2. Discuss the concepts of State assignment & Reduction (L2)
3. Analyse the design and synthesis of synchronous sequential circuits (L3)

Textbooks:

1. Anand Kumar, Switching Theory and Logic Design. PHI, 2014.
2. M. Morris Mano and Michael D. Ciletti, Digital Design, 4th Edition, Pearson Education, 2013.

Reference Books:

1. Foundation of Switching theory and Logic Design, A k Singh, New age International Publishers, 2008
2. Modern Digital Electronics, R P Jain, 4th Edition, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010
3. Fundamentals of Logic Design, Charles. R. Roth, Thomson Publications, 5th edition, 2004.

Web References:

1. <https://nptel.ac.in/courses/108105132> (Digital Electronic Circuits)
2. https://onlinecourses.nptel.ac.in/noc24_ee147/preview (Digital Circuits)
3. <https://nptel.ac.in/courses/117105080> (Digital Systems Design)
4. https://onlinecourses.swayam2.ac.in/nou24_ec07/preview (Digital electronic and System design)

PYTHON PROGRAMMING

I Year B. Tech. II Semester

[Common to CSE, IT, CSE (AI&ML)]

Course Code: 24CT11RC06

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1:** Understand the historical development, necessity, applications, and basic concepts of python programming. (L2)
- CO2:** Identify and implement appropriate control structures to solve a particular programming problem. (L3)
- CO3:** Examine various data structures and apply to solve real world problems. (L3)
- CO4:** Build simple functions and packages used in python for solving real world problems. (L3)
- CO5:** Outline Object Oriented concepts in python and illustrate Exception handling. (L2)

UNIT-I

8 Lectures

Introduction: History of Python, Need of Python Programming, Applications of Python, Variables, Assignment, Comments, Keywords, Data types, Input-Output, Indentation. [TextBook-1: Chapter 3 (S-3.1 – S-3.12)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand the Evolution of Python [L2]
2. Recall the Need and Applications of Python [L1]
3. Outline python's Input and Output Functions[L2]

UNIT-II

10 Lectures

Operators and Expressions: Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations, Control Flow- if, if-elif-else, for, while, break, continue, pass [TextBook-1: Chapter 3 (S-3.12), Chapter 4 (S-4.1 – S-4.7)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Illustrate python operators: arithmetic, comparison, assignment, logical, bitwise, membership, identity [L2]
2. Make use of control flow statements: if, if-elif-else, for, while, break, continue, pass. [L3]

UNIT-III

10 Lectures

Data Structures: Strings, Lists, Tuples, Sets, Dictionaries. Data Structures manipulations - create, Index, Negative indexing, Slicing, update, add elements, delete or remove elements, operations, Comprehension, Membership Test, Iteration. [TextBook-1: Chapter 6 (S-6.1 – S-6.9), Chapter 8 (S-8.1 – S-8.6)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understanding basic operations on lists, including indexing and slicing [L2]
2. Utilize methods of lists, tuples, sets, and dictionaries to solve problems [L3]
3. Compare and apply appropriate use cases for lists, tuples, sets, and dictionaries. [L2]

UNIT-IV

10 Lectures

Functions - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Lambda Functions, Function Returning Values, Built-in functions, Scope of the Variables in a Function - Global and Local Variables.

Modules: Creating modules, import statement, from...import statement, namespaces. Python packages: Introduction to PIP, Installing Packages via PIP [TextBook-1: Chapter 5 (S-5.1 – S-5.8,5.12)]

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understanding and implementing various types of function arguments and scopes in Python. [L2]
2. Utilize Python modules to understanding the import mechanisms [L3]

UNIT-V

10 Lectures

Object Oriented Programming (OOP) in Python: Classes and Objects, Class Method and self-Argument, The __init() Method (The Class Constructor), Class Variables and Object Variables, Public and Private Data Members, Inheritance, Overriding Methods.

Error and Exceptions: Introduction to Errors and Exceptions, Handling Exception, try except block, finally block, Raising Exceptions.

File Handling: Type of files, Opening and Closing files, Reading and Writing files.

TextBook-1: Chapter 9 (S-9.1 – S-9.8), Chapter 10 (S-10.1 – S-10.3)

TextBook-1: Chapter 7 (S-7.1 – S-7.5), Chapter 12 (S-12.1 – S-12.10)

Learning Outcomes:

At the end of the unit, the student will be able to

1. Understand and implement classes, methods, and the 'self' variable in Python [L2]
2. Demonstrate concepts of inheritance, method overriding, and data hiding in OOP [L2]

3. List the differences between errors and exceptions, and handle exceptions using try-except blocks [L1]
4. Illustrate file operations including reading, writing, and manipulating file pointers in Python. [L2]

Textbooks:

1. Reema Thareja, “Python Programming: Using Problems Solving Approach”, Oxford University Press, 2017
2. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.

Reference Books:

1. Fundamentals of Data Structures using Python, P Lalitha Surya Kumari, P. S. Avadhani, Lambert Academic Publishing
2. Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Web References:

1. https://www.tutorialspoint.com/python3/python_tutorial.pdf
2. <https://www.python.org/doc/>

COMMUNICATION SKILLS LAB

I Year B. Tech. II Semester

[Common to ECE, EEE, CSE (AI&ML)]

Course Code: 24HE11RC02

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

- CO1: Identify and pronounce the sounds of English; choose the accurate stress in connected speech for proper intonation. (L3)
- CO2: Apply the main theme and ideas of the audio/video to take notes and summarize. (L3)
- CO3: Develop speaking skills by taking part in Just A Minute (JAM) – Picture Prompts-Narratives-Role Play. (L3)
- CO4: Practice discussions and debates. (L3)
- CO5: Demonstrate Presentation Skills. (L3)

ACTIVITY-I

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Apply the knowledge of Phonetics for better pronunciation and articulation. (L3)
2. Choose appropriate stress, intonation and rhythm of English language for clear communication. (L3)

ACTIVITY-II

Listening Skills: Listening for gist and specific information - listening for Note taking, Summarizing and for opinions - Listening to the speeches of eminent personalities.

Learning Outcomes:

At the end of the unit, the student will be able to

1. Develop effective listening skills for better comprehension of academic lectures and English spoken by native speakers. (L3).
2. Apply effective strategies for good writing. (L3)
3. Demonstrate writing skills in note taking and summarizing. (L3)

ACTIVITY-III

Speaking Skills: Just A Minute (JAM) session –Picture Prompts- Narrating stories and anecdotes-Role Play

Learning Outcomes:

At the end of the unit, the student will be able to

1. Make use of dialogues for different roles. (L3)
2. Develop communication skills in formal and informal situations. (L3)
3. Practice speaking skills through participation in activities such as narrating stories and role plays(L3)

ACTIVITY-IV

Speaking skills: Group Discussions-Arguments-Debates

Learning Outcomes:

At the end of the unit, the student will be able to

1. Organize one's own ideas for various Group-Discussion formats. (L3)
2. Develop ideas and arguments to debate. (L3)

ACTIVITY-V

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation

Learning Outcomes:

At the end of the unit, the student will be able to

1. Design presentations with PowerPoint slides(L3)
2. Apply appropriate body language (postures, gestures, facial expressions and eye contact) in formal presentations. (L3)

LIST OF LAB ACTIVITIES:

1. Identification and pronunciation of Vowel sounds and Consonant sounds (CO1)
2. Identification of word stress, Intonation and Rhythm (CO1)
3. Listening for specific information & Note taking (CO2)
4. Listening to the speeches of eminent personalities and summarizing (CO2)
5. Just A Minute sessions (CO3)
6. Picture Prompts (CO3)
7. Narrating Stories& anecdotes (CO3)
8. Role-Plays (CO3)
9. Group Discussions (CO4)
10. Debates (CO4)
11. Presentation Skills-I (CO5)
12. Presentation Skills-II (CO5)

Reference Books:

1. Language and Life: A Skills Approach Board of Editors, Orient Black swan Publishers, India.2018.
2. A Textbook of English Phonetics for Indian Students, T.Balasubramanian, Macmillan India Ltd.
3. Ashraf Rizvi. Effective Technical Communication. Tata McGraw Hill Education Private Limited, New Delhi.
4. Speak Well. Orient Black swan Publishers, Hyderabad.
5. Allan Pease. Body Language. Manjul Publishing House, New Delhi.

Web References:

1. <https://www.englishlanguageclub.co.uk>
2. <https://www.ted.ed.com/>
3. <https://learningenglish.voanews.com/>
4. <https://www.bbc.co.uk/learningenglish/>
5. <https://www.abc.net.au/education/learn-english>
6. NDTV News

PYTHON PROGRAMMING LAB

I Year B. Tech. II semester
[Common to CSE, CSE (AI&ML), IT]

Course Code: 24CT11RC07

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Understand core programming basics and various Operators of Python. (L2)
- CO2: Implement programs using conditional statements and loops and strings. (L3)
- CO3: Develop functions and strings to perform simple tasks. (L3)
- CO4: Make use of various data structures like lists, tuples, sets and dictionaries. (L3)
- CO5: Implement Python programs with files, Classes and objects. (L3)

Module-1: Basics of Python

1. Write a program to display the statements.
2. Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)
3. Write a Python program to demonstrate various type conversion functions.
4. Write a program to demonstrate the inbuilt Math function

Module-2: Operators in Python

1. Demonstrate the following Operators in Python with suitable examples.
 - i) Arithmetic Operators
 - ii) Relational Operators
 - iii) Assignment Operators
 - iv) Logical Operators
 - v) Bit wise Operators
 - vi) Ternary Operator
 - vii) Membership Operators
 - viii) Identity Operators

Module-3: Conditional Branching Statements

1. Write a program to check whether the given number is even or odd
2. Write a program to read marks of a student and display the corresponding grade
3. Write a program to find the largest element among the given numbers (multi-way if-elif-else statements.)

Module-4: Looping/Iterative Statements

1. Implement the following programs using while loop and for loop
 - i. Display all prime numbers up to n.
 - ii. Print the nth multiplication table.
 - iii. Print different patterns using loops:

2. Demonstrate the following control transfer statements in Python with suitable examples.
 - i. break
 - ii. continue
 - iii. Pass

Module-5: Functions

1. Write a function to find the multiplication of two numbers and demonstrate the usage of parameters and arguments of a function.
2. Write a program to define a function using default arguments.
3. Demonstrate lambda functions in Python with suitable example programs.

Module-6: Strings

1. Write a program to manage and analyse customer feedback using string operations include:
 - i. Create feedback with name, email, comment
 - ii. Collecting feedback.
 - iii. Normalizing feedback (e.g., removing extra spaces, converting to lowercase).
 - iv. Extracting key information (e.g., names, email addresses, and comments).
 - v. Searching for keywords.
 - vi. Replacing certain words.
 - vii. Formatting feedback for display.
 - viii. Summarizing feedback.

Module-7: Lists:

1. Write a program to create a list and perform the following operations:
 - i. +
 - ii. *
 - iii. slicing
 - iv. del
2. Inventory Management: You have a list of items in your warehouse along with their quantities. Write a program to find out which items are low in stock (quantity less than 10). (use only comprehensions)
3. Employee Performance: You have a list of employee names and their corresponding performance scores. Write a program to sort the list based on the performance scores in descending order.
4. Sales Analysis: you have a list of sales figures for the past week. Write a program to find the total sales, the highest sale, the lowest sale, and the average sale.
5. Write a program to calculate the length of each element in a list using map function in python.

Module-8: Tuples

1. Write a program to return the top n's most frequently occurring chars and their respective counts. e.g. string=aaaaaabbccc, n=2 should return [(a 6) (b 4)].
2. Write a program to create n iterables of varied sizes and group the values using zip function in python.
3. Student Information: Write a program to create a list of tuples where each tuple contains the student ID, name, and grade and find the student with the highest grade.

4. Course Enrolment: Write a program to create list of tuples where each tuple contains the course ID and the number of students enrolled and find the total number of students enrolled across all courses
5. Faculty Information: Write a program to create a list of tuples where each tuple contains the faculty ID, name, and department and find all faculty members in a given department.
6. Library Book Tracking: You have a list of tuples where each tuple contains the book ID, title, and number of copies available. Write a program to find all books with fewer than 5 copies available.

Module-9: Sets & Dictionaries

1. Write a program to create two sets and perform the following operations:
 - i. Union
 - ii. Intersection
 - iii. Difference
 - iv. Asymmetric Difference
2. Write a program to generate a dictionary that contains numbers (between 1 and n) in the form of (x,x*x).
3. Write a program to implement a shopping cart where you can add items with their prices and quantities, and then calculate the total cost.
4. Banking System: Write a program to create dictionary with customer name and balance and retrieve the balance for a given customer, deposit a specified amount into a customer's account, Withdraw a specified amount from a customer's account if sufficient balance is available, Transfer a specified amount from one customer's account to another's and Remove a customer from the bank's system.

Module-10: Classes and objects

1. Create a class to represent menu items in a restaurant with attributes like name, price, and category. Implement methods to display menu details and calculate the total cost of a selected list of items.
2. Write a program to read 3 subject marks and display pass or failed using class and object.

Module-11: Files

1. Write a program to copy the contents of a file to another file.
2. Write a program to compute the number of characters, words and lines in a file.

Case Study:

Select any one application mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

1. Design a Python program to manage inventory, process orders, and handle customer information for an online store.
2. Create a library system to track books, manage member accounts, and handle book loans and returns.
3. Implement a personal finance management tool to track income, expenses, and generate monthly reports.
4. Create a system to manage student grades, calculate GPAs, and generate academic reports.

5. Develop a Python-based movie recommendation system using collaborative filtering.
6. Build a to-do list application that allows users to add, update, delete, and prioritize tasks..
7. Build a patient management system to handle appointments, medical records, and billing.
8. Design a digital menu for a restaurant with options for ordering, bill generation, and inventory management.
9. Implement a fitness tracking application to log workouts, track progress, and suggest exercise plans.
10. Build a secure online voting platform with user authentication and vote tallying.
11. Create a program to manage recipes, including ingredients, instructions, and nutritional information.
12. Build a travel planning application to manage itineraries, bookings, and budget tracking.
13. Develop an e-learning application with course creation, student enrolment, and progress tracking.
14. Build a car rental management system to handle bookings, returns, and vehicle maintenance.
15. Build a budget planning application to track expenses, income, and financial goals.
16. Develop a cryptocurrency tracking application to monitor prices, market trends, and portfolio performance.

Reference Books:

1. Python Programming: Using Problem Solving Approach by Reema Theraja , Oxford publications
2. Ashok N Kamthane, Amit Ashok Kamthane, Programming and Problem Solving with Python, 1st Edition, McGraw Hill Education (India), 2018.

Web References:

1. <https://www.python.org/doc/>
2. https://www.w3schools.com/python/python_reference.asp
3. <https://thepythonguru.com/>
4. <https://www.programiz.com/python-programming>

WEB TECHNOLOGIES LAB

I Year B. Tech. II semester

[Common to CSE, CSE (AI&ML), IT]

Course Code: 24CT11RC08

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Develop professional web pages for an application using HTML elements like lists, navigations, tables, various form elements, and embedded media, including images, audio, and video. (L3)
- CO2:** Build inline, internal, and external CSS to enhance the visual presentation of web pages, including layout, fonts, colors, and backgrounds. (L3)
- CO3:** Utilize JavaScript to develop interactive HTML web pages and validate form data. (L3)
- CO4:** Apply JavaScript functions and events to enhance user interaction and provide a dynamic user experience. (L3)
- CO5:** Experiment with XML files to store and display structured data and write a DTD to perform well-formed and validated XML documents. (L3)

Module-1:

Design a web page using Basic HTML Elements – Structure of HTML, Headings, Paragraph, Division and Span, List, Link, Image, Table, Form, Input, Iframe, and Media Elements.

Module-2:

Design the following static web pages required for an online book store website.

1. HOME PAGE:

- i. The static home page must contain three frames.

Top frame: Logo and the college name and links to the Home page, Login page, Registration page, Catalogue page, and Cart page (the description of these pages will be given below).

Left frame: At least four links for navigation, which will display the catalogue of respective links. For e.g.: When you click the link "CSE" the catalogue for CSE Books should be displayed in the Right frame.

Right frame: The pages to the links in the left frame must be loaded here. Initially, this page contains a description of the website.

- ii. Add media content in a frame using audio, video, and iframe elements to the Home page of an online bookstore website. The page should include:
- iii. Audio Element: An audio player to play background music or a podcast.
- iv. Video Element: A video player to display a promotional video about the bookstore.

- v. Iframe Element: An iframe to embed a Google Maps location of the bookstore.
- 2. **LOGIN PAGE**
- 3. **CATALOGUE PAGE:** The catalogue page should contain the details of all the books available on the website in a table: The details should contain the following:
 - i) Snapshot of Cover Page.
 - ii) Author Name.
 - iii) Publisher.
 - iv) Price.
 - v) Add to cart button.
- 4. **REGISTRATION PAGE:** Create a "registration form "with the following fields
 - i) **Username:** Text input field
 - ii) **Password:** Password input field
 - iii) **Email:** Email input field
 - iv) **Phone number:** Text input field
 - v) **Birthday:** Date picker
 - vi) **Favorite Color:** Color picker
 - vii) **Gender:** Select an element with options (Male, Female, Other).

Module-3:

Develop and demonstrate the usage of inline, internal, and external style sheets using CSS.

Module-4:

Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (colour, bold, and font size).

Module-5:

Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:

- 1. Input: Click on the Display Date button using onclick() function
Output: Display the date in the textbox.
- 2. Input: A number n obtained using prompt
Output: Factorial of n number using alert.
- 3. Input: A number n obtained using prompt
Output: A multiplication table of numbers from 1 to 10 of n using alert.
- 4. Input: A number n obtained using prompt and add another number using confirm
Output: Sum of the entire n numbers using alert.

Module-6:

Write JavaScript to validate the following fields of the Registration page.

- 1. First Name (Name should contain alphabets and the length should not be less than 6 characters).
- 2. Password (Password should not be less than 6 characters in length).
- 3. E-mail ID (should not contain any invalid and must follow the standard pattern name@domain.com)
- 4. Mobile Number (The phone number should contain 10 digits only).

5. Last Name and Address (should not be Empty).

Module-7:

Write an HTML page including any required JavaScript that takes a number from the text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets, and special characters.

Module-8:

Create an 'Employee' class extending from a base class 'Person'. The task should include:

1. Create a class 'Person' with attributes 'name' and 'age' and add a constructor to initialize these values.
2. Create a class 'Employee' that extends 'Person' and includes an additional attribute 'role,' with a constructor to initialize 'name,' 'age,' and 'role.'

Module-9:

Create an array of objects representing book details in an online bookstore. Each object should include the book title, author, genre, and price. Render the details of the books on the page using this array, demonstrating array creation, accessing array elements, and applying array methods.

Module-10:

Write an XML file which will display the Book information which includes the following:

- | | | |
|----------------------|----------------|--------------|
| a) Title of the Book | b) Author Name | c) ISBN Name |
| d) Publisher Name | e) Edition | f) Price |

Write a Document Type Definition (DTD) to validate the above XML file.

Case Study:

Select any one practical application mentioned below.

Note: A report has to be submitted by every student at the end of the semester, including design, coding, output, etc.

1. Portfolio Website: Create a personal portfolio website showcasing projects, skills, and experience using HTML, CSS, and JavaScript for interactive features.
2. Responsive Blog: Design a responsive blog template with multiple pages, utilizing HTML for structure, CSS for styling, and JavaScript for dynamic content.
3. E-commerce Site: Develop a basic e-commerce website with product listings, shopping cart functionality, and user authentication using HTML, CSS, and JavaScript.
4. Quiz Game: Create an interactive quiz game with multiple-choice questions, scoring, and feedback using HTML, CSS, and JavaScript for functionality.

5. To-Do List: Develop a to-do list application allowing users to add, edit, and delete tasks, with data persistence using JavaScript local storage.
6. Interactive Resume: Design a dynamic resume with sections for education, experience, and skills, including interactive elements powered by JavaScript.
7. Photo Gallery: Create an interactive photo gallery with image lightbox effects, using CSS for styling and JavaScript for functionality.
8. Recipe Finder: Build a recipe search application that fetches and displays recipes from an API, using JavaScript for dynamic content updates.
9. Expense Tracker: Develop an expense tracker app to log and categorize expenses, with data visualization using charts and graphs created with JavaScript.
10. Event Countdown: Create a countdown timer for upcoming events with HTML structure, CSS styling, and JavaScript for the timer logic.
11. Contact Form: Create a contact form with validation and submission handling using JavaScript, styled with CSS to match the site's theme.
12. Memory Game: Develop a memory matching game with cards that flip and match, using CSS for design and JavaScript for game logic.
13. Interactive Story: Design an interactive storytelling website where users make choices that affect the narrative, using JavaScript for decision logic.
14. Fitness Tracker: Build a fitness tracker to log workouts and track progress, with dynamic charts and data visualization using JavaScript.
15. Task Manager: Create a task manager application with features for adding, editing, and prioritizing tasks, using JavaScript for interactivity.
16. Interactive Timelines: Design interactive timelines to visualize historical events or project milestones, using HTML, CSS, and JavaScript.
17. Product Landing Page: Develop a product landing page with animations and interactive elements, using CSS for styling and JavaScript for effects.
18. Calculator: Build a fully functional calculator with basic arithmetic operations, using JavaScript for logic and CSS for design.
19. Job Board: Develop a job board where users can post and search for jobs, with dynamic content updates using JavaScript.
20. Interactive Form: Create a multi-step interactive form with validation and progress indicators, using JavaScript for form handling and CSS for styling.

References:

1. Internet and Web Technologies by Raj Kamal, Tata McGraw-Hill.
2. Programming the World Wide Web by Robert W. Sebesta, Pearson Education.

3. An Introduction to Web Design and Programming by Paul S Wang, Sanda S Katila, 1st Edition, Cengage Learning.

Web Links:

1. https://onlinecourses.swayam2.ac.in/nou24_cs18/preview
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview (HTML5)
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview (JavaScript)

DISCRETE MATHEMATICAL STRUCTURES

II Year B. Tech. I Semester
[Common to CSE, CSE (AI&ML), IT]

L	T	P	C
3	0	0	3

Course Code: 24BM11RC05

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Interpret relations through ordered pairs, mapping diagrams and tables [L5].
- CO2:** Analyze mathematical arguments using logical connectives and quantifiers and verify the validity of arguments using propositional logic [L4].
- CO3:** Define the main concepts related to primality, divisibility, congruences [L1].
- CO4:** Apply combinatorial principle and techniques to solve counting problems [L3].
- CO5:** Classify precise and accurate mathematical definitions of objects in graph theory [L2].

UNIT-I:

10 Lectures

SET THEORY AND RELATIONS : Sets - Operations on Sets, Principle of Inclusion – Exclusion - Relations - Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams – Functions – Bijective Function – Composition of Functions – Permutation Function - Recursive Function - Lattice and its Properties.

(Sections 2.1, 2.3, 2.4, 2.6, 4-1.1 to 4-1.3 of Text book 1)

UNIT-II:

10 Lectures

MATHEMATICAL LOGIC: Propositional Calculus: Statements and Notations, Logical Connectives, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Rules of Inference for Statement Calculus, Consistency of Premises, Indirect methods of proof. Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus.

(Sections 1.1 to 1.6 of Chapter 1 of Text book 1)

UNIT-III:

10 Lectures

MATHEMATICAL INDUCTION AND NUMBER THEORY: Mathematical Induction, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm,

Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Solving congruence, Fermat, Euler and the Chinese Remainder Theorems.

(Sections 5.1, 4.1, 4.2, 4.3, 4.4 of Text book 3)

UNIT-IV:

10 Lectures

RECURRENCE RELATIONS: Basics of Combinatorics -Function of Sequences, Formulation of Recurrence Relations, Generating Functions, Partial Fractions, Calculating Coefficient of Generating Functions, Solving Recurrence Relations - Substitution, Generating Functions and Method of Characteristic roots.

(Sections 3.1 – 3.6 of Text book 2)

UNIT-V:

10 Lectures

GRAPH THEORY : Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring – Trees - Spanning Trees – DFS and BFS algorithms - Minimum Spanning Trees – Kruskal's and Prim's algorithms. (Sections 10.1 - 10.8, 11.4 - 11.5 of Text book 3)

Text Books:

1. **J. P. Tremblay and P. Manohar**, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill.
2. **J. L. Mott, A. Kandel and T. P. Baker**, Discrete Mathematics for Computer Scientists and Mathematicians, 2nd Edition, Prentice Hall of India.
3. **K. H. Rosen**, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, Tata McGraw Hill.

Reference Books:

1. **Bernard Kolman, Robert C. Busby and Sharon Cutler Ross**, Discrete Mathematical Structures, PHI.
2. **S. K. Chakraborty and B. K. Sarkar**, Discrete Mathematics, Oxford, 2011.
3. **Seymour Lipschutz and Marc Lars Lipson**, Theory and Problems of Discrete Mathematics, Schaum's Outline Series, 3rd Edition, McGraw Hill.
4. **C. L. Liu and D. P. Mohapatra**, Elements of Discrete Mathematics-A Computer Oriented Approach, 3rd Edition, Tata McGraw Hill.
5. **Ralph. G. Grimaldi**, Discrete and Combinatorial Mathematics, Pearson Education, New Delhi.

MANAGERIAL ECONOMICS

II Year B. Tech. I semester

[CSE (AI&ML)]

Course Code: 24HM11RC01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understand principles and concepts of managerial economics (L2)

CO2: Analyse concepts of demand and utility (L4)

CO3: Identify and recognize the production function and cost analysis (L3)

CO4: Classify the knowledge on market structures and pricing (L4)

CO5: Examine various business cycles (L4)

UNIT-I

08 Lectures

Significance of Economics and Managerial Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions; Classification of Economics- Micro and Macro Economics. Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

UNIT-II

12 Lectures

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand, Assumptions and limitations. Exceptional demand curve; Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand. Demand forecasting methods and its uses. Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

UNIT-III

10 Lectures

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making-CVP Analysis- Calculations (Simple problems) and Limitations.

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs.

Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs; Economies and Diseconomies of scale.

UNIT-IV

10 Lectures

Market Structures and Pricing : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve; Monopolistic Competition. Pricing Analysis: Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing, Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

UNIT-V

08 Lectures

Business Cycles: Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles; Inflation and Deflation.

Textbooks:

1. Arya Sri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.
2. Sankaran, S., Managerial Economics, Marghan Publications, 2015, Chennai.
3. J.V. Prabhakara Rao & P. Venkata Rao, Managerial Economics and Financial Analysis, Maruthi Publications

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., Modern Economic Theory, S. Chand & Company Ltd., New Delhi, 2005.
3. Dr.B. Kuberudu & T.V. Ramana: Managerial Economics and Financial Analysis, Himalaya Publishing House

DATA STRUCTURES
II Year B. Tech. I Semester
[Common to CSE, CSE (AI&ML), IT, ECE]

Course Code: 24CT11RC09

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** **Outline** the concept of ADT, **identify** suitable data structures to solve problems, and experiment with different searching & sorting techniques using arrays. (L2,L3)
- CO2:** **Develop** and **analyse** algorithms for stacks, queues, and priority queues. (L3,L4)
- CO3:** **Model** linked list representations for various applications. (L3)
- CO4:** **Develop** and **analyse** algorithms for Binary Trees and Binary Search Trees. (L3,L4)
- CO5:** **Summarize** the concepts of Graph representation, graph traversals and hashing. (L2)

UNIT-I

10 Lectures

Data Structures: Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Introduction to array ADT.

Searching: Linear search, Binary search.

Sorting: Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort)

UNIT-II

10 Lectures

Stacks: Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Applications- Infix to Postfix Conversion, Evaluating Postfix Expressions.

Queues: Introduction to Queues, Representation of Queues-using Arrays, Implementation of Queues-using Arrays, Circular Queues.

Priority Queue: model, simple implementation, Binary Heap-structure property, heap order property, heap operations, Heap sort.

UNIT-III

12 Lectures

Linked List: Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal, Reversing Single Linked list, Double Linked list, Circular Linked list.

Applications on Single Linked list: Stacks and queues using linked list, Polynomial Expression Representation, Sparse Matrix Representation using Linked List.

UNIT-IV

10 Lectures

Introduction: Terminology, Representation of trees

Binary Trees: The ADT, Properties of binary trees, Binary tree Representations, Binary tree Traversals: in order traversal, preorder traversal, post order traversal

Binary Search Trees: Definition, Searching a BST, Insertion into a BST, Deletion from a BST

Efficient Binary Search Tree: AVL Trees.

UNIT-V

8 Lectures

Graphs: Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Hashing-Introduction, static hashing, hashing functions, overflow handling techniques.

Text Books:

1. Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahin, Universities Press.
2. Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss.

Reference Books:

1. Data Structures Using C. 2nd Edition, ReemaThareja, Oxford.
2. Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon, Cengage.

Web References (e-Resources):

1. https://onlinecourses.swayam2.ac.in/cec25_ma15/preview.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

II Year B. Tech. I semester
[Common to CSE, CSE (AI&ML), IT]

L	T	P	C
3	0	0	3

Course Code: 24CT11RC10

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1:** Explain the fundamental concepts of Object-Oriented Programming and Java features. (L2)
- CO2:** Apply inheritance and polymorphism concepts to develop reusable and maintainable java applications. (L3)
- CO3:** Utilize exception handling and multithreading techniques to enhance application reliability. (L3)
- CO4:** Build interactive GUI applications using Java Swing and event-driven programming. (L3)
- CO5:** Construct data handling mechanisms using Java I/O and develop JDBC applications to perform CRUD operations with MySQL. (L3)

UNIT-I

12 Lectures

An Overview of Java: Object-Oriented Programming- OOP Principles, The Java Buzzwords, A First Simple Program, Lexical Issues, Data Types, Variables, Arrays, Operators, Control Statements.

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, A Closer Look at Methods and Classes - Introducing Methods, Constructors, this Keyword, Garbage Collection, Overloading Methods, Using Objects as Parameters, Understanding static, Introducing final, Introducing Nested and Inner Classes, Using Command- Line Arguments.

UNIT-II

10 Lectures

Inheritance and Polymorphism: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, Constructor invocation- Execution of Constructors, Method Overriding, Run-time polymorphism - Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. Packages and Interfaces –Packages and Member Access, Importing Packages, Interfaces, Use static Methods, String Handling.

UNIT-III

10 Lectures

Exception Handling: Exception-Handling Fundamentals, Exception Types, Using try and catch, Multiple catch Clauses, Nested try Statements, Throw, Throws, Finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions.

Multithreaded Programming: The Java Thread Model, Creating a Thread and Multiple Threads, Thread States, Thread Properties, Thread Priorities, Synchronization, Inter thread Communication.

UNIT-IV

10 Lectures

Applets and Event Handling: Applets- A Simple Applet, The Applet HTML tag and its Attributes, Two Event Handling Mechanisms, Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Handling Mouse Events, Handling Keyboard Events, Adapter and Inner Classes.

Introducing GUI Programming: Using AWT Controls, Layout Managers, and Menus, Introducing Swing.

UNIT-V

8 Lectures

Input/Output: Exploring java.io, The Stream Classes, The Byte Streams, The Character Streams, Serialization.

Java Database Connectivity (JDBC): JDBC Introduction, JDBC Architecture, Java Database Connectivity with MySQL, CRUD operations.

Textbooks:

1. Java The Complete Reference (11th ed.), Herbert Schildt (2018), McGraw Hill. ISBN: 978-1260440232.
2. Object-Oriented Programming with Java (8th ed.), Balagurusamy, E (2019). McGraw Hill.

Reference Books:

1. Core Java Volume I - Fundamentals (8th ed.), Horstmann, Gary Cornell (2018), Pearson. ISBN: 978 813171945-9.
2. Java How to Program, Early Objects Version (11th ed.), Deitel, P., & Deitel, H. (2017). Pearson.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_cs58/preview
2. <https://docs.oracle.com/javase/tutorial/>
3. <https://www.udemy.com/course/java-tutorial/>
4. <https://www.edx.org/learn/java/universidad-carlos-iii-de-madrid-introduction-to-javaprogramming-starting-to-code-in-java>
5. <https://docs.oracle.com/javase/8/docs/technotes/guides/jdbc>

DATABASE MANAGEMENT SYSTEMS

II Year B. Tech. I Semester

[CSE (AI&ML)]

Course Code: 24CT11RC12

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Explain the basic concepts of Database Management System, levels of abstraction, architecture of DBMS. (L2)

CO2: Construct the E-R model to perform conceptual design and summarize the concepts of Basic SQL, Relational Algebra, Relational Calculus to manipulate the database. (L3)

CO3: Apply Relational Model concepts to perform various operations. (L3)

CO4: Relate and Plan the concept of data planning and database design using normalization. (L2)

CO5: Make use of the ACID properties, concurrency control mechanisms, File Organizations and Indexing Techniques. (L3)

UNIT-I

10 Lectures

Introduction: Database system, Characteristics (Database Vs File System), Advantages of Database systems, Database Applications. Describing and Storing Data in a DBMS – Relational Model, Levels of abstraction, Data Independence, Structure of a DBMS, People Who Work with Databases.

UNIT-II

10 Lectures

Introduction to Database Design: Database Design and E-R Diagrams, Entities, Attributes and Entity Sets, Relationship and Relationship Sets, Conceptual Design With the E-R Models.

Basic SQL: Simple Database schema, data types, table definitions (create, alter), Creating tables with relationship, Implementation of key and integrity constraints different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion).

Relational Algebra and Calculus: Relational Algebra-Selection and Projection, Set Operation, Renaming, Joins and Division, Relational Calculus.

UNIT-III

12 Lectures

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, The Relational Model Integrity Constraints Over Relations- Key Constraints-Foreign Key Constraints-General Constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non updatable), relational set operations, Complex Integrity Constraints in SQL, Triggers and Active Databases.

UNIT-IV

10 Lectures

Schema Refinement and Normal Forms: Introduction to schema refinement, functional dependency, Reasoning abouts FDs, Normal forms-1NF, 2NF, 3NF and Boyce-codd normal form (BCNF), Properties of Decomposition- Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT-V

10 Lectures

Transaction Management and Concurrency Control: Transaction, ACID properties, transaction log and transaction management with SQL using commit rollback and save point, Transactions and Schedules, Concurrent Execution of Transactions, Concurrency control with locking methods-lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering- Wait/Die and Wound/Wait Schemes Overview of Storage and Indexing - Data on External Storage, File Organizations and Indexing, Index data Structures

Textbooks:

1. Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH.
2. Database System Concepts, 5/e, Silberschatz, Korth, TMH.

Reference Books:

1. Introduction to Database Systems, 8/e C J Date, PEA.
2. Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA.
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web References:

1. <https://nptel.ac.in/courses/106/105/106105175/>

DATA STRUCTURES LAB

II Year B. Tech. I semester

[Common to CSE, CSE (AI&ML), IT, ECE]

Course Code: 24CT11RC14

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Apply different Searching and Sorting Techniques using arrays. (L3)

CO2: Experiment with different linear data structure concepts using stacks and Queues. (L3)

CO3: Develop linear data structure models using various Linked lists. (L3)

CO4: Build Binary Search Tree & AVL tree and examine their traversals. (L3)

CO5: Apply DFS and BFS graph traversal techniques. (L3)

Implement the following programs with either C/C++/JAVA/Python

Module-1: Searching

1. Write a program that use non recursive functions to perform linear search for a Key value in a given list.
2. Write a program that use non recursive functions to perform Binary search for a Key value in a given list.

Module-2: Sorting

1. Write a program that implement Bubble sort, to sort a given list of integers in ascending order.
2. Write a program that implement Selection sort, to sort a given list of integers in ascending order.
3. Write a program that implement Insertion sort, to sort a given list of integers in ascending order.

Module-3: Efficient Sorting

1. Write a program that implement Quick sort, to sort a given list of integers in ascending order.

Module-4: Stack & Queue

1. Write a program that implement stack (its operations) using arrays.
2. Write a program that implement Queue (its operations) using arrays.

Module-5: Singly Linked List

1. Write a program that uses functions to create and perform operations on singly linked list.

Module-6: Double Linked List

1. Write a program that uses functions to create and perform operations on double linked list.

Module-7: Circular Linked List

1. Write a program that uses functions to create and perform operations on circular linked list.

Module-8: Binary Search Trees

1. Write a program to Create a Binary Search Tree and Perform insertion and deletion operations.

Module 9: AVL tree

1. Write a program to Build an AVL tree and perform insertions.

Module-10: Graphs

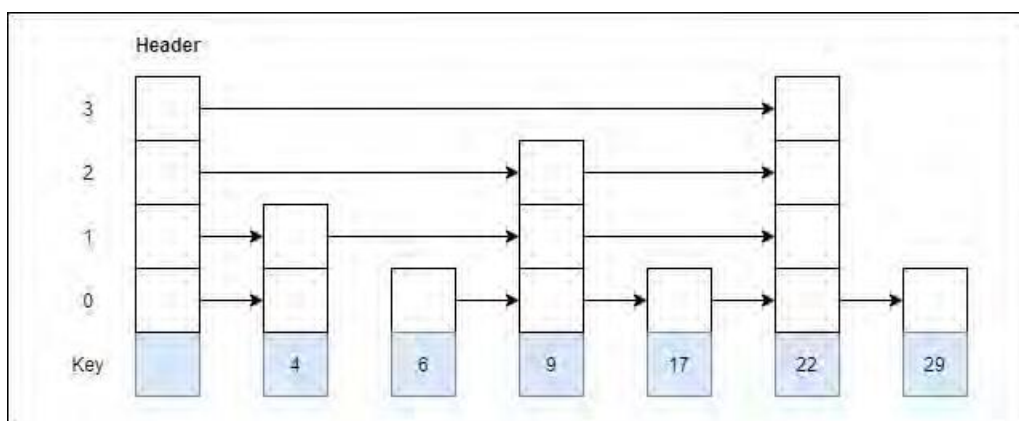
1. Write a program to implement Depth First Search
2. Write a program to implement Breadth First Search

Case Study: Select any five practical applications mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes requirements, design, coding, and output with testing results of a real example.

1. Demonstrate to convert an infix expression into a postfix expression and evaluate to find the result.
2. Demonstrate to convert an infix expression into a prefix expression
3. Demonstrate a queue using Linked List and Stack.
4. Demonstrate a sparse matrix using array and linked list
5. Create a skip list, to insert these following keys in the empty skip list.
 - a. 6 with level 1.
 - b. 29 with level 1.
 - c. 22 with level 4.
 - d. 9 with level 3.
 - e. 17 with level 1.
 - f. 4 with level 2.

Implement all basic operations of skip list and demonstrate with examples. Skip list structure is shown below for reference.

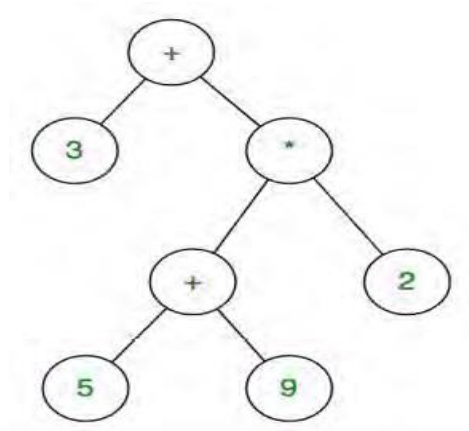


6. Given an array representation of min Heap, convert it to max Heap and then apply Heapsort concept to display the data in decreasing order.

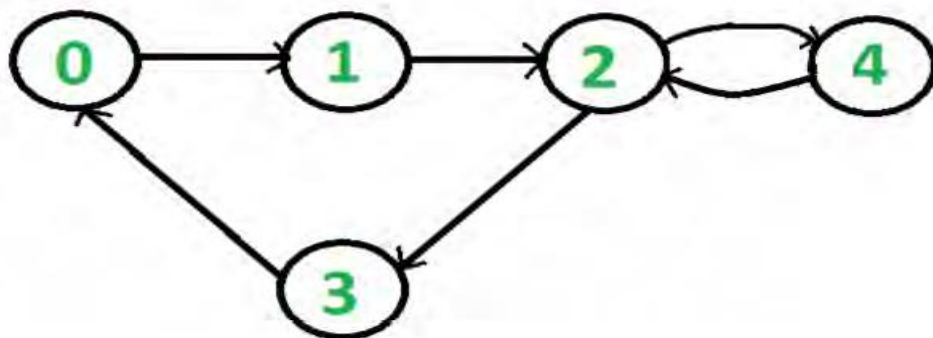
Input: arr[] = {3, 5, 9, 6, 8, 20, 10, 12, 18, 9}

7. Make use of Radix sort algorithm to sort an array by individual digits, starting with the least significant digit.
8. Model a linked list data structure to add two polynomials.
9. Design a system to manage employee records {empID, empname, dept, salary}, and implement efficient basic operations based on employee ID.
10. Construct an expression tree i.e. a binary tree in which each internal node corresponds to the operator and each leaf node corresponds to the operand.

For example: expression tree for $3 + ((5+9)*2)$ would be: Demonstrate with required operations to convert this above expression into corresponding prefix, and postfix expressions and evaluate the result of the expression.



11. Demonstrate topological sorting for a Directed Acyclic Graph (DAG) is a linear ordering of vertices such that for every directed edge $u \rightarrow v$, vertex u comes before v in the increasing order a vertex with no. of incoming edges.
12. Given a directed graph, check whether the graph contains a cycle or not. Your function should return true if the given graph contains at least one cycle, else return false. For example, the following graph contains two cycles $0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 0$ and $2 \rightarrow 4 \rightarrow 2$. Demonstrate with required operations to display the results in the form of true and the cyclic path if any. Make use of BFA concept to solve this problem.



13. Find the frequency of each character in a string using Hashing Data Structure

OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

II Year B. Tech. I semester
[Common to CSE, CSE (AI&ML), IT]

Course Code: 24CT11RC15

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Apply** fundamental Java programming constructs to develop basic applications. (L3)
- CO2: Construct** object-oriented programs to develop modular and reusable software components. (L3)
- CO3: Develop** robust applications by implementing exception handling, multithreading, techniques to enhance reliability and efficiency. (L3)
- CO4: Build** interactive Graphical User Interfaces (GUIs), handle user events, and perform file operations to create user-friendly applications. (L3)
- CO5: Utilize** Java Database Connectivity (JDBC) to manage data storage and retrieval in Java applications. (L3)

Module-1: If Condition, Switch Case, Command Line Arguments

- Write a Java program to determine whether a person is a Child, Teenager, or Adult based on their age. Children (age < 13) → Serve Water, Teenagers (13-19) → Serve Badam Milk, Adults (20 and above) → Serve Coke.
- Write a Java program that reads two command-line arguments. If both are numbers, add them. If both are strings, concatenate them. If neither, print an error message.
- Write a Java program that converts a student mark into words. Example: Input: 56 → Output: "Fifty-Six"(Assume valid marks are 0-100 only)

Module-2: Loops, Arrays

- Write a Java program to print the first 50 ugly numbers.
- Write a Java program to find leap years between 1947 and 2050.
- Write a Java program to compute the difference between the largest and smallest array values.

Module-3: Strings

- Write a Java program to reverse each word in a given sentence while maintaining the order of words.
- Write a Java program to check if two given strings are anagrams. Two strings are anagrams if they contain the same characters in the same frequency, but in a different

order (ignoring spaces and case sensitivity).

Module-4: Classes, Methods, Constructors

1. Write a Java program to illustrates Create a class Rectangle.The class has attributes length and width. It should have methods that calculate the perimeter and area of the rectangle. It should have read Attributes method to read length and width from user.
2. Write a Java program to create a class called Student with instance variables studentId, studentName, and grade. Implement a default constructor and a parameterized constructor that takes all three instance variables. Use constructor chaining to initialize the variables. Print the values of the variables.

Module-5: Inheritance, Polymorphism

1. Write a Java program to create a base class Vehicle with attributes like brand, model, and speed. Derive classes Car and Bike from Vehicle, each with unique attributes (e.g., Car has numDoors, and Bike has hasGear). Implement a method displayDetails() in each subclass to print specific details.
2. Write a Java program to create a base class BankAccount with methods deposit(), withdraw(), and calculateInterest(). Derive classes SavingsAccount and CurrentAccount. Override calculateInterest() in SavingsAccount to apply interest and in CurrentAccount to maintain a minimum balance condition.
3. Implement single and multi-level inheritance.
4. Demonstrate abstract classes with area calculation for shapes.

Module-6: Packages, Abstraction, Interface

1. Write a Java program to create an abstract class Medicine with a method displayLabel(). Derive classes Tablet, Syrup, and Ointment, each implementing displayLabel() with specific instructions (e.g., "Store in a cool place" for Tablet, "Shake well before use" for Syrup). Organize these classes in a package pharma.(Abstraction & Packages).
2. Write a Java program to define an interface BankAccount with methods deposit(), withdraw(), calculateInterest(), and displayBalance(). Implement this interface in SavingsAccount and CurrentAccount classes with specific logic. Place all classes in a package named banking.(Interface & Packages).
3. Write a Java program to create an abstract class Shape with an abstract method calculateArea(). Implement subclasses Circle, Rectangle, and Triangle to compute area based on user input. Use an interface Drawable with a method draw() to display the shape's type. Organize these classes in a package geometry. (Abstraction & Interface).

Module-7: Exception Handling, Multithreading

1. Write a Java program that describes exception handling mechanism with try, catch, finally, throw and throws.
2. Write a Java program to illustrate the concept of User defined Exceptions creation.
3. Write a Java program that creates threads by extending Thread class. First thread display —Good Morning —every 1 sec, the second thread displays —Hello GVPW— every 2 seconds and the third display —Welcome to JAVA— every 3 seconds, (Repeat the same by implementing Runnable).
4. Write a Java program to create a producer-consumer scenario using the wait() and notify() methods for thread synchronization.

Module-8: Event Handling & GUI Programming

1. Write a Java program to handle mouse and keyboard events.
2. Write a Java program to paint like paint brush in applet.
3. Write a Java program to demonstrate FlowLayout, BorderLayout, and GridLayout.

Module-9: File Handling

1. Write a Java program, which takes file/directory name from console and print whether it's a file or directory (if it exists). Also, print the details corresponding to it like is it readable, writable, where on disk is it located (absolute path), etc).
2. Write a Java program to count lines, characters, and words from a given text file as input.

Module-10: JDBC

1. Write a Java program to connect to a MySQL database using JDBC. The program should include fields such as id, name, and email in a table named users.
2. Write a Java program to implement functionality to insert a new user into the database and retrieve all records from the user's table.

Case Study:

Select any one application mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

Library Management System

Objective:

1. Develop a system for managing books, borrowers, and transactions.

OOP Concepts to be Applied:

- **Encapsulation:** Book, Member, and Transaction classes with private attributes.
- **Inheritance:** Subclasses like StudentMember and FacultyMember extending Member class.

- **Polymorphism:** Overriding calculateFine() method for different types of members.
- **Exception Handling:** Handling scenarios like issuing a book when none are available.
- **JDBC:** Storing book and member details in a database.

Implementation Details:

- Book class with attributes like title, author, ISBN, and availability.
- Member class with attributes like memberID, name, contact.
- Transaction class to record book issues and returns.
- LibraryManagement class to handle book issues, returns, and database interactions.

E-Commerce Shopping Cart

Objective:

Implement a shopping cart system that allows customers to browse products, add to cart, and place orders.

OOP Concepts to be Applied:

- **Encapsulation:** Product and Order classes to store item details securely.
- **Inheritance:** ElectronicItem and ClothingItem subclasses extending Product.
- **Polymorphism:** Applying discount methods differently for different product categories.
- **Collections Framework:** Using ArrayList and HashMap for cart management.
- **JDBC:** Connecting the system with a database to store orders.

Implementation Details:

- Product class with productID, name, price, category.
- Cart class using HashMap<Product, Integer> for storing cart items.
- Order class to store order details.
- E-commerce System class to manage transactions and payment processing.

Banking System Objective:

Design a banking application to manage customer accounts, transactions, and loans.

OOP Concepts to be Applied:

- **Encapsulation:** Account details are private with public getter/setter methods.
- **Inheritance:** SavingsAccount, CurrentAccount, LoanAccount extending Account.
- **Polymorphism:** Overriding calculateInterest() for different accounts.
- **Exception Handling:** Handling insufficient balance, invalid transactions.
- **Multithreading:** Handling multiple transactions simultaneously.

Implementation Details:

- Account class with accountNo, balance, ownerName.
- Transaction class to manage deposits, withdrawals.

- Bank class with ArrayList<Account> to store customer accounts.

Online Examination System Objective:

Build an online exam portal for students to take tests and view results.

OOP Concepts to be Applied:

- **Encapsulation:** Secure student and question data.
- **Inheritance:** MultipleChoiceQuestion and DescriptiveQuestion extending Question.
- **Polymorphism:** Implementing different grading strategies.
- **Event Handling:** Capturing user inputs for answers.
- **JDBC:** Storing student results in a database.

Implementation Details:

- Question class with questionID, questionText, options[], correctAnswer.
- Exam class to manage multiple questions.
- Student class with studentID, name, marks.

Hotel Booking System Objective:

Develop a system where users can book rooms, cancel bookings, and check availability.

OOP Concepts to be Applied:

- **Encapsulation:** Private room details with public methods.
- **Inheritance:** LuxuryRoom and EconomyRoom extending Room.
- **Polymorphism:** Overriding calculatePrice() for different room types.
- **JDBC:** Managing room bookings in a database.

Implementation Details:

- Room class with roomNumber, price, availability.
- Customer class storing customerID, name, contactDetails.
- Booking class handling room reservations.

Reference Books:

1. Herbert Schildt - Java: The Complete Reference (11th Edition), McGraw Hill, ISBN: 978-1260440232.
2. Cay S. Horstmann - Core Java Volume I - Fundamentals (8th Edition), Pearson, ISBN:978-0135166307.
3. E. Balagurusamy - Object-Oriented Programming with Java (8th Edition), McGraw Hill, ISBN: 978-9353162344.

4. Paul Deitel & Harvey Deitel - Java: How to Program (11th Edition), Pearson, ISBN: 978-0134743356.

Web References (e-Resources):

1. <https://docs.oracle.com/javase/tutorial/>
2. https://onlinecourses.nptel.ac.in/noc20_cs58/preview

DATABASE MANAGEMENT SYSTEMS LAB

II Year B. Tech. I semester
[Common to CSE, CSE (AI&ML), IT]

Course Code: 24CT11RC16

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

- CO1: Build** the database using SQL DDL, DML commands and make use of built-in functions to write queries. (L3)
- CO2: Identify** and implement different operators and Apply nested queries to solve real time problems. (L3)
- CO3: Plan** Queries on Joins, Aggregate functions, views. (L3)
- CO4: Construct** simple PL/SQL programs using control statements and exception handling methods. (L3)
- CO5: Develop** applications using PL/SQL including procedures, functions, cursors, packages and triggers. (L3)

Implement the following modules using ORACLE

Module-1:

Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.

Module-2:

Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)

Module-3:

Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT
Constraints

Module-4:

Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, ORDER BY, HAVING clauses

Module-5:

Queries on Views and Joins

Module-6: PL/SQL

1. Create a simple PL/SQL program which includes declaration section, executable section and exception Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
2. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

Module-7:

Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.

Module-8:

Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT-IN Exceptions, and USER DEFINED Exceptions, RAISE_APPLICATION_ERROR

Module-9:

Programs development using creation of procedures, passing parameters IN and OUT of Procedures

Module-10:

Program development using creation of functions, invoke functions in SQL Statements and write complex functions

Module-11:

1. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
2. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers

Case Study:

Select any one application mentioned below and Apply the Database Design steps

Note: A report has to be submitted by every student at the end of the semester

1. Accounting Package for Shops
2. Database Manager for Magazine Agency or Newspaper Agency
3. Ticket Booking for Performances

4. Preparing Greeting Cards & Birthday Cards
5. Personal Accounts - Insurance, Loans, Mortgage Payments, Etc.,
6. Doctor's Diary & Billing System
7. Personal Bank Account
8. Class Marks Management
9. Hostel Accounting
10. Video Tape Library
11. History of Cricket Scores
12. Cable TV Transmission Program Manager
13. Personal Library
14. Sailors Database
15. Suppliers and Parts Database

Reference Books:

1. Oracle: The Complete Reference by Oracle Press.
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007.
3. Rick F Vander Lans, —Introduction to SQL, Fourth Edition, Pearson Education, 2007.

Web References:

1. <https://docs.oracle.com/en/>
2. https://www.w3schools.com/sql/sql_exercises.asp
3. <https://www.w3resource.com/sql-exercises/>

CONTINUOUS INTEGRATION AND CONTINUOUS DELIVERY USING DEVOPS

II Year B. Tech. I semester
[Skill Course: CSE (AI&ML), IT]

Course Code: 24CT11SC01

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Illustrate** the DevOps lifecycle, install and configure Git, execute Git commands, create and manage GitHub repositories, and perform file operations using version control. (L2)
- CO2: Make Use of** Freestyle pipeline jobs to perform upstream/downstream relationships and develop CI/CD pipelines using Declarative and Scripted approaches. (L3)
- CO3: Build** Java applications using Maven, configure dependencies, generate JAR files, and deploy a Spring-based web application. (L3)
- CO4: Utilize** Docker to execute container management commands, create custom Docker images, and containerize Python Flask to Spring Boot applications. (L3)
- CO5: Demonstrate** containerized applications on Kubernetes. (L2)

Module -1: Introduction to DevOps, Git installation, and basic Git commands.

1. Introduction to DevOps and DevOps Life Cycle, installation of Git and Demonstrate git Commands.

Module-2: GitHub repository creation, cloning, and file management.

1. Create a GitHub repository, clone it to your local system, create a text file (sample.txt) in the local repository with some content, stage and commit the file, push the changes to the remote repository, and verify that the file is successfully updated in the GitHub repository.

Module -3: Jenkins installation, Freestyle Projects, and Build Pipeline Plugin.

1. Jenkins Installation & Setup, Create a Freestyle Project in Jenkins to Execute a Simple Java , Html , Python Applications.
2. Create Three Freestyle Jobs, Configuring Upstream and Downstream Relationships, and Visualizing the Pipeline Using the Build Pipeline Plugin in Jenkins.

Module -4: Declarative and Scripted Pipelines in Jenkins.

1. Demonstrate Declarative Pipeline and Scripted Pipeline in Jenkins.
2. Write a Declarative Pipeline script and Configure a Pipeline Job in Jenkins.

Module -5: Jenkins CI/CD Pipelines

1. Create a Declarative Pipeline script (Jenkins file) with stages for Checkout, Build, Test, and Deploy. Configure post actions to handle success, failure, and always conditions.
2. To create Pipeline Jobs in Jenkins where one pipeline job (pipelineJob-2) triggers another pipeline job (pipelineJob-1), demonstrating the creation of upstream and downstream relationships between pipeline jobs.

Module -6: Building and Deploying Applications

1. Create a simple Java application that prints "Hello, World!" to the console. Configure the pom.xml file to include the necessary Maven plugins, build the application using Maven, and execute the resulting JAR file using Java.
2. Create a simple Java web application using the Spring Framework that displays a welcome message when accessed via a web browser. Configure the pom.xml file to include the necessary dependencies, build the application using Maven, and execute the resulting JAR file using Java.
3. Create a simple Java web application, configure the pom.xml file to include the necessary dependencies, build the application using Maven, and deploy the application using Tomcat.

Module -7: Docker installation, basic commands, and custom image creation.

1. Install Docker and practice essential Docker commands to pull images, run containers, and manage them.
2. Create a custom Docker image using a Dockerfile and run a container from it.

Module -8: Containerizing Python Flask and Spring Boot applications.

1. Develop a Python Flask web application and containerizing it using Docker.
2. Create a simple Java web application using the Spring Framework that displays a welcome message. Configure the pom.xml file to include the necessary dependencies, build the application using Maven, and deploy it into a Docker container.

Module -9: Kubernetes installation, commands, and deploying containerized applications.

1. Exploring Kubernetes Commands used for interacting with a Kubernetes cluster, managing resources, and troubleshooting issues. Build and Deploy Containerized Applications on Kubernetes.

Case Study: End-to-End CI/CD Pipeline for a Web Application

Note: A report has to be submitted by every student at the end of the semester that includes the following:

Objective:

Develop a web application and implement a CI/CD pipeline to automate the build, testing, deployment, and orchestration of the application using the following tools and technologies:

1. **Version Control:** Use Git for version control and GitHub for remote repository management.
2. **Build Tool:** Use Maven to build the application.
3. **CI/CD Tool:** Use Jenkins to automate the CI/CD pipeline.
4. **Containerization:** Use Docker to containerize the application.
5. **Orchestration:** Use Kubernetes to deploy and manage the containerized application.

Reference Books:

1. Learning Continuous Integration with Jenkins: A beginner's guide to implementing Continuous Integration and Continuous Delivery using Jenkins - Nikhil Pathania ,Packt publication.
2. Jenkins 2 – Up and Running: Evolve Your Deployment Pipeline for Next Generation Automation - Brent Laster, O__Reilly publication

Web References:

1. <https://www.jenkins.io/doc/book/>

PROFESSIONAL ETHICS AND HUMAN VALUES

II Year B. Tech. I Semester
[Common to CSE(AI&ML), ECE, EEE]

L	T	P	C
2	0	0	0

Course Code: 24HM11MC01

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Make use of the human values, morals and ethical principles that ought to govern the engineering profession [L3]

CO2: Relate the importance of human values and professional/engineering ethics at work. [L1]

CO3: Cultivate the moral values and dispositions that engineers ought to instill and tackle ethical challenges and moral dilemmas in engineering by utilizing ethical theories and moral development concepts. [L3]

CO4: Outline the knowledge of risk assessment techniques, rights and maintain good Collegiality and loyalty to prevent occupational crime [L2].

CO5: Identify global issues and use ethical principles to navigate professional challenges [L3].

UNIT-I

06 Lectures

HUMAN VALUES: Values - Respect - Caring - Sharing - Honesty- Courage - Self-confidence-Self exploration- Self-awareness –Intentional competency - Communal Harmony-character- Spirituality.

UNIT-II

06 Lectures

PROFESSIONAL VALUES: Integrity - Discipline - Valuing time - Cooperation - Commitment - Empathy- Code of conduct - Challenges in the workplace.

UNIT-III

06 Lectures

PROFESSIONAL ETHICS: Overview - Engineering ethics –Theories of moral developments- Kohlberg Theory- Gilligan theory- Heinz dilemma.

Moral issues - Profession - Models of professional roles – Responsibility.

UNIT-IV

06 Lectures

RESPONSIBILITIES AND RIGHTS: Safety and risk - Collegiality and loyalty - Confidentiality - Occupational crime – Human rights - Employee rights - Intellectual property rights.

UNIT-V

06 Lectures

GLOBAL ISSUES: Globalization - Environmental ethics - Computer ethics - Code of ethics - Multinational corporations - Engineers as advisors in Planning and Policy making.

Text Books:

1. R.S. Nagarajan. A Textbook on Professional Ethics and Human Values. New Age International Publishers. 2006.
2. R. Subramanian. Professional Ethics. OUPIndia.2013.

Reference Books:

1. Premvir Kapoor. Professional Ethics and Human Values. Khanna Publishing House.2019.
2. B.S. Raghavan. Human Value and Professional Ethics. S. Chand Publications. 2012.
3. R.R. Gaur & Others. A Foundation Course in Human Values and Prof. Ethics. Excel Books. 2009.
4. A.N. Tripathi. Human Values. New Age International (P) Limited.2009

PROBABILITY AND STATISTICS

II Year B. Tech. II Semester
[Common to CSE, CSE (AI&ML), IT]

L	T	P	C
3	0	0	3

Course Code: 24BM11RC06

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Analyze** the statistical data using various graphical techniques and compute the key descriptive measures to **interpret** the distribution, spread, and shape of a dataset [L5].
- CO2: Determine** the mean and variance of discrete and continuous random variables and **identify** various types of discrete and continuous distributions like Binomial, Poisson and Normal [L5].
- CO3:** Compute the sampling distribution of means, variance, and the difference of two means and **construct** a confidence interval to estimate population mean [L3].
- CO4:** Draw **inference** by a test of hypothesis concerning means, variances, and proportions [L4].
- CO5: Utilize** the method least squares to fit a curve like straight line, parabola, exponential function and **interpret** the coefficient of correlation to find the relationship between the variables [L3].

UNIT-I:

08 LECTURES

DESCRIPTIVE STATISTICS : Introduction to Statistics – Populations and Samples – Data Analysis – Graphical Representation – Scatter Plot – Stem and Leaf plot – Histograms - Box plot – Measures of Central tendency – Measures of Dispersion - Coefficient of variation - Standard Deviation of combination of two groups – Moments - Skewness - Kurtosis. (Sections: 1 and 6 of Chapter 1 of Text Book 1, 25.5 – 25.11 of Text Book 2)

UNIT-II:

12 LECTURES

RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS : Review of probability and Baye's Theorem - Random Variables - Discrete and Continuous Probability Distributions - Mathematical Expectation and Variance of random variables - Mean and Variance of Linear combination of Random Variables – Binomial Distribution – Poisson Distribution – Normal Distribution.
(Sections: 1 - 3 of Chapter 3 of Text Book 1, 1 – 3 of Chapter 4 of Text Book 1, 1 – 2, 5 of Chapter 5 of Text Book 1, 2 -5 of Chapter 6 of Text Book 1)

UNIT III:

10 LECTURES

SAMPLING DISTRIBUTIONS AND ESTIMATION: Populations and Samples – Statistic, Parameter - Sampling Distributions – Sampling Distribution of means – Central Limit Theorem – Sampling Distribution of Difference of Two means – t- Distribution - Sampling Distribution of Variance - χ^2 -distribution – F- Distribution.

Estimation: Point Estimation – Unbiased Estimator – Standard Error of Point Estimate - Interval Estimation – Estimating the mean, Proportion (Single Sample).

(Sections: 1 - 7 of Chapter 8 of Text Book 1, 1 – 7, 10 of Chapter 9 of Text Book 1)

UNIT-IV:

10 LECTURES

TESTS OF HYPOTHESIS: Statistical Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning single mean – Test concerning Two means – Paired t- test – Tests Concerning Single and Two Proportions – Tests Concerning Variances – Goodness of Fit test. (Sections: 1 – 5, 8 – 11 of Chapter 10 of Text Book 1)

UNIT-V:

08 LECTURES

CURVE FITTING AND CORRELATION: Curve Fitting - Method of Least Squares – Straight Line - Parabola – Exponential – Power curves. Correlation – Correlation coefficient – Lines of Regression.

(Sections: 24.4 – 24.6, 25.12 – 25.14 of Text Book 2)

Text Books:

1. **Ronald E. Walpole Raymond H. Myers Sharon L. Myers, Keying Ye**, Probability and Statistics for Engineers and Scientists, 9th Edition, Pearson Publications, 2023.
2. **B. S. Grewal**, Higher Engineering Mathematics, 45th Edition, Khanna Publishers, 2024.

Reference Books:

1. **Richard A.Johnson**, “Miller & Freund’s Probability and Statistics for Engineers”, 8th Edition, PHI Learning India Private Limited, 2011.
2. **T. Veerarajan** - Probability, Statistics and Random Processes (3rd Edition) - Tata McGraw-Hill Education

Web References:

1. <https://archive.nptel.ac.in/courses/111/105/111105090/>
2. <https://nptel.ac.in/courses/111102160>

COMPUTER ORGANIZATION

II Year B. Tech. II semester
[CSE (AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24CT11RC11

Course Outcomes: At the end of the Course, the student shall be able to

- CO1: Demonstrate** the design of major components of a basic computer such as register, transfer Micro-operations and arithmetic logic shift unit. (L2)
- CO2: Classify** various instruction codes, timing & control unit and understand the design of CPU, Micro-programmed control Unit. (L2)
- CO3: Make Use of** register organization, instruction formats, and addressing modes to understand the working of central processing units (CPUs) and 8086 microprocessors. (L3)
- CO4: Interpret** different ways of communication with I/O devices and parallel processors. (L2)
- CO5: Outline** the performance of various memory modules and to comprehend computer arithmetic algorithms. (L2)

UNIT-I

08 Lectures

Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro-operations, Shift Micro operations, Arithmetic Logic Shift Unit.

UNIT-II

10 Lectures

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Micro Programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

UNIT-III

12 Lectures

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.

Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC).

8086 Microprocessor: Family Overview, Internal Architecture.

UNIT-IV

10 Lectures

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline.

Input/Output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access.

UNIT-V

10 Lectures

Computer Arithmetic: Addition and Subtraction with Signed-Magnitude Data, Booth Multiplication Algorithm.

Memory Organization: Memory Hierarchy, Main memory, Associative Memory, Cache Memory.

Textbooks:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept.2008.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.

Reference Books:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.
2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN81- 7319-609-5.
3. Computer System Architecture, John. P.Hayes.

Web References:

1. NPTEL :: Computer Science and Engineering - NOC:Computer architecture and organization

DESIGN AND ANALYSIS OF ALGORITHMS

II Year B. Tech. II Semester

[Common to CSE, CSE (AI&ML), IT]

Course Code: 24CT11RC18

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Analyse the time and space complexities of algorithms using growth of functions. (L4)

CO2: Apply and **analyse** divide and conquer and greedy paradigm to generate efficient solutions of real-time problems. (L3,L4)

CO3: Develop and **analyse** algorithms using dynamic programming paradigm to generate optimal solutions of real-time applications. (L3,L4)

CO4: Develop and **analyse** algorithms using Backtracking paradigm to generate optimal solutions of real-time applications. (L3,L4)

CO5: Develop and **analyse** algorithms using Branch and Bound paradigm to generate optimal solutions of real-time applications. Classify polynomial and non-polynomial problems. (L3,L4)

UNIT-I

08 Lectures

Introduction: Algorithm Criteria, Algorithm Specification, Performance Analysis-Space Complexity, Time Complexity, Asymptotic Notations, Amortized Analysis.

UNIT-II

12 Lectures

Divide and Conquer: General Method, The master method for solving recurrences, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.

The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees, Single Source Shortest Paths.

UNIT-III

10 Lectures

Dynamic Programming: The General Method, Multistage Graphs, All Pairs-Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack Problem, Reliability Design, The Traveling Salesperson Problem.

UNIT-IV

10 Lectures

Backtracking: The General Method, The 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles, Knapsack Problem.

UNIT-V

10 Lectures

Branch and Bound: The Method - Least Cost (LC) Search, The 15-puzzle, Control Abstraction for LC- Search, Bounding, FIFO Branch-and-Bound, LC Branch-and-Bound, 0/1 Knapsack Problem, Traveling Salesperson Problem.

NP-Hard and NP-Complete problems: Basic concepts, Non-Deterministic Algorithms, The Classes NP-hard and NP-Complete, Cook's Theorem.

Textbooks:

1. Introduction to Algorithms, 3rd Edition edition by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, PHI.
2. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press.

Reference Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson, 4th edition
2. S. Sridhar, —Design and Analysis of Algorithms, Oxford University Press.

Web References:

1. <http://nptel.ac.in/courses/106101060/>

DATA WAREHOUSING AND DATA MINING

II Year B. Tech. II semester
[CSE (AI&ML)]

Course Code: 24CT11RC19

L	T	P	C
3	0	0	3

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

CO1: Illustrate the importance of Data Mining and its functionalities. (L2)

CO2: Summarize various Data Preprocessing Techniques and outline concepts of data warehousing. (L2)

CO3: Apply various classification algorithms on real world data to perform classification, model evaluation. (L3)

CO4: Make use of association rule mining techniques viz. Apriori and FP Growth algorithms and analyze on frequent item sets generation. (L3)

CO5: Outline the various clustering methods of unsupervised learning evaluate the result. (L2)

UNIT-I

7 Lectures

Introduction: Importance of Data Mining and Data Warehousing, Kinds of Patterns can be mined, Which Technologies Are Used, Applications, Major Issues in Data Mining Getting to Know Your Data: Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity

UNIT-II

12 Lectures

Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data Warehousing and OLAP Technology: Basic Concepts of Data warehouse, Data Warehouse Modelling: Data Cubes and OLAP, Data Generalization by Attribute Oriented Induction

UNIT-III

10 Lectures

Classification: Basic Concepts, General Approach to solving a classification problem, Decision, Tree Induction: Attribute Selection Measures, Tree Pruning, Bayes Classification Methods, Model Evaluation and Selection.

UNIT-IV

10 Lectures

Association Analysis: Problem Definition, Frequent Item set Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP- Growth Algorithm.

UNIT-V

10 Lectures

Cluster Analysis: Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Agglomerative Clustering Algorithm, DB SCAN Algorithm, Evaluation of Clustering.

Text Books:

1. Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
2. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
3. Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford.

Web References (e-Resources):

1. NPTEL course by Prof.Pabitra Mitra http://onlinecourses.nptel.ac.in/noc17_mg24/previe
2. NPTEL course by Dr. Nandan Sudarshanam& Dr. Balaraman Ravindran)
http://www.saedsayad.com/data_mining_map.html

ARTIFICIAL INTELLIGENCE

II Year B. Tech. II semester

[CSE (AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24IA11RC01

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

- CO1: Outline** basic knowledge of Artificial Intelligence and the role of AI in various problem solving methods using informed and uninformed strategies. (L2)
- CO2: Utilize** logic concepts, including propositional and predicate logic to formalize reasoning and problem-solving tasks. (L3)
- CO3: Make use of** rules in knowledge representation techniques to encode knowledge in the evolution of AI. (L3)
- CO4: Extend** the concepts and methods in advanced AI by including symbolic reasoning under uncertainty and Statistical Reasoning. (L2)
- CO5: Construct** plans for solving hard problems in playing games, could learn from its mistakes and improve its performance to shape expert systems. (L3)

UNIT-I

10 Lectures

Introduction to Artificial Intelligence: Introduction, Brief History, Intelligent Systems, Foundations of AI, Applications, Tic-Tac-Toe Game Playing.

Problem Solving:

General Problem Solving, Characteristics of Problem, Exhaustive Searches (BFS, DFS, and Depth-First Iterative Deepening Search), Heuristic Search Techniques (Hill Climbing, Best-First Search, A* Algorithm), Iterative Deepening A*, Constraint Satisfaction, Means-Ends Analysis

UNIT-II

10 Lectures

Logic Concepts: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic.

Predicate Logic: Representing Simple Facts in Logic, Representing Instance and is-a Relationships, Computable Functions and Predicates, Resolution.

UNIT-III

10 Lectures

Knowledge Representation: Approaches to Knowledge Representation, Knowledge Representation Using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation Using Frames.

Advanced Knowledge Representation Techniques: Conceptual Dependency Theory, Script Structure, CYC Theory, Case Grammars, Semantic Web.

UNIT-IV

10 Lectures

Symbolic Reasoning Under Uncertainty: Introduction to Non-Monotonic Reasoning, Logics for Non-Monotonic Reasoning, Implementation using Depth-First-Search With Dependency-Directed Backtracking, Implementation using Breadth-First-Search.

Statistical Reasoning: Probability and Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic.

UNIT-V

10 Lectures

Game Playing: The Minimax Search Procedure, Adding Alpha-Beta Cutoffs.

Planning: An Example Domain-The blocks World, Components of a Planning System, Goal Stack Planning.

Expert Systems and Applications: Phases in Building Expert Systems, Expert System Architecture, Expert System Vs Traditional Systems, Rule-Based Expert Systems, Application of Expert Systems, List of Shells and Tools

Text Books:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw -Hill Publications.
2. Artificial Intelligence - Saroj Kaushik, CENGAGE Learning. ISBN-13: 978-81-315-1099, ISBN 10: 81-315-1099-9

Reference Books:

1. Artificial intelligence, A modern Approach, 3rd ed, Stuart Russel, Peter Norvig, PEA , ISBN: 978-93-325-4351-5.
2. Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5th ed, PEA, ISBN: 978-81-317-2327-2.

Web References (e-Resources):

1. <https://nptel.ac.in/courses/106102220>

ALGORITHMS LAB THROUGH C++

II Year B. Tech. II semester
[Common to CSE, CSE (AI&ML), IT]

Course Code: 24CT11RC21

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Apply** the object-oriented concepts such as class, object, inheritance, encapsulation and other features. (L3)
- CO2: Develop** the code to demonstrate merge sort, quick sort and other applications using divide and conquer technique. (L3)
- CO3: Make use of** Greedy and Dynamic Programming techniques to design and implement various optimal problems. (L3)
- CO4: Utilize** backtracking technique to solve the optimal problems like sum of subsets and Hamiltonian cycles. (L3)
- CO5: Build** the optimal problems like Travelling Sales Person Problem using branch and bound technique. (L3)

Module-1: Basics of C++

1. Write a C++ program to demonstrate the keywords continue and break.
2. Read a value n=10 and display 1, 2, 3, 5, 6, 8, 10 and 1, 2, 3, 4, 5.
3. Write a C++ program to create a Calculator to find addition, subtraction, multiplication, division, or remainder of two given numbers using the switch Statement as user's choice.
4. Write a C++ program to demonstrate call-by-value and call-by reference concepts to swap two numbers.
5. Write a C++ program to demonstrate function overloading by using function area with different combination of required parameters to calculate the area of a square, rectangle, and circle by taking suitable input values as float or integer.

Module-2: OOP concepts using C++

1. Write a C++ program using a class called Student with the following attributes within it. **student_roll, student_name, programme_name, phone_number, grade** Create n=7 Student objects and print the **student_roll, student_name, programme_name, phone_number, and grade>8.0** of these objects with suitable headings. Demonstrate the program using constructor and destructor.
2. Write a C++ program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.

Module-3: Inheritance using C++

1. Write a C++ program to design a superclass called Staff with details as StaffId, Name, Phone, and Salary. Extend this class by writing three subclasses namely Teaching (branch, highest_degree, no_of_publications), Technical (skills), and Contract (period). Read and display at least 3 staff objects of all three categories. Demonstrate above program by deriving subclasses using all three access modes (public, private, and protected).

Module-4: Divide-and-Conquer

1. Write a C++ program to demonstrate following sorting techniques
 - a. Merge Sort
 - b. Quick Sort

Read at least 15 numbers in a range of 1 to 100 and display the sorted output.

2. Write a C++ program to find the Maximum and Minimum element in the given Array

Module-5: The Greedy Method

1. Write a C++ program to find solution for job sequencing with deadlines problem.
2. Write a C++ program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
3. Write a C++ program to perform Single source shortest path problem for a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.

Module-6: Dynamic Programming

1. Write a C++ program to implement following algorithms using Dynamic Programming Concept.
 - a. All-Pairs Shortest Paths problem using Floyd's algorithm
 - b. 0/1 Knapsack problem

Module-7: Backtracking:

1. Write a C++ program to implement following algorithms using Backtracking Concept.
 - a. Sum of subsets problem for a given set of distinct numbers
 - b. Hamiltonian cycle problem.

Module-8: Branch and Bound

1. Write a C++ program to implement following algorithm using Branch and Bound Concept.
 - a. Travelling Sales Person problem.

Case Study: Select any five practical applications mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

1. To Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of $n \geq 5000$ and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using CPP how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
2. To sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n \geq 5000$, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using CPP how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.
3. Write a C++ program to implement Strassen's Matrix Multiplication Algorithm using the divide and conquer technique.
4. Write a C++ program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
5. Write a C++ program to implement reliability optimization in system design using Dynamic Programming (DP). The goal is to select a combination of components that provides the maximum system reliability while staying within a given budget.
6. Write a C++ program to implement the Optimal Binary Search Tree (OBST) algorithm using Dynamic Programming (DP). The goal is to arrange search terms based on their frequencies so that frequent queries are retrieved faster, optimizing the auto-complete feature in a search engine.
7. Write a C++ program to implement the Graph Coloring Problem using the Backtracking Algorithm for scheduling university exams. The goal is to assign the minimum number of time slots (colors) to subjects such that no two exams with common students (conflicting subjects) are scheduled at the same time.
8. Write a C++ program to implement the N-Queens Problem using the Backtracking Algorithm to arrange students in a classroom, exam hall, or conference room while maintaining social distancing. The goal is to ensure that: No two students sit in the same row, No two students sit in the same column, No two students sit diagonally adjacent.
9. Write a C++ program to solve the 0/1 Knapsack Problem using the Branch and Bound approach. Consider a scenario where a relief truck has a fixed weight capacity, and you must select essential supplies (food, medicine, blankets, etc.) to maximize the total priority value while staying within the weight limit.

10. Write a C++ program to solve the 15-Puzzle Problem using the Branch and Bound approach. The goal is to arrange the tiles in ascending order (from 1 to 15) with the blank space (0) at the bottom-right corner by sliding tiles into the empty space using the fewest moves.

Reference Books:

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press.
2. J. Kleinberg and E. Tardos, Algorithm Design, Addison-Wesley.
3. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins.
4. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press.
5. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, John Wiley.
6. R. Sedgewick, Algorithms in C (Parts 1-5), Addison Wesley.
7. M. H. Alsuwaiyel, Algorithm Design Techniques and Analysis, World Scientific.
8. Gilles Brassard and Paul Bratley, Algorithmics: theory and practice, Prentice-Hall.
9. Udi Manber, Introduction to Algorithms: A Creative Approach, Addison-Wesley.
10. Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, Addison-Wesley.

Web References:

1. <https://archive.nptel.ac.in/courses/106/105/106105164>
2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-toalgorithms-fall-2011/>

DATA MINING LAB USING PYTHON

II Year B. Tech. II semester

[CSE (AI&ML)]

Course Code: 24AI11RC01

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Make Use of Numpy, Pandas to perform operations on Arrays, Vectors, Data Structures and Matplotlib, Seaborn libraries to create various plots

CO2: Perform data Pre-processing tasks such as Data Cleaning, Data Transformation on the real world data and Utilize Streamlit Library to create interactive data apps.

CO3: Construct Python Program using various classification algorithms to classify new, unseen observations.

CO4: Build Python Program to Apply Apriori Algorithm for generating frequent Item Sets and Association Rules.

CO5: Identify clusters for the realistic data using K-Means Clustering algorithm in Python

Module-1: NumPy Basics: Arrays and Vectorized Computation

- The NumPy ndarray, Creating ndarrays, Data Types for ndarrays
- Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing, Pseudorandom Number Generation, Mathematical and Statistical Methods
- Linear Algebra

Module-2: Getting Started with pandas

- Introduction to pandas Data Structures- Series, DataFrame
- Index Objects, Reindexing, Dropping Entries from an Axis, Indexing, Selection and Filtering
- Arithmetic and Data Alignment
- Sorting and Ranking, Axis Indexes with Duplicate Labels
- Summarizing and Computing Descriptive Statistics
- Correlation and Covariance
- Unique Values, Value Counts, and Membership

Module-3: Plotting and Visualization: Use matplotlib and seaborn to create the following plots

- Line Plots
- Bar Plots
- Histograms and Density Plots

iv. Scatter or Point Plots

Module-4: Load, Storing and Data Cleaning

- i. Reading and Writing Data in Text Format
- ii. Handling Missing Data, Filtering Out Missing Data, Filling In Missing Data

Module-5: Data Transformation

- i. Removing Duplicates, Replacing Values, Renaming Axis Indexes
- ii. Discretization and Binning, Detecting and Filtering Outliers Permutation and Random Sampling, Computing Indicator/Dummy Variable
- iii. String Manipulation: Python Built-In String Object Methods
- iv. Categorical Data, Categorical Extension Type in pandas, Computations with Categoricals, Categorical Methods

Module-6: Classification

- i. Write a Python program to implement Naive Bayesian classification Algorithm

Module-7: Association Mining

- i. Write a Python program to generate frequent item sets / association rules using Apriori algorithm

Module-8: Clustering

- i. Write a Python program to implement K-Means clustering algorithm

Module-9: Clustering

- i. Write a Python program to implement DBSCAN clustering algorithm

Module-10: Introduction to Streamlit: install Streamlit library and perform the following:

- i. Write a Streamlit app that displays a title, a header, and some text using `st.title()`, `st.header()`, and `st.write()`.
- ii. Create a Streamlit app where the user enters their name using `st.text_input()`, and the app displays a greeting message (e.g., "Hello, [name]!").
- iii. Develop a Streamlit app with a button (`st.button()`). When clicked, it should display a message like "Button clicked!".
- iv. Write a Streamlit app that loads and displays an image from a file using `st.image()`.

Reference Books:

1. K.P. Soman, Shyam Diwakar and V. Ajay —Insight into Data mining Theory and Practice, Easter Economy Edition, Prentice Hall of India, 2006.
2. G. K. Gupta —Introduction to Data Mining with Case Studies, Easter Economy Edition, Prentice Hall of India, 2006.

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs32/preview

Case Study

Select any one application mentioned below

Note: A report has to be submitted by every student at the end of the semester

1. Movie Review Classification
2. Text Classification
3. Multilabel Classification
4. Email spam Filtering
5. Customer Segmentation
6. Anomaly Detection
7. Social Network Analysis
8. Product Recommendations (Frequently Bought Together)
9. Fraud Detection

MERN STACK DEVELOPMENT

II Year B. Tech. II semester
[Skill Course: CSE, CSE(AI&ML)]

Course Code: 24CT11SC02

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Illustrate** the fundamental concepts of JavaScript, TypeScript, and asynchronous programming with examples. (L2)
- CO2: Identify** the components of MERN architecture, including MongoDB, Express.js, React.js, and Node.js, and their roles in web application development. (L3)
- CO3: Demonstrate** CRUD operations using MongoDB and Mongoose for database management. (L2)
- CO4: Build** RESTful APIs using Node.js and Express.js to enable server-side communication. (L3)
- CO5: Develop** a full-stack web application with authentication and state management, integrating React.js frontend with a Node.js backend. (L3)

Module -1: JavaScript Fundamentals

- 1. **Javascript Fundamentals:** Difference between Javascript and ECMAScript, Constants, Variables, Arrays, Objects, Functions, Arrow Functions, Modules, Spreading operators and destructuring assignment.
- 2. **Typescript:** Adding Typescript support to ECMAScript, Types, Interfaces
- 3. **Asynchronous Programming:** Callbacks, Promises, Async/Await

Module-2: Introduction to MERN

- 1. Introduction to 3-Tier client/server architecture
- 2. Introduction to NoSQL
- 3. Introduction to REST API
- 4. Introduction to Web UI
- 5. Introduction to JSON
- 6. Overview of MERN Stack (MongoDB, Express.js, React, Node.js)

Module-3: MongoDB - NoSQL Database

- 1. Introduction to MongoDB and its features
- 2. Setting up MongoDB locally and on the cloud (MongoDB Atlas) Designing Collections and Documents
- 3. CRUD operations using MongoDB
- 4. Mongoose ODM for MongoDB schema and validation Aggregation framework and indexing

Module-4: Node.js - Server-Side Development

1. Setting up Node.js
2. Understanding Package Managers (npm, yarn)
3. Understanding package.json
4. Understanding Node.js
5. Architecture Create a Web Server in Node.js Restarting Node Application
6. File System & Module Management

Module-5: Express.js – Backend Framework

1. Express Development Environment Defining and Handling Routes Route and Query Parameters
2. Middleware (Custom, Built-in, Third-Party)
3. Connecting to MongoDB with Mongoose CRUD Operations
4. REST API Development
5. Testing API with Postman

Module-6: Angular.js – Frontend Development

1. Introduction to Angular.js & JSX
2. Environment Setup- installing Angular CLI
3. Create your first Angular app and understand its project structure
4. Work with components, directives, and pipes

Module-7: React.js – Frontend Development

1. Introduction to React.js & JSX
2. Functional Components
3. Nested Components
4. Properties and Property Drilling
5. Context Management with useContext
6. State Management using useState and useEffect
7. Global State Management with useReducer
8. Routing with React Router
9. Styling with Tailwind

Module-8: Enterprise Application Development

1. Connecting the UI with Backend

2. Client requests using Fetch API
3. Client requests using Axios
4. Security and JWT
5. Preparing WebUI for distribution Deployment strategies

Case study:

Select any one practical application mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

Building a Real-World MERN Stack Application with Authentication & CRUD

Operations for the following problem statements Tech Stack:

1. **Frontend:** React.js, React Router, Axios
2. **Backend:** Node.js, Express.js, MongoDB, Mongoose.
3. **Authentication:** JWT (JSON Web Tokens), bcrypt (for password hashing).
4. **Database:** MongoDB (for storing users and tasks).

1. Healthcare Appointment Scheduling System:

A hospital faced challenges in managing patient appointments, leading to long wait times and inefficient resource utilization.

2. Food Delivery Service Expansion:

A food delivery startup struggled to scale operations to new cities due to logistical challenges.

3. Smart Agriculture System:

Farmers faced challenges in monitoring crop health and optimizing water usage.

4. Online Learning Platform for Kids:

Parents struggled to find engaging and educational content for their children during the pandemic.

5. Waste Management App:

A city faced challenges in managing waste collection and recycling efforts.

Text Books:

1. Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'Reilly Media.
2. MongoDB - The Definitive Guide, 2nd Edition, Kristina Chodorow, O'Reilly.

Reference Books:

1. Robert W. Sebesta, —Programming with World Wide Web, Fourth Edition, Pearson, 2008.

2. Dayley B., —Node.js, MongoDB, and AngularJS Web Developmentll, Addison Wesley Professional, 2014.
3. Vainikka J., —Full-Stack Web Development using Django REST Framework and Reactll, 2018

Web References:

- 1.https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview
(HTML5)
- 2.https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview
(Javascript)
- 3.https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overview
(Node.js & Express.js)
- 4.[https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/over](https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview)
view(Typescript)
- 5.[https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared /overview](https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overview)
(Angular JS)
- 6.https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_s
hared/overview (MongoDB)

ENVIRONMENT SCIENCE

II Year B. Tech. II Semester

[Common to CSE (AI&ML), ECE, EEE]

L	T	P	C
2	0	0	0

Course Code: 24BC11MC01

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Understanding the impacts of developmental activities and mitigation measures for sustainable environment.

CO2: Categorize the importance of natural resources management for the sustenance of the life and the society.

CO3: Differentiate various forms of pollutions and their impact on the environment

CO4: Discuss elements of Sustainable Development, energy and environmental management.

CO5 : Develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT-I

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems. Salient features of international conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC)

UNIT-II

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide- watershed management. **Forest resources:** Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings. **Water resources:** Exploitation of surface and groundwater, Floods, droughts, Dams: benefits and costs. **Mineral Resources:** Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

UNIT-III

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems. Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment, Marine pollution and its impact on blue economy. Noise pollution. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary.

UNIT-IV

Sustainable Development: Population and its explosion Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management. **Energy and Environment:** Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. **Renewable Energy:** Production of Hydrogen via Water Splitting Using Photocatalytic and Photo electrocatalytic Route process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. **Biomass energy:** Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

UNIT-V

Solid waste management: Important elements in solid waste management- Waste to energy concepts. **Management of plastic waste and E-waste:** Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Environmental Studies by R. Rajagopalan, Oxford University Press
2. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
3. Base, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India 67

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB) 2018.

FORMAL LANGUAGES AND AUTOMATA THEORY

III Year B. Tech. I semester

[CSE (AI&ML)]

Course Code: 24CT11RC20

L	T	P	C
3	0	0	3

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

CO1: Construct a Deterministic Finite Automata (DFA) and a Non-Deterministic Finite Automata (NFA) for a given regular language and compare their structures. (L3)

CO2: Make Use of regular expressions to generate finite automata and demonstrate how to apply algebraic laws to simplify complex regular expressions. (L3)

CO3: Construct parse trees for context-free grammars and identify ambiguities in grammars and their corresponding languages. (L3)

CO4: Identify the language recognized by a Pushdown Automaton by analyzing its transitions and stack operations. (L3)

CO5: Solve computational problems by applying Turing machine constructions to model the problem-solving process. (L3)

UNIT-I

12 Lectures

Finite Automata: Need for Automata Theory , The Central Concepts of Automata Theory, Grammar, Types of Grammars, Chomsky Hierarchy, Finite Automata -An Informal Picture of Finite Automata, Deterministic Finite Automata(DFA), Non-Deterministic Finite Automata (NFA), Design of NFA, Equivalence of DFA and NFA, Finite Automata with ϵ - Transitions, Minimization of Finite Automata, Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNIT-II

8 Lectures

Regular Expressions: Regular Expressions, Regular Sets, Identity Rules, Algebraic Laws for Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma, Closure Properties, Regular Grammar-Equivalence of Finite Automata and Regular Grammars, Converting Finite Automata to Regular Grammar.

UNIT-III

10 Lectures

Context Free Grammars and Languages: Context Free Grammars-Definition of Context Free Grammar, Derivations using a Grammar, Leftmost and Rightmost Derivations, The Language of a Grammar, Sequential Forms, Parse Trees, Ambiguity in Grammars and Languages-Ambiguous Grammars, Removing Ambiguity from Grammars.

Simplification of Context Free Grammars-Elimination of Useless Symbols, ϵ - productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma , Closure Properties, Applications of Context Free Grammars

UNIT-IV

8 Lectures

Pushdown Automata: Definition of Pushdown Automata-The Formal Definition of PDA, Graphical Notation of PDA, Instantaneous Description of Push Down Automata, The Languages of PDA, Equivalence of Pushdown Automata and Context Free Grammars Conversion-From Grammar to Pushdown Automata, From PDA to Grammar, Deterministic Pushdown Automata.

UNIT-V

12 Lectures

Turing Machine: Turing Machine as a Computational Machine, Techniques for Turing Machine Construction, Types of Turing Machines, Universal Turing Machine, Recursive and Recursively Enumerable Languages.

Undecidability and Computability: Decision Problems, Decidability and Decidable Languages, Halting Problem, Post Correspondence Problem.

Non-Deterministic Polynomial Completeness: P-Problems, NP-Problems, NP- Hard and NPComplete Problems.

Text Books:

1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.
2. Formal Language and Automata Theory, K.V.N.Sunitha and N.Kalyani, Pearson, 2015.
3. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekharan, 3rd Edition, PHI, 2007.

Reference Books:

1. Introduction to Automata Theory, Formal Languages and Computation, Shyamalendu Kandar, Pearson, 2013.
2. Introduction to the Theory of Computation, Michael Sipser, 3rd Edition, Cengage Learning, 2012.

Web References(e-Resources):

1. <https://archive.nptel.ac.in/courses/106/105/106105196/>
2. <https://archive.nptel.ac.in/courses/106/106/106106049/>

3. <https://www.coursera.org/courses?query=theory+of+computation>
4. <https://www.classcentral.com/course/swayam-formal-language-and-automata-theory-anapplication-in-compiler-design-291835>
5. <https://infolab.stanford.edu/~ullman/ialc.html>

OPERATING SYSTEMS

III Year B. Tech. I semester

[CSE(AI&ML)]

Course Code: 24CT11RC13

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Classify operating system types, concepts, and core services to understand their role in managing hardware and software resources. (L2)

CO2: Summarize the impact of scheduling policies and interprocess communication on system performance in multitasking environments. (L2)

CO3: Make use of synchronization mechanisms and deadlock handling strategies to ensure safe and efficient concurrent process execution. (L3)

CO4: Apply memory management techniques like paging, segmentation, and virtual memory to optimize resource utilization and system performance. (L3)

CO5: Utilize file system structures, allocation methods, and disk scheduling algorithms to enhance data storage and retrieval efficiency. (L3)

UNIT-I

10 Lectures

Introduction: Operating System's role, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security.

System Structures: Operating-System Services, System Calls, Types of System Calls, Operating System Structure, Operating-System Generation, System Boot.

UNIT-II

10 Lectures

Process Concept: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication.

Multithreaded Programming: Overview, Multithreading Models, Threading Issues.

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple Processor Scheduling.

UNIT-III

12 Lectures

Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT-IV

8 Lectures

Memory-Management Strategies: Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

Virtual-Memory Management: Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing.

UNIT-V

10 Lectures

File System: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing.

Implementing File-Systems: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Mass-Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling, Swap-Space Management, RAID Structure.

Text Books:

1. Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, 9th Edition, Wiley, 2018, ISBN: 978-1118063330.
2. Operating Systems: Internals and Design Principles, William Stallings, 9th Edition, Pearson, 2018, ISBN: 978-1292214290.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, Herbert Bos, 5th Edition, Pearson, 2022.
2. Operating Systems: A Concept-Based Approach, Dhananjay M. Dhamdhere, 3rd Edition, McGraw Hill, 2017.
3. Operating Systems: A Design-Oriented Approach, Charles Crowley, 1st Edition, McGraw Hill, 2019.

Web References:

1. <https://nptel.ac.in/courses/106106144>.
2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828operating-system-engineering-fall-2012/>.
3. <https://cs140.stanford.edu>

MACHINE LEARNING

III Year B. Tech. I Semester

[CSE(AI&ML)]

L	T	P	C
3	0	0	3

Course Code: 24CT11RC23

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Outline the fundamental concepts of machine learning. [L2]

CO2: Explain the life cycle of a machine learning project. [L2]

CO3: Build a variety of supervised learning models. [L3]

CO4: Apply the ensemble learning methods. [L3]

CO5: Experiment with the clustering techniques and dimensionality reduction models. [L3]

UNIT-I:

09 Lectures

Introduction: Relationship between artificial intelligence, machine learning, and deep learning. Main benefits of machine learning systems. Supervised, unsupervised and reinforcement learning, batch versus online learning, instance-based versus model-based learning. Main challenges of machine learning: irrelevant, insufficient, non- representative and poor quality data, problems of underfitting and overfitting models, testing and validating ML models.

UNIT-II:

09 Lectures

End-to-End Machine Learning Project: Problem formulation: working with real data, looking at the big picture, framing the problem and select a performance measure. Exploratory data analysis: data collection, cleaning, visualization and preparation. Model building: selection and training a model, evaluating and fine-tuning the model through cross-validation, grid_search_CV, and randomized_search_CV. Launching an ML system: evaluate an ML system on the test set, launching, monitoring, and maintaining an ML system.

UNIT III:

12 Lectures

Supervised Learning: Binary, multiclass and multilabel classification problems. Performance measures. Linear regression, gradient descent, polynomial regression, regularization, logistic regression and softmax regression. Popular classification models: k-nearest-neighbours algorithm (k-NN), naïve Bayes classifier, and decision trees.

UNIT-IV:

10 Lectures

Advanced Supervised Learning: Linear Discriminant Analysis, Support Vector Machines: linear and nonlinear SVM classification, SVM regression. Ensemble Learning and Random Forests: introduction, voting classifiers, bagging and pasting, random forests, boosting and stacking.

UNIT-V:

10 Lectures

Dimensionality Reduction: The curse of dimensionality, main approaches for dimensionality reduction, principal component analysis, incremental, randomized, and kernel PCA algorithms.

Introduction to Artificial Neural Networks: Backpropagation algorithm, solving classification and regression problems using ANNs.

Text Books:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, Aurélien Géron (2022), O'Reilly Publications.
2. Machine Learning, Tom M. Mitchell (1998), McGraw-Hill.

Reference Books:

1. Python Machine Learning By Example, Yuxi Liu (2024), Packt Publishing.

Web References:

1. https://onlinecourses.nptel.ac.in/noc25_cs46/preview
2. <https://www.coursera.org/specializations/machine-learning-introduction>

OPERATING SYSTEMS LAB

III Year B. Tech. I semester

[CSE(AI&ML)]

Course Code: 24CT11RC17

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Make use of Linux commands for shell programming. (L3)

CO2: Construct programs for various OS concepts and Linux commands using System Calls. (L3)

CO3: Develop and implement programs to demonstrate various CPU Scheduling Algorithms, Process Synchronization Concepts in Operating Systems and Deadlock Prevention and Avoidance Techniques. (L3)

CO4: Build programs for Memory Management Techniques and Page Replacement Algorithms. (L3)

CO5: Develop programs for various DISK Scheduling Algorithms. (L3)

Module-1: Implementation of basic Linux commands

1. Navigate to a directory, create a subdirectory, copy files into it, change permissions, and list them using various commands.
2. Create three empty text files using the touch command (e.g., file1.txt, file2.txt, file3.txt).
3. Use the cp command to copy one of the text files to another directory. If no other directory exists, create one using mkdir and then copy the file. Rename one of the text files using the mv command.
4. Create a text file in Vi that contains a list of files in your home directory. Include descriptions for each file. Use commands like :w, :q, :set number, and navigation commands to format it.
5. Modify the file using dd, yy, p, and /search commands. Save the file and quit.

Module-2: Write a C program on scheduling algorithms in Linux/Windows OS.

1. Implementation and Analysis of FCFS Scheduling Algorithm
2. Implementation and Analysis of SJF Scheduling Algorithm
3. Implementation and Analysis of Round Robin Scheduling Algorithm

Module-3: Implementation of Critical Section Problem Using Peterson's Algorithm

1. Mutual exclusion
2. Progress
3. Bounded waiting between two processes.

Module-4: Write simple shell programming in Linux OS.

1. Hello World Script
2. List Files in Directory
3. Check if a File Exists
4. Count Lines in a File
5. Sum of Numbers
6. Display Date and Time
7. Reverse a String
8. Calculate Factorial
9. Check Prime Number

Module-5: Shell programming using decision making constructs, loop constructs, file and directory manipulation

1. **Decision-Making Constructs:** Write a shell script that checks whether a number entered by the user is positive, negative, or zero. Use if, else, and elif statements for the decision making.
2. **Loop Constructs:** Write a shell script that prints the first 10 Fibonacci numbers using for loop.
3. **File and Directory Manipulation:** Write a shell script that accepts a file name from the user and checks whether it exists. If the file exists, display the number of lines in the file; otherwise, print "File does not exist."

Module-6: Simple C programs using command line arguments, system calls, library function calls, make utility in Linux OS.

1. Command-Line Arguments: Simple Calculator: Description

Write a C program that accepts command-line arguments to perform basic arithmetic operations (addition, subtraction, multiplication, division). The user should provide the operation type (+, -, *, /) and two operands.

2. System Calls: File Copy Using open(), read(), and write()

Write a C program that should copy a file from one location to another using system calls like open(), read(), and write().

3. Library Function Calls: String Reversal

Write a C program that takes a string as input and returns the reversed string using standard library functions.

Module-7: Write C programs to study deadlock avoidance and detection in Linux/Windows OS.

Module-8: C programs using system call to create processes and study parent, child process mechanism in Linux OS.

1. Simple Parent-Child Process using fork().
2. Parent Waiting for Child to Exit using wait().

Module-9: Write a C Programs to simulate free space management in Linux/Windows OS.

- a) first fit b) best fit c) worst fit

Module-10: Write a C programs to create process chaining, spawning in Linux OS.

1. Process Chaining using fork()
2. Process Spawning using fork() and exec()

Module-11: Write a C programs to error handling using errno(), perror() function in Linux OS.

1. File Opening Error
2. Division by Zero
3. Memory Allocation Error
4. Invalid File Descriptor

Module-12: Write C programs to use pipe system call for interprocess communication between Parent and Child Process in Linux OS.

Module-13: Write C programs for page replacement implementing in Linux/Windows OS.

- a. FIFO b. Optimal c. LRU

Module-14: Write C programs for disk scheduling algorithms in Linux/Windows OS.

- a. SCAN b. SSTF c. LOOK

Case Study: Select any one case study mentioned below.

Note: At the end of the semester, each student is required to submit a report. Compare any of two operating systems such as Windows, Linux, macOS, Android, or others.

The report should include a case study covering the following topics:

1. Different operating systems implement their file systems in unique ways, depending on their architecture and design objectives. Write an overview of how file systems function across various operating systems.

2. Memory management is responsible for allocating and deallocating memory space to various programs and ensuring efficient utilization of system memory.
3. Different operating systems implement scheduling in unique ways based on their design goals and hardware requirements. Below is an overview of scheduling across various operating systems
4. Protection ensures the integrity, confidentiality, and availability of the system, preventing unintentional or intentional harm, an overview of how protection is implemented across different operating systems.
5. Each operating system handles I/O operations through a combination of system calls, device drivers, and I/O subsystems to provide seamless interaction with hardware, an overview of how different operating systems manage I/O operations input/output.

References Books :

1. Unix concepts and applications by Sumitabha Das, TMH Publications.
2. Unix programming by Stevens, Pearson Education.
3. Shell programming by Yashwanth Kanetkar.
4. Operating System Concepts by Silberschatz, and Peter Galvin.

Web References(e-Resources)

1. <https://nptel.ac.in/courses/106106144>
2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828-operatingsystem-engineering-fall-2012/>
3. <https://cs140.stanford.edu>

MACHINE LEARNING LAB

III Year B. Tech. I semester

[CSE(AI&ML)]

Course Code: 24CT11RC25

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Apply exploratory data analysis and categorical encoding techniques to understand the data and make it ready for model building. (L3)

CO2: Build ML models based on classic algorithms like kNN, linear regression and logistic regression. (L3)

CO3: Develop SVM model from scratch. (L3)

CO4: Construct ML models based on ensemble techniques. (L3)

CO5: Make use of PCA, K-Means and EM to construct unsupervised learning models. (L3)

Module-1: Exploratory Data Analysis

Illustrate Exploratory Data Analysis using Pandas or Matplotlib: Getting a quick statistical summary of a dataset, Checking Missing Values, Removing Duplicates, Showing Correlations, and Looking for Outliers using BoxPlots.

Module-2: Categorical Encoding

Write a program to implement Categorical Encoding: One-hot/Label/Ordinal Encodings.

Module-3: Decision Trees

Use sklearn to build a decision tree for IRIS data set and visualize the decision tree. Use the decision tree built to classify a new data point using both predict and predict_proba methods. Need to demonstrate your understanding of sklearn's decision tree classifier by using both entropy and Gini index.

Module-4: k-Nearest Neighbors algorithm

Use sklearn's k-Nearest Neighbors algorithm to classify the iris dataset. Print both correct and wrong predictions. You need to print the attributes values for wrong predictions.

Module-5: Linear Regression

Use linear regression algorithm to predict median price of a district by training a regression model on the Boston housing dataset.

Module-6: Logistic Regression

Use logistic regression algorithm to classify a handwritten digit as even or odd by training a logistic regression model on the MNIST dataset.

Module-7: Support Vector Machines

Implement, visualize and test Support Vector Machines in Python (not allowed to use sklearn's Support Vector classes).

Module-8: Random Forest algorithm

Run decision tree classification and random forest algorithms on a dataset and confirm that ensembling indeed improves performance significantly reducing the variance component (using bias- variance decomposition). Also, print feature importances as found by the random forest algorithm.

Module-9: Gradient Boosting algorithm

Use sklearn's GradientBoostingRegressor and demonstrate the use of early stopping to find the optimal number of trees in the GBRT ensemble.

Module-10: Principle Component Analysis

Implement and test Principle Component Analysis in Python (not allowed to use sklearn's PCA classes).

Module-11: Clustering algorithms

Apply expectation-maximization (EM) algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.

Case Study: Select any practical application mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

1. Customer Segmentation for a Retail Business Concepts: Clustering (k-Means, EM), PCA
Description: Analyze customer purchase history and segment customers for personalized marketing strategies.

2. Credit Card Fraud Detection

Concepts: Logistic Regression, Random Forest, Decision Trees, Gradient Boosting
Description: Use transaction data to predict fraudulent transactions, improving fraud detection mechanisms.

3. Employee Attrition Prediction

Concepts: Logistic Regression, Decision Trees, Categorical Encoding
Description: Identify key factors influencing employee retention in a company.

4. Predicting House Prices

Concepts: Linear Regression, PCA, Gradient Boosting

Description: Build a model to predict house prices based on historical housing data.

5. Fake News Detection

Concepts: NLP, Logistic Regression, Decision Trees, SVM

Description: Classify news articles as real or fake using text-based features.

6. Movie Recommendation System Concepts: k-NN, PCA

Description: Build a recommendation system based on user preferences and ratings.

7. Stock Market Price Prediction

Concepts: Linear Regression, Gradient Boosting

Description: Predict stock prices based on historical trends and market indicators.

8. Healthcare Readmission Prediction Concepts:

Logistic Regression, Decision Trees

Description: Predict which patients are at high risk of hospital readmission.

9. Air Quality Prediction

Concepts: Linear Regression, PCA, Decision Trees

Description: Predict air pollution levels based on meteorological and traffic data.

10. Predicting Loan Default Risk

Concepts: Logistic Regression, Random Forest

Description: Assess whether a loan applicant is likely to default.

11. E-commerce Product Review Sentiment Analysis

Concepts: NLP, SVM, k-NN

Description: Classify product reviews into positive, neutral, or negative sentiments.

12. Energy Consumption Forecasting

Concepts: Linear Regression, Gradient Boosting

13. Description: Predict energy consumption trends for efficient energy planning.

1. Traffic Accident Severity Prediction

2. Concepts: Decision Trees, k-NN, PCA

14. Description: Predict accident severity based on road conditions, weather, and driver behavior.

1. Disease Diagnosis from Symptoms Concepts:

2. Decision Trees, Random Forest, SVM

15. Description: Predict diseases based on patient symptoms.

1. Customer Churn Prediction for Telecom
2. Concepts: Logistic Regression, Decision Trees, Categorical Encoding Description:
Predict which customers are likely to switch telecom providers.

Reference Books:

1. Aurélien Géron (2022), —Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Publications.
2. Yuxi Liu (2024), —Python Machine Learning By Example, Packt Publishing.

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc25_cs46/preview
2. <https://www.coursera.org/specializations/machine-learning-introduction>

SOFT SKILLS

III Year B. Tech. I semester

[Skill Course: Common to ECE, CSE(AI&ML) & EEE]

Course Code: 24HE11SC01

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** **Apply** effective communication skills in personal and professional settings. (L3)
- CO2:** **Develop** and implement effective goal setting and time management strategies. (L3)
- CO3:** **Function** as a leader and a member of a team. (L4)
- CO4:** **Analyze** data to write concise technical reports (L4), **Organize** Effective meetings and record minutes of the meeting. (L3)
- CO5:** **Take part** in group discussions (L4), **Build** resumes to successfully navigate job interviews. (L3)

UNIT-I

Communication skills: Verbal & Non-verbal communication- Personal grooming (Etiquette, Attitude, Body Language), Posture, Gestures, Facial Expressions, Eye contact, Space Distancing, Interpersonal communication- Presentation skills, Public speaking, - Cross Cultural communication.

UNIT-II

Goal Setting and Time Management: Immediate, Short term, Long term, SMART Goals, Strategies to Achieve goals, Time Management Skills, Identifying Time Wasters, Stress Busters.

UNIT-III

Leadership and Team Management: Qualities of a Good Leader, Team Dynamics, Leadership Styles, Decision Making, Problem Solving, Negotiation Skills.

UNIT - IV

Business communication: Types of reports- Technical report writing, Proposals, SOP; Planning for effective meetings, Minutes of the Meetings.

UNIT-V

Interview Skills: Group Discussions, Resume preparation and Mock interviews.

Reference Books:

1. Krannich, Caryl, and Krannich, Ronald L. Nail the Resume! Great Tips for Creating Dynamite Resumes. United States, Impact Publications, 2005.
2. Hasson, Gill. Brilliant Communication Skills. Great Britain: Pearson Education, 2012
3. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Education, 2001.
4. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.
5. Rizvi, Ashraf M. Effective Technical Communication: India, McGraw-Hill Education. 2010
6. Thorpe, Edgar & Showick Thorpe. Winning at Interviews. 2nd Edition. Delhi: Dorling Kindersley, 2006.
7. N.L.Gupta. Cross cultural Communication: Global perspectives. Concept Publishing Company, 1998.
8. Peter Hartley and Clive G. Bruckmann. Business communication. 2002.

Web References:

1. <https://www.hbr.org>
2. A step-by-step guide to writing a technical report | Indeed.com UK
3. <https://www.grammarly.com/blog/business-writing/meeting-minutes/>
4. <http://www.youtube.com/@PebblesLanguageLearning>
5. https://www.onlinecourses.nptel.ac.in/noc20_hs60/preview

DESIGN THINKING, INNOVATION & ENTREPRENEURSHIP

III Year B. Tech. I Semester
[Common to CSE, CSE (AI&ML), IT]

Course Code: 24AI11MC01

L	T	P	C
2	0	0	0

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline a problem, apply methods of Empathy on user groups. [L2]

CO2: Describe and Define the problem specific to the user group. [L2]

CO3: Apply Ideation tools to generate Ideas to solve the problem. [L3]

CO4: Develop prototypes for the selected Ideas. [L3]

CO5 : Test the ideas and demonstrate Storytelling ability to present the Ideas. [L4]

Students shall form into groups and identify a problem (preferably societal problem with engineering orientation to solve) suitable for the design thinking and go through the process week-wise. At the end of each phase, brief documentation shall be submitted and a final report covering all phases has to be submitted at the end of the semester.

Weeks 1-3:

Introduction to Design Thinking: A primer on design thinking - Traditional approach, The new design thinking approach. Stages in Design Thinking: Empathize, Define, Ideate, Prototype, Test. Mindset for design thinking, Design thinking for product and process innovation, Difference between engineering design and design thinking.

Establishing Startups: Opportunity Scanning and Identification, Market Survey and assessment, Choice of technology and selection of business sites.

Case Studies: General, Engineering and Service applications.

Activities: Identify an Opportunity and Scope of the Project Explore the possibilities and Prepare design brief

Weeks 4-6:

Methods and Tools for Empathize and Define phases:

Empathize - Methods of Empathize Phase: Ask 5 Why / 5W+H questions, Stakeholder map,

Empathy Map, Peer observation, Trend analysis

Define - Methods of Define Phase: Storytelling, Critical items diagram, Define success

Activities: Apply the methods of empathize and Define Phases Finalize the problem statement

Weeks 7-8:

Methods and Tools for Ideate phase:

Ideate - Brainstorming, 2X2 matrix, 6-3-5 method, NABC method;

Activities: Apply the methods of Ideate Phase: Generate lots of Ideas

Weeks 9-11:

Methods and Tools for Prototype Phase:

Prototype - Types of prototypes - Methods of prototyping - Focused experiments, Exploration map, Minimum Viable Product;

Activities: Apply the methods of Prototype Phase: Create prototypes for selected ideas

Weeks 12-13:

Methods and Tools for Test Phase:

Test - Methods of Testing: Feedback capture grid, A/B testing

Activities: Collect feedback; iterate and improve the ideas

Weeks 14-15:

Solution Overview - Create a Pitch - Plan for scaling up - Road map for implementation

Activities: Present your solution using Storytelling method

Week 16:

Project Submission: Fine tuning and submission of project report.

Reference Books:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books, 2009.
2. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Toolbox, John Wiley & Sons, 2020.
3. Michael Lewrick, Patrick Link, Larry Leifer, The Design Thinking Playbook, John Wiley & Sons, 2018.
4. Kristin Fontichiaro, Design Thinking, Cherry Lake Publishing, USA, 2015.
5. Walter Brenner, Falk Uebernickel, Design Thinking for Innovation - Research and Practice,

Springer Series, 2016.

6. Gavin Ambrose, Paul Harris, Design Thinking, AVA Publishing, 2010.
7. Muhammad Mashhood Alam, Transforming an Idea into Business with Design Thinking, First Edition, Taylor and Francis Group, 2019.
8. S.Balaram, Thinking Design, Sage Publications, 2011.

Web References:

1. <https://designthinking.ideo.com/>
2. <https://thinkibility.com/2018/12/01/engineering-vs-design-thinking/>
3. <https://www.coursera.org/learn/design-thinking-innovation>
4. https://swayam.gov.in/nd1_noc20_mg38/preview

COMPUTER NETWORKS

III Year B. Tech. II Semester
[CSE (AI&ML)]

Course Code: 24CT11RC22

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** **Summarize** the concepts of Computer networks and Network reference models (OSI and TCP/IP reference models) and Transmission media. (L2)
- CO2:** **Utilize** Data link layer framing techniques, Error control techniques using CRC, Data link protocols, HDLC and PPP. (L3)
- CO3:** **Outline** the Media Access control problem in a network using multiple access protocols–ALOHA, CSMA, multiplexing, Ethernet and Wireless LAN protocols. (L2)
- CO4:** **Make use** of the Network Layer Design issues, routing algorithms and Internet protocols to perform better network communication. [L2]
- CO5:** **Apply** the Transport layer protocols- TCP, UDP protocol working mechanism in Client – Server Data communication and Application layer protocols. [L3]

UNIT-I:

10 Lectures

Introduction to Computer Networks: Network types LAN, MAN, WAN, Network Topologies, Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, Internet History.

Physical Layer –Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and unguided media: Wireless-Radio waves, microwaves, infrared.

UNIT-II:

12 Lectures

Data link layer: Design issues, Framing: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer.

Elementary Data Link Layer protocols: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.

Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field, point to point protocol (PPP): framing transition phase, multiplexing, multi-link PPP.

UNIT-III:

10 Lectures

Media Access Control: Random Access: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance.

Controlled Access: Reservation, Polling, Token Passing.

Channelization: frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).

Ethernet(IEEE802.3):Standard Ethernet, Fast Ethernet, Gigabit Ethernet.

Wireless LAN(IEEE802.11): Architecture and Protocol stack.

UNIT-IV:

12 Lectures

The Network Layer Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks.

Internet Protocols: IPv4, IPv6, and DHCP, Routing Algorithms-The Optimality principle- Shortest path, Flooding, Hierarchical, Distance vector, Link state, Congestion Control algorithms-Leaky bucket and Token bucket.

UNIT-V:

10 Lectures

The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.

Application Layer – World Wide Web: HTTP, Electronic Mail-Architecture, Domain Name System, SNMP.

Text Books:

1. Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.

Reference Books:

1. Data Communications and Networks- Achut S Godbole, Atul Kahate

2. Computer Networks, Mayank Dave, CENGAGE

Web References (e-Resources):

1. <https://inl.info.ucl.ac.be/CNP3>
2. https://wps.pearsoned.com/ecs_kurose_compnetw_8/
3. <https://www.netacad.com/>

BIG DATA ANALYTICS

III Year B. Tech. II semester

[CSE(AI&ML)]

Course Code: 24AI11RC02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** **Outline** the building blocks of Hadoop. (L2)
- CO2:** **Experiment with** writing basic MapReduce programs. (L3)
- CO3:** **Demonstrate** PIG Architecture and Develop PIG scripts. (L2)
- CO4:** **Apply** Hive queries to create, update, delete, and manage data in databases. (L3)
- CO5:** **Analyze** Spark architecture, apply transformations, manage RDDs, and perform operations for efficient data processing. (L4)

UNIT-I

10 Lectures

Introduction to Big Data and Hadoop: Introduction to Big Data Platform, Challenges of Conventional Systems, History of Hadoop, building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Hadoop Distributed File System- The Design of HDFS, HDFS Concepts, Basic Filesystem Operations, Anatomy of a Map Reduce Job run, Map Reduce Types and Formats.

UNIT-II

10 Lectures

Writing MapReduce Programs: A Weather Dataset, Basic programs of Hadoop MapReduc-Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner.

UNIT-III

8 Lectures

Pig: Hadoop Programming Made Easier: Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.

UNIT-IV

10 Lectures

Hive: Introduction to Hive, data types, file formats, HiveQL data definition, HiveQL data manipulation, joins, Window functions, Table partitioning, Bucketing, Indexing, User-Defined Functions.

UNIT-V

12 Lectures

Apache spark- Introduction to Spark - Spark_s Basic Architecture, Transformations Narrow and Wide, lazy evaluation, Actions, Advantages over Hadoop, Basic Structured Operations: Schemas, Records and Rows,

DataFrame Transformations.

Resilient Distributed Datasets (RDDs): Creating RDDs, Manipulating RDDs, Transformations, Actions, Saving Files, Classification Models in MLlib: Naïve Bayes, Random Forest.

Text Books:

1. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O_reilly
2. Hadoop for Dummies by Dirk deRoos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, Rafael Coss
3. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018 Edition.

Reference Books:

1. Programming Hive, O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
2. Programming Pig, O'Reilley, Alan Gates, 2011

Web References (e-Resources):

1. <https://archive.nptel.ac.in/courses/106/104/106104189/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126052684230082561692_shared/overview
3. <https://sparkbyexamples.com/>

DEEP LEARNING TECHNIQUES

III Year B. Tech. II semester

[CSE(AI&ML)]

Course Code: 24AI11RC03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Summarize the basic principles of artificial neural networks. (L2)
- CO2:** Interpret the various difficulties in training deep neural networks. (L2)
- CO3:** Develop deep learning models to computer vision problems and time series analysis. (L3)
- CO4:** Build deep learning models for generative AI. (L3)
- CO5:** Apply deep learning techniques in reinforcement learning. (L3)

UNIT-I

9 Lectures

Introduction to ANNs with Keras: Biological and artificial neurons, implementing multilayer perceptrons with Keras, fine-tuning neural network hyperparameters.

UNIT-II

9 Lectures

Training Deep Neural Networks: The vanishing/exploding gradients problems, Glorot and He initializations, batch normalization, reusing pretrained models, faster optimizers, avoiding overfitting through regularization.

UNIT-III

14 Lectures

CNNs and RNNs: The architecture of the visual cortex, convolutional layers, pooling layers, famous CNN architectures, object detection, fully convolutional networks, YOLO, semantic segmentation. Recurrent neurons and layers, training RNNs, forecasting a time series, stacking recurrent layers, using bidirectional RNNs, handling long sequences using LSTMs and GRUs

UNIT-IV

9 Lectures

Generative deep learning: Efficient data representations, stacked, convolutional, recurrent, denoising, sparse and variational autoencoders, generative adversarial networks, basic introduction to transformers and stable diffusion.

UNIT-V

9 Lectures

Deep Reinforcement Learning: Essential theory of reinforcement learning, Markov decision processes, the optimal policy, essential theory of deep Q-learning networks, defining a DQN agent.

Text Books:

1. Aurélien Géron (2022), —Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow,|| 3rd Edition, O__Reilly Publications.
2. Krohn et al (2020) , —Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence,|| Pearson Education.

Reference Books:

1. Francois Chollet (2021), —Deep Learning with Python,|| 2nd Edition

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2. <https://www.coursera.org/specializations/deep-learning>

COMPUTER NETWORKS LAB

III Year B. Tech. II semester
[CSE(AI&ML)]

Course Code: 24CT11RC24

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to

- CO1: Understand** the Network Establishment and communication with the uses of NS2 Simulator, Linux and Network Commands. [L2]
- CO2: Experiment** Data link layer framing methods, Error detection and correction codes like Checksum, CRC, and Hamming code. [L3]
- CO3: Apply** Network layer routing methods for Distance Vector Routing Algorithm and shortest path routing algorithm. [L3]
- CO4: Make use of** socket programming and Transport layer protocols TCP, UDP for data communication in a Computer Network. [L3]
- CO5: Make use of** Application layer protocols HTTP and FTP for data communication in a Computer Network. [L3]

Module-1:

1. Write different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Connect the computers in Local Area Networks.
3. Write and Execute Basic Network commands and Network configuration commands like ping, ipconfig, traceroute, nslookup, netstat, whois, arp, rarp, etc
4. Write and Execute Basic Linux commands.

Module-2:

1. Configure a Network topology using packet tracer software.
2. Simulate to find the Number of Packets Dropped using NS2 Simulator.
3. Configure subnet on Linux using ip commands. Verify connectivity with ping and trace route.

Module-3:

1. Write a program to implement the data link layer framing methods such as character stuffing and bit stuffing.
2. Write a program to implement on a data set of characters the three CRC polynomials CRC-12, CRC-16 and CRC-CCIP.

Module-4:

1. Write a program to implement Error Detection Technique using Checksum.
2. Write a program to implement Error Correction Technique using Hamming code.

Module-5:

1. Write a program to implement Stop and Wait Protocol.
2. Write a program to implement Go back-N protocol.
3. Write a program to implement Sliding window protocol.

Module-6:

1. Write a program to implement High-Level Data Link Control protocol.
2. Write a program to implement Point-to-Point protocol.

Module-7:

1. Write a program to implement Dijkstra's algorithm to compute the Shortest path in a graph.
2. Write a program to implement Flooding routing algorithm.

Module-8:

1. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table at each node using distance vector routing algorithm.
2. Write a program to implement Link state routing algorithm.
3. Write a program for congestion control using leaky bucket algorithm

Module-9:

1. Understand and Usage of elementary socket system calls (socket (), bind(), listen(), accept(),connect(),send(),recv(),sendto(),recvfrom())
2. Write a program to implement Connection oriented service protocol (TCP).
3. Write a program to implement Connection less service protocol (UDP).

Module-10:

1. Write a program to implement HTTP protocol.
2. Write a program to implement FTP protocol.
3. Write a program to implement SMTP protocol.

Case Study: Select any one practical application mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

- i. Configuring routers and switches, experimenting with routing algorithms and analysing network performance under different topologies.
- ii. Students analyse network protocols (e.g., TCP, UDP, HTTP, FTP) using tools like Wireshark to understand packet structures, communication flows, and protocol behaviour.
- iii. Setting up IoT-based networks with sensors and actuators, evaluating wireless communication protocols (e.g., Zigbee, LoRa, MQTT), and assessing security vulnerabilities.

Reference Books:

1. Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI
2. Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH.
3. Data Communications and Networks- Achut S Godbole, Atul Kahate
4. Computer Networks, Mayank Dave, CENGAGE

Web References (e-Resources):

1. <https://inl.info.ucl.ac.be/CNP3>
2. https://wps.pearsoned.com/ecs_kurose_compnetw_8/
3. <https://www.netacad.com/>

BIG DATA ANALYTICS LAB

III Year B. Tech. II semester
[CSE(AI&ML)]

Course Code: 24AI11RC04

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Develop MapReduce programs for large-scale data processing. (L3)

CO2: Apply Pig Latin scripts to sort, filter, group, and join data. (L3)

CO3: Create and manage Hive tables, indexes, functions, and perform table alterations. (L6)

CO4: Understand and work with PySpark RDDs and apply transformations. (L2)

CO5: Build any one machine learning model using the PySpark ML library. (L3)

Module-1:

Implement the following file management tasks in Hadoop:

- a) Adding files and directories
- b) Retrieving files
- c) Deleting files

Module-2:

Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm

Module-3:

Write a Map Reduce program that mines weather data.

Module-4:

Write a Map Reduce program that Compute Average and Total Salary by Gender for an Enterprise.

Module-5:

Write a pig latin scripts to wordcount

Module-6:

Write a pig latin scripts to sort, group, join, filter your data.

Module-7:

Run Hive then use Hive to create, alter, and drop databases

Module-8:

Working on hive tables

- i. Creating hive tables (External and internal)
- ii. Loading data to external hive tables from sql tables
- iii. Performing hive operations like filter and updations
- iv. Performing Join (inner, outer etc)

Module-9:

Implement the following pyspark operations

- i. SparkSession
- ii. SparkContext
- iii. ways to Create RDD

Module-10:

Perform the following pyspark transformations

- i. Convert RDD to DataFrame
- ii. PySpark Read CSV file into DataFrame
- iii. drop() & drop Duplicates()
- iv. orderBy() and sort()
- v. map and flatMap
- vi. PySpark Groupby, sort and join

Module-11:

Build any Machine Learning model using pyspark ml library.

Case Study: Select any one practical application mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

1. Patient Disease Prediction

Analyze patient records to predict diseases based on symptoms. Use MapReduce for data cleaning, Hive for structured storage, and PySpark ML for classification models (e.g., Decision Trees).

2. Drug Effectiveness Analysis

Process clinical trial data to compare drug effectiveness. MapReduce can aggregate patient responses, Hive can store trial data, and PySpark can run statistical tests or survival analysis.

3. Hospital Resource Optimization

Analyze hospital admission data to optimize resource allocation. Use MapReduce to process logs, Hive to store patient flow data, and PySpark to predict resource needs using regression models.

4. Electronic Health Record (EHR) Analytics

Process massive EHR datasets to identify common treatment patterns. MapReduce for initial aggregation, Hive for structured queries, and PySpark for clustering patients with similar medical histories.

5. Outbreak Prediction and Monitoring

Analyze disease spread patterns using historical data. MapReduce for geographical data aggregation, Hive for time-series records, and PySpark for building predictive models to forecast outbreaks.

6. Crop Yield Prediction

Analyze weather and soil data to predict crop yields. MapReduce for data preprocessing, Hive to store historical records, and PySpark to train a regression model for yield forecasting.

7. Precision Farming Analytics

Process IoT sensor data from fields to recommend optimal farming practices. MapReduce to clean sensor logs, Hive for storage, and PySpark for anomaly detection or clustering regions with similar conditions.

8. Pest and Disease Detection

Analyze image or sensor data to detect crop diseases. MapReduce for initial image data processing, Hive for metadata storage, and PySpark with ML models for image classification.

9. Market Price Prediction for Crops

Analyze historical crop prices to help farmers decide what to plant. MapReduce for price aggregation, Hive for storing market data, and PySpark for time-series forecasting.

10. Water Usage Optimization

Monitor water usage across farms to suggest efficient irrigation strategies. MapReduce to clean sensor readings, Hive for water usage history, and PySpark to build prediction models for optimal water schedules.

11. Student Performance Prediction

Analyze student records to predict academic success. MapReduce to clean exam data, Hive to store student details, and PySpark to train classification models based on attendance, scores, and participation.

12. Course Recommendation System

Recommend courses based on student interests and past performance. MapReduce to preprocess course enrolments, Hive to store course metadata, and PySpark for collaborative filtering recommendation models.

13. Library Usage Analysis

Track library book checkouts to find popular books and peak usage times. MapReduce to aggregate checkout logs, Hive to store records, and PySpark for clustering frequent book borrowers.

14. Online Learning Engagement Analytics

Analyze interaction logs from online platforms to measure engagement. MapReduce to count interactions, Hive to store event logs, and PySpark to cluster students based on engagement

patterns.

15. Fraud Detection in Transactions

Identify suspicious transactions in real-time. MapReduce to preprocess logs, Hive to store transaction history, and PySpark MLlib to train fraud detection models (e.g., anomaly detection).

16. Customer Segmentation for Marketing

Segment customers for targeted marketing campaigns. MapReduce for initial customer data aggregation, Hive for structured customer profiles, and PySpark for clustering (like K-means).

17. Credit Risk Assessment

Predict the likelihood of loan default based on customer attributes. MapReduce to clean application data, Hive to store historical records, and PySpark to train a classification model (e.g., logistic regression).

18. Stock Price Trend Analysis

Analyze historical stock prices to predict future trends. MapReduce for data aggregation, Hive for structured storage, and PySpark for building time-series forecasting models.

Text Books:

1. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
2. Programming Hive, O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
3. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018 Edition

Web References (e-Resources):

1. <https://archive.nptel.ac.in/courses/106/104/106104189/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126052684230082561692_shared/overview
3. <https://sparkbyexamples.com/>

DEEP LEARNING TECHNIQUES LAB

III Year B. Tech. II semester
[CSE(AI&ML)]

Course Code: 24AI11RC05

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1: Build** deep neural networks to solve real world problems (L3)
- CO2: Apply** convolution neural networks to solve computer vision problems.(L3)
- CO3: Apply** recurrent neural networks to solve time series problems. (L3)
- CO4: Choose** appropriate pre-trained model to solve real time problems (L3)
- CO5: Construct** generative AI models for real world applications (L3)

Module-1: Multilayer Perceptron MLP

Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.

Module-2: Binary Classification

Design a neural network for classifying movie reviews using IMDB dataset.

Module-3: Multiclass Classification

Design a neural Network for classifying newswire articles using Reuters dataset.

Module-4: Regression algorithm

Design a neural network for predicting house prices using Boston Housing Price dataset.

Module-5: Convolution, Pooling and Strides

Build a Convolution Neural Network for MNIST Hand written Digit Classification. Try with both convolution and pooling layers, with just convolution layers (possibly with stride greater than 1).

Module-6: Data Augmentation

Build a Convolution Neural Network for simple image (dogs and Cats) classification with and without data augmentation.

Module-7: Recurrent Neural Networks

Implement a deep Recurrent Neural Network for a time series analysis.

Module-8: LSTM and GRU Networks

Implement a deep LSTM and GRU networks for a time series analysis.

Module-9: Transfer Learning

Use a pre-trained convolution neural network (VGG16) for image classification.

Module-10: Autoencoders

Implement dimensionality reduction using an autoencoder.

Module-11: GANs

Implement GAN to generate fashion item images.

Case Study: Select any practical application mentioned below.

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

1. Handwritten Signature Verification

Concepts: MLP, CNN, Transfer

Learning

Description: Develop a deep learning model to verify handwritten signatures and detect forgeries.

2. Skin Disease Classification

Concepts: CNN, Transfer Learning, Data Augmentation

Description: Use a CNN-based model to classify different types of skin diseases from medical images.

3. Real-Time Face Mask Detection

Concepts: CNN, Transfer Learning (VGG16), Data Augmentation

Description: Build a model that detects whether a person is wearing a mask or not in real-time.

4. Sentiment Analysis of Social Media Posts

Concepts: Multiclass Classification, RNN,

LSTM

Description: Classify tweets or social media posts into positive, negative, or neutral sentiments.

5. Fake News Detection

Concepts: Binary Classification, LSTM, GRU

Description: Build a model to classify news articles as real or fake.

6. Weather Forecasting using Time-Series Data Concepts: RNN, LSTM, GRU

Description: Predict weather conditions (e.g., temperature, humidity) using historical data.

7. AI-Powered Chatbot for Customer

Support Concepts: NLP, LSTM, GRU

Description: Develop a chatbot that can respond to customer queries using deep learning.

8. Music Genre Classification

Concepts: CNN, RNN, Transfer Learning

Description: Classify songs into different genres based on their audio features.

9. Hand Gesture Recognition

Concepts: CNN, Data

Augmentation

Description: Build a model to recognize hand gestures for controlling smart devices.

10. Autonomous Vehicle Lane

Detection Concepts: CNN,

Transfer Learning

Description: Develop a lane detection system to assist in self-driving cars.

11. Super-Resolution Image

Enhancement Concepts:

Autoencoders, GANs

Description: Implement a deep learning model to improve image resolution.

12. Fashion Item Generation using

GANs Concepts: GANs

Description: Train a Generative Adversarial Network (GAN) to create new fashion designs.

13. Personalized Movie Recommendation

System Concepts: Neural Networks,

Autoencoders

Description: Build a model that recommends movies based on user preferences.

14. 3D Object Reconstruction from 2D

Images Concepts: CNN, Autoencoders

Description: Develop a deep learning model to reconstruct 3D objects from 2D images.

15. Autonomous Speech-to-Text

Conversion Concepts: RNN, LSTM,

GRU

Description: Build a deep learning model that converts spoken language into text with high accuracy.

Text Books:

1. —Deep Learning with Python,|| 2nd Edition, Francois Chollet (2021), Manning Publications.

2. —Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, Aurélien Géron (2022), O'Reilly Publications.

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2. <https://www.coursera.org/specializations/deep-learning>

MLOPs WITH CLOUD PLATFORM

III Year B. Tech. II semester

[Skill Course: CSE(AI&ML)]

Course Code: 24AI11SC01

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Analyze the fundamental concepts of MLOps, versioning, reproducibility, and cloud environments.

CO2: Make use of MLflow and cloud storage to model training, tracking, and experiment management.

CO3: Develop containerized ML model services using Docker and deploy them on cloud platforms.

CO4: Apply ML workflows using CI/CD pipelines with GitHub Actions and Docker integration.

CO5: Evaluate and Monitor deployed models using scalable model-serving techniques and cloud-based monitoring tools

Module-1: Introduction to MLOps and Cloud Environments

- i. What is MLOps?
- ii. Why MLOps versioning, reproducibility, deployment pipelines
- iii. Overview of popular cloud platforms (AWS, GCP, Azure)
- iv. Set up free-tier accounts on GCP or AWS.

Module-2: Introduction to MLOps and Cloud Environments

- i. Use Google Colab or AWS SageMaker Studio Lab.
- ii. Train a simple ML model (classification) and save artifacts.
- iii. Store artifacts in cloud storage (Google Cloud Storage / S3).

Module-3: Model Tracking and Experiment Management

- i. Introduction to MLflow and experiment tracking.
- ii. Model registry basics
- iii. Install and set up MLflow locally.

Module-4: Model Tracking and Experiment Management

- i. Train multiple models and track experiments.
- ii. Register a model in the MLflow model registry.
- iii. Connect MLflow with cloud storage (GCS/S3).

Module-5: Containerization with Docker and Deployment Basics

- i. Why Docker for MLOps?
- ii. Docker concepts: Images, containers, Dockerfiles
- iii. Write a Dockerfile for a simple ML model inference service (Flask/FastAPI).

Module-6: Containerization with Docker and Deployment Basics

- i. Build and run the Docker container locally.
- ii. Push Docker images to Docker Hub or Google Artifact Registry.
- iii. Deploy containerized service on a free-tier VM (GCP Compute Engine / AWS EC2).

Module-7: CI/CD Pipelines for ML Projects

- i. What is CI/CD in MLOps?
- ii. Common tools (GitHub Actions, GitLab CI, Jenkins)
- iii. Set up a GitHub repository with a simple ML project

Module-8: CI/CD Pipelines for ML Projects

- i. Write a GitHub Actions workflow to automate unit tests and Docker image builds.
- ii. Integrate automatic push to Docker Hub.

- iii. Trigger deployment on successful build.

Module 9: Scalable Model Serving and Monitoring

- i. Model serving solutions (FastAPI, TensorFlow Serving, TorchServe)
- ii. Basics of monitoring (latency, errors, data drift)
- iii. Deploy a model using FastAPI on GCP Cloud Run or AWS Lambda.

Module-10: Scalable Model Serving and Monitoring

- i. Set up Prometheus and Grafana for monitoring container metrics.
- ii. Simulate inference load and monitor performance.
- iii. Log prediction requests and responses in Cloud Logging.

Text Books:

- 1. Andriy Burkov, "Machine Learning Engineering," 1st Edition, True Positive Inc., 2020.
- 2. Carl Osipov, "MLOps Engineering at Scale," 1st Edition, Manning Publications, 2023.

Web References (e-Resources):

- 1. <https://cloud.google.com/architecture/mlops-continuous-delivery-and-automation-pipelines-in-machine-learning>
- 2. <https://huyenchip.com/mlops/>

End-to-End Pipeline and Final Project

A report has to be submitted by every student at the end of the semester that includes

- i. Real-time image classification REST API on GCP with monitoring dashboard
- ii. Predictive analytics for student performance, deployed and served on AWS Lambda
- iii. Automated pipeline for dataset versioning, model training, and deployment using GitHub Actions and Cloud Run

I o T A P P L I C A T I O N S

III Year B. Tech. II semester

[Skill Course: common to ECE & CSE(AI&ML)]

Course Code: 24EC11SC02

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Outline the architecture, features, and pin configuration of Raspberry Pi/ Node MCU, and develop programs for IoT applications.
- CO2:** Interface and control digital and analog sensors using Raspberry Pi/Node MCU.
- CO3:** Implement motor control applications by interfacing and operating servo and stepper motors with Raspberry Pi/Node MCU.
- CO4:** Establish IoT communication by setting up Raspberry Pi/Node MCU as a web server, integrating with cloud platforms
- CO5:** Design and develop IoT-based mini-projects using Raspberry Pi/Node MCU.

SYLLABUS

Introduction to IoT and architecture, edge IoT, Raspberry Pi/ Node MCU and IoT Concepts: Features and Pin configuration and Programming. Communicating with web servers: HTTP, HTML, Raspberry Pi/ Node MCU as a web server, Web controllers, calling of web services using Thing Speak.

List of Experiments:

Cycle 01

1. Interacting Digital Outputs with Raspberry PI/Node MCU
2. Interfacing IR sensor to Raspberry PI/Node MCU.
3. Measuring temperature and humidity with a digital sensor using Raspberry PI/Node MCU
4. Interfacing and Controlling Servo Motor using Raspberry PI/Node MCU
5. Interfacing with Stepper Motor using Raspberry PI/Node MCU
6. Interfacing with Magnetometer using Raspberry PI/Node MCU
7. Integrate a cloud platform to Log data using Raspberry PI/Node MCU and upload to the cloud platform.

Cycle 02

Mini Project

1. Implementing Smart Home Systems using Raspberry PI/Node MCU
2. Implementing Smart Soil Monitoring System Raspberry PI/Node MCU
3. Design any IOT based system.

Web References:

1. <https://www.raspberrypi.org/documentation/>
2. <https://nodemcu.readthedocs.io/en/latest/>
3. <https://thingspeak.com/>
4. <https://learn.adafruit.com/>
5. <https://randomnerdtutorials.com/>

IPR & PATENTS

III Year B. Tech. II Semester
[Common to CSE, CSE (AI&ML), IT]

Course Code: 24HM11MC02

L	T	P	C
2	0	0	0

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Understand basic concepts of Intellectual property rights, IPR tool kit and its importance in the global scenario. (L2)
- CO2:** Apply the knowledge on patents for registration process and understand recent developments in patent system. (L3)
- CO3:** Demonstrate an understanding about copyright protection, the registration process and legal remedies available in case of infringement (L2)
- CO4:** Integrate and understand the concept of Trademarks and industrial design, their registration, infringement and related laws (L3)

CO5: Identify principles of trade secrets, Semi conductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right and emerging areas of IP (L4)

Unit-I: Introduction and Evolution of IP system

6

Lectures

Concept of property, Intellectual Property Rights (IPR), Importance of IP, Value creation through IP, Advantages of IP protection, Competitive advantage, History and rationale behind development of IP system, WTO and TRIPS agreement, Role of WIPO. Major forms of IP in India and globally.

TextBook-1: Chapter 1, 2, 3, 11 & 12, Text Book -2: Chapter1, 2 3 & 4 Text Book -4: Chapter 41

Unit-II: Patent, Patent filing and prosecution

6

Lectures

Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non- obviousness, and utility, Non-patentable inventions. Prior art search, Process of obtaining a patent in India, Convention application, Patent Cooperation Treaty (PCT), Patent Infringement, IP commercialization: Licensing & Royalty; Technology Transfer, Compulsory License, Pat informatics. Case studies on patenting of life saving drugs and their implications. TextBook-1: Chapter 3 & 4, Text Book -2: Chapter 4,5,6 &10

Unit-III: Trademarks and Industrial Design

6

Lectures

Types of trademarks, Trademark Registration process, Trademark Infringement, Post registration procedures & Trade Mark maintenance, Genericide Concept of Industrial design, Design registration, Design infringement. TextBook-1: Chapter 7, 8 & 10

Unit-IV: Copyrights and related rights

6

Lectures

Subject Matters of Copyright, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act– Rights Afforded by Copyright Law, Fair use –Right to Prepare Derivative Works - Plagiarism vs Copyright infringement- Copyright pertaining to Software/Internet and other Digital media. TextBook-1: Chapter 5 & 6

Unit-V: Other forms of IP and Emerging areas of IP

6

Lectures

Trade Secret- Maintaining Trade Secret –Employee Confidentiality Agreement – Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers’ rights, Traditional knowledge- **Case studies on biopiracy.** IP in bank loan, and insurance, Use of artificial intelligence in IP enforcement. TextBook-1: Chapter 9, 10 Text Book -2 Chapter 11

Text Books

1. Kompal Bansal & Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
2. Prabhuddha Ganguli: ‘ Intellectual Property Rights’ Tata Mc-Graw Hill, New Delhi
3. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning , New Delhi
4. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.

Reference Materials

1. The Indian Patents Act 1970 (as amended in 2005)
2. The Indian Copyright Act 1950 (as amended in 2017)
3. Indian Trademarks Act 1999
4. The Indian Industrial Designs Act 2000
5. The Protection of Plant Varieties and Farmers' Right Act 2001
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
7. Geographical Indications of Goods Act 1990

Web References (e-Resources):

1. <https://www.wipo.int/en/web/wipo-academy/>
2. Inventing the Future: An Introduction to Patents for small and medium sized enterprises, WIPO publication No 917 www.wipo.int/ebookshop
3. Looking Good: An Introduction to Industrial Designs for Small and Medium sized Enterprises; WIPO publication No.498 www.wipo.int/ebookshop Ganguli Prabuddha
4. "Geographical Indications-its evolving contours accessible in [http ips. nminsoda/files/2012/05/main book pdf](http://ips.nminsoda/files/2012/05/main_book.pdf) (2009)

GENERATIVE AI AND PROMPT ENGINEERING

IV Year B. Tech. I semester
[Skill Course: CSE(AI&ML)]

Course Code: 24AI11SC02

L	T	P	C
1	0	2	2

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Identify the key concepts, evolution, and types of Generative AI, including text, image, and code generation.

CO2: Apply prompt engineering techniques and Generative AI models for text, image, and code generation

CO3: Analyze the architecture and working principles of Large Language Models (LLMs) and diffusion models.

CO4: Develop fine-tuned Generative AI models and deploy them using cloud-based tools.

CO5: Evaluate Generative AI applications in terms of effectiveness, safety, and ethical considerations.

Module 1: Introduction to Generative AI and Prompt Engineering

- What is Generative AI?
- Evolution and types (text, image, code, audio generation)
- Basics of prompt engineering: few-shot, zero-shot, and chain-of-thought prompting.

Module 2: Introduction to Generative AI and Prompt Engineering

- Create an OpenAI API account or use Hugging Face Playground.
- Write 5 prompts for text summarization and compare outputs.
- Experiment with few-shot examples for code generation.
- Generate a story from a short prompt and tune it with style constraints.

Module 3: Large Language Models (LLMs) Under the Hood

- Transformer architecture basics.
- What makes LLMs work (parameters, fine-tuning, embeddings).

Module 4: Large Language Models (LLMs) Under the Hood

- Load a small transformer model from Hugging Face using Python.
- Generate text completions with GPT-2 or Falcon models.
- Experiment with temperature and top-p parameters.
- Create a simple chatbot interface using Streamlit.

Module 5: Image Generation using Diffusion Models

- i. Concept of diffusion models.
- ii. How models like DALL·E and Stable Diffusion work.

Module 6: Image Generation using Diffusion Models

- i. Generate images using DALL·E or Stable Diffusion from simple prompts.
- ii. Modify prompts for style, lighting, and composition effects.
- iii. Generate a 3-image sequence telling a visual story.
- iv. Set up a simple Flask app to serve generated images.

Module 7: Fine-Tuning and Custom Models

- i. Difference between fine-tuning and prompt engineering.
- ii. Introduction to LoRA (Low-Rank Adaptation) techniques.

Module 8: Fine-Tuning and Custom Models

- i. Fine-tune a small language model on a custom dataset (small corpus).
- ii. Upload a dataset to Hugging Face and train a text classification model.
- iii. Perform embeddings-based semantic search using Sentence Transformers.
- iv. Deploy a fine-tuned model using Gradio.

Module 9: Code Generation and AutoML

- i. Applications of generative AI in code.
- ii. Limitations and safety issues.

Module 10: Code Generation and AutoML

- i. Use OpenAI Codex or Code Llama to generate Python functions.
- ii. Prompt models to generate test cases.
- iii. Build an app that generates boilerplate CRUD code from a model.
- iv. Use AutoML libraries to generate predictive models from datasets.

Real-World Applications and Final Project

A report has to be submitted by every student at the end of the semester Applications in content creation, healthcare, education, and productivity.

1. Design prompts for generating educational quizzes.
2. Build a simple AI-powered Resume generation tool.
3. Create a simple chatbot for college admissions.
4. AI-Powered Text Story Generator using Transformers

5. Music Composition with LSTM-Based Generative AI
6. Realistic Image Synthesis Using GANs and VAEs
7. Chatbot with Context-Aware Text Generation

Reference Books:

1. Generative Adversarial Networks Cookbook: Over 100 recipes to build generative models using Python, TensorFlow, and Keras by Josh Kalin.
2. Generative AI in Software Development: Beyond the Limitations of Traditional Coding Jesse Sprinter, 2024.
3. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
4. Neural Networks and Deep Learning: A Textbook by Charu C. Aggarwal.

Web References:

1. <https://elearn.nptel.ac.in/shop/iit-workshops/completed/leveraging-generative-ai-for-teaching-programming-course/s/?v=c86ee0d9d7ed>

API AND MICRO SERVICES

[Professional Elective]

Course Code: 24CT11PE01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Identify the core components of the Spring Framework, including IoC containers, dependency injection techniques, and module configurations. (L3)

CO2: Build Spring Boot applications with autowiring, logging, and Aspect-Oriented Programming (AOP) to enhance modularity and maintainability. (L3)

CO3: Utilize Spring Data JPA for database interactions, implementing CRUD operations, pagination, query methods, and transaction management. (L3)

CO4: Develop SOAP-based and RESTful web services, applying SOA principles and best practices for service implementation. (L3)

CO5: Make use of Spring REST features such as request handling, response processing, API versioning, exception handling, and security mechanisms. (L3)

UNIT-I

10 Lectures

Spring 5 Basics: Introduction to Spring Framework, Spring Framework - Modules, Configuring IoC container using Java-based configuration, Introduction to Dependency Injection, Constructor Injection, Setter Injection, AutoScanning.

UNIT-II

10 Lectures

Spring Boot: Creating a Spring Boot Application, Spring Boot Application Annotation, Autowiring, Scope of a bean, Logger, Introduction to Spring AOP, Implementing AOP advices, Best Practices : Spring Boot Application.

UNIT-III

12 Lectures

Spring Data JPA with Boot: Limitations of JDBC API, Need for Spring Data JPA, Spring Data JPA with Spring Boot, Spring Data JPA Configuration, Pagination and Sorting, Query Approaches, Named Queries and Query, Overview of Spring Transaction, Spring Declarative Transaction, Update Operation in Spring Data JPA, Custom Repository Implementation, Best Practices - Spring Data JPA.

UNIT-IV

08 Lectures

Web Services: Introduction to Web services, SOA - Service Oriented Architecture, Types of Web Services, SOAP based Web Services, RESTful Web Services, How to creation of RESTful.

UNIT-V

10 Lectures

Spring REST: Spring REST - An Introduction, Creating a Spring REST Controller, @RequestBody and ResponseEntity, Parameter Injection, Usage of @PathVariable, @RequestParam and @MatrixVariable, Exception Handling, Data Validation, Creating a REST Client, Versioning a Spring REST endpoint, Enabling CORS in Spring REST, Securing Spring REST endpoints.

Text Books:

1. "Spring in Action," Craig Walls, 5th Edition, Manning Books, 2018. ISBN: 978- 1617294945.
2. "Pro Spring Boot 2: An Authoritative Guide to Building Microservices, Web and Enterprise Applications, and Best Practices," Felipe Gutierrez, Apress, 2018. ISBN: 978-1484236758.

Reference Books:

1. "Mastering Spring Boot 3.0," Ranga Rao Karanam, Packt Publishing, 2022.
2. "Mastering Spring Boot 2," Dinesh Rajput, *Packt Publishing*, 2019.

Web References (e-Resources):

1. Infosys Spring board courses:
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_19872203945352840000_shared/overview [Spring 5 Basics]
2. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01296689056211763272_shared/overview [Spring 5 Basics with Spring Boot]
3. https://infyspringboard.onwingspan.com/en/app/toc/lex_4313461831752789500_shared/overview [Spring Data JPA with Boot]
4. https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_012731900963905536190_shared/overview [Spring REST]
5. <https://docs.spring.io/spring-framework/reference/>
6. <https://docs.spring.io/spring-boot/>
7. <https://docs.spring.io/spring-data/jpa/reference/>
8. <https://spring.io/guides/gs/rest-service>
9. <https://spring.io/guides/gs/securing-web>

ETHICAL HACKING

[Professional Elective]

Course Code: 24CT11PE02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** **Explain** hacking concepts and penetration testing techniques to assess system vulnerabilities, thereby enhancing cyber security measures and system defences. (L2)
- CO2:** **Apply** foot printing and scanning techniques to analyse network systems and evaluate security vulnerabilities for effective penetration testing. (L3)
- CO3:** **Make use of** system hacking techniques, password-cracking methods, and understand malware operations to assess and mitigate security threats. (L3)
- CO4:** **Apply** sniffing, session hijacking techniques, analyse packet data, and **understand** social engineering methods to identify and mitigate security threats. (L3)
- CO5:** **Demonstrate** cryptography, steganography, and vulnerability assessment techniques to analyse system security and **apply** testing methods for identifying and mitigating risks. (L3)

UNIT-I

8 Lectures

Introduction to Hacking: Hacking, Types and phases of hacking.

Introduction to Ports & Protocols: Ports, Protocols, Primary Network Types, Virtualization & Introduction to Kali Linux: Virtualization, Virtualization software, supported platforms, Introduction to Penetration Testing: Penetration test, Categories and Types of Penetration tests, Structure of Penetration Test Report.

UNIT-II

8 Lectures

Foot printing: Foot printing, Types, Using ping and ns Lookup commands in Windows command line.

Scanning: Scanning, Basics of Scanning, Basic Techniques of Scanning, Enumerating DNS using DNS, enum, performing flag scan using hping3.

UNIT-III

10 Lectures

Hacking into System: System Hacking, Password Cracking, Default password databases, Manual and Automated Password Cracking, Process of System Hacking, Rootkits, Using Key Loggers.

Trojans & Backdoors: Trojans, Working of Trojan, Infection Techniques, Attack, Lifecycle and Classification of Virus, Worms, Virus Construction Kit.

UNIT-IV

10 Lectures

Sniffing, Types of Sniffing-Active and passive sniffing Techniques, Packet Analysis, ARP Spoofing, session hijacking

Social Engineering: Social Engineering, Process, Identity Theft, Human and Computer Based Social Engineering Techniques, Phishing Process, Types of Phishing Attacks, Social Engineering Toolkit (SET).

UNIT-V

10 Lectures

Vulnerability Assessment: Vulnerability, The Open Web Application Security Project (OWASP), Prevention, Damn Vulnerable Web Application (DVWA), installation and testing of DVWA

Advanced Hacking: Web Application & Web Server Penetration Testing, Denial of Service, Wireless Network Exploitation

Case study: The students are advised to perform End-to-End Penetration Testing on DVWA (Damn Vulnerable Web Application).

Text Books:

1. Hacking: Be a Hacker with Ethics, Harsh Bothra, Khanna Publications, 2019.
2. Ethical Hacking and Penetration Testing Guide, Rafay Baloch, 2014.

Reference Books:

1. Kali Linux Wireless Penetration Testing Beginner's Guide, Vivek Ramachandran, Cameron Buchanan, Packt Publishing, 2015.
2. SQL Injection Attacks and Defense, 1st Edition, Justin Clarke-Salt, Syngress Publication.
3. Mastering Modern Web Penetration Testing, Prakhar Prasad, Packt Publishing, October 2016.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_cs13/preview

GENERATIVE AI MODELS

[Professional Elective]

Course Code: 24CT11PE03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Summarize large language models' architecture and pre-training techniques. (L2)

CO2: Make Use of the GPT model for natural language processing tasks. (L3)

CO3: Apply the BERT model for natural language processing tasks. (L3)

CO4: Utilize LSTM, Transformers, GANs, and VAEs for text and image generation, including fine-tuning models for real-world applications. (L3)

CO5: Apply LSTM and Transformers for music generation and composition. (L3)

UNIT-I

10 Lectures

Introduction to Large Language Models: Overview of Generative AI and Large Language Models. Basics of attention mechanisms and Transformer architecture. Pre- training techniques and transfer learning strategies.

UNIT-II

10 Lectures

GPT Models and Applications: Study of GPT architecture and variants. Applications of GPT models in text generation and dialogue systems. Case study-based implementation of GPT-based tasks. GPT-based chatbot enhances E-Shop's customer support service

UNIT-III

8 Lectures

BERT and Advanced Techniques: Understanding BERT architecture and pre-training objectives. Fine-tuning BERT for downstream NLP tasks. Exploration of advanced Transformer architectures and techniques

UNIT-IV

12 Lectures

Text Generation with Generative AI: Introduction to Text Generation, LSTM-based Text Generation, Transformer-based Text Generation, Fine-Tuning Language Models, and Text Generation Applications

Image Generation with Generative AI: Introduction to Image Generation, Implementing GANs for Image Generation Training and Fine-Tuning GANs, Generating Images with VAEs, Advanced Techniques in Image Generation, and Image and Video Generation Applications.

UNIT-V

10 Lectures

Music Generation with Generative AI:

Introduction to Music Generation, Music Representation, and LSTM-based Music Generation. Transformer-based Music Generation, Evaluation and Fine-Tuning, Music Composition Applications.

Text Books:

1. Generative AI for Everyone: Understanding the Essentials and Applications of This Break through Technology". Altaf Rehmani.
2. Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models, Joseph Babcock and Raghav Bali, 2024.

Reference Books:

1. Generative Adversarial Networks Cookbook: Over 100 recipes to build generative models using Python, TensorFlow, and Keras by Josh Kalin.
2. Generative AI in Software Development: Beyond the Limitations of Traditional Coding Jesse Sprinter, 2024.
3. Deep Learning- Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2016

Web References (e-Resources):

- 1 <https://elearn.nptel.ac.in/shop/iit-workshops/completed/leveraging-generative-ai-for-teaching-programming-course/s/?v=c86ee0d9d7ed>

MOBILE APPLICATION DEVELOPMENT

[Professional Elective]

Course Code: 24CT11PE04

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Explain the Android development framework. (L2)

CO2: Demonstrate usage of user interface components and layouts. (L3)

CO3: Utilize Image Views to display pictures dynamically in Android applications. (L3)

CO4: Utilize networking functionalities to fetch and send data over the intent. (L3)

CO5: Build APK files and configure them for different Android devices. (L3)

UNIT-I

12 Lectures

Getting Started with Android Programming: Introduction to Android, Obtaining the Required Tools
Activities and Intents: Software Economics, pragmatic software cost estimation.

Improving Software Economics: Understanding Activities, Linking Activities Using Intents, Calling Built-In Applications Using Intents,

UNIT-II

12 Lectures

Getting to Know the Android User Interface: Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Creating the User Interface Programmatically.

Designing Your User Interface Using Views: Basic Views, Picker Views, List Views.

UNIT-III

8 Lectures

Fragments: Creating Fragments with Java Code . Creating Special Fragments.

Displaying Pictures and Menus with Views: Using Image Views to Display Pictures, Using Menus with Views.

UNIT-IV

8 Lectures

Messaging and Networking: SMS Messaging, Sending E-Mail, Networking.

Data Persistence: Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases

UNIT-V

10 Lectures

Publishing Android Applications: Preparing for Publishing, Deploying APK Files, Publishing on the Android Market.

Text Books:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013.
2. Android™ Programming Unleashed, B.M. Harwani, 1st Edition, Pearson Education, 2013.

Reference Books:

1. Reto Meier , Professional Android 4 Application Development, Wiley India, (Wrox) , 2012.
2. James C. Sheusi, Android Application Development for Java Programmers, Cengage Learning, 2013.

Web References (e-Resources):

1. <https://developer.android.com/docs>
2. <https://www.technosip.com/mobile-application-development/>
3. <https://www.denimgroup.com/media/pdfs/MobileDevReference.pdf>

SOFT COMPUTING**[Professional Elective]****Course Code: 24CT11PE05**

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Summarize various soft computing techniques in order to solve problems effectively and efficiently. (L2)

CO2: Outline appropriate learning rules for each of the architectures based supervised neural networks with its applications. (L2)

CO3: Outline appropriate learning rules for each of the architectures based unsupervised neural networks and third-generation neural networks with its applications. (L2)

CO4: Demonstrate Fuzzy logic concepts to recognize, represent, manipulate, interpret, and use data and information that is vague and lacks certainty. (L2)

CO5: Solve optimization problems using genetic algorithms and **Develop** hybrid system using the principles of soft computing techniques in various applications. (L3)

UNIT-I**8 Lectures**

Introduction: Neural Networks, Application Scope of Neural Networks, Fuzzy Logic, Genetic Algorithm, Hybrid Systems, Soft Computing.

UNIT-II**12 Lectures**

Artificial Neural Network: Fundamental Concept, Evolution of Neural Networks, Basic Models of Artificial Neural Network, Important Terminologies of ANNs, McCulloch–Pitts Neuron, Linear Separability, Hebb Network.

Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron (Adaline), Back- Propagation Network, Autoassociative Memory Network, Heteroassociative Memory Network

UNIT-III**10 Lectures**

Unsupervised Learning Networks: Fixed Weight Competitive Nets, Kohonen Self- Organizing Feature Maps, Learning Vector Quantization, Counter propagation Networks, Adaptive Resonance Theory Network.

Third-Generation Neural Networks: Spiking Neural Networks, Convolutional Neural Networks

UNIT-IV**10 Lectures**

Fuzzy Set Theory: Fuzzy Versus Crisp, Crisp Sets, Fuzzy Sets, Crisp Relations, Fuzzy Relations **Fuzzy**

Systems: Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based System, Defuzzification Methods

UNIT-V

10 Lectures

Fundamentals of Genetic Algorithms: Genetic Algorithms, Basic concepts, Creation of Offsprings, Working Principle, Encoding, Fitness function, Reproduction.

Hybrid Soft Computing Techniques: Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid Systems, Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems.

Text Books:

1. Principles of Soft Computing, 3rd Edition, S. N. Sivanandam, S. N. Deepa, Wiley India Private Ltd., 2019, ISBN: 978-81-265-7713-2.
2. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S. Rajsekaran and G. A. Vijayalakshmi Pai, Prentice Hall of India.

Reference Books:

1. Neuro-Fuzzy and Soft Computing, J. S. R. Jang, C.T. Sun and E. Mizutani, PHI / Pearson Education 2004.
2. Neural Networks Comprehensive Foundation, Second Edition, Simon Haykin, Pearson Education, 2005.

Web References (e-Resources):

1. <https://archive.nptel.ac.in/courses/106/105/106105173/>

COMPUTER VISION**[Professional Elective]****Course Code: 24CA11PE01**

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline fundamental concepts of image representation, image analysis tasks, and data structures for image processing. (L2)

CO2: Classify various image pre-processing techniques, including edge detection, image smoothing, and image restoration. (L2)

CO3: Apply deep learning-based object detection techniques using frameworks such as R- CNN, Faster R-CNN, and YOLO. (L3)

CO4: Build face recognition and gesture recognition models using deep learning approaches like FaceNet and DeepFace. (L3)

CO5: Utilize deep learning architectures such as ResNet, Inception, and GoogleNet for video analytics applications. (L3)

UNIT-I**10 Lectures**

Computer Vision: Image representation and image analysis tasks, Image representations, digitization, properties, color images, Data structures for Image Analysis, Levels of image data representation, Traditional and Hierarchical image data structures.

UNIT-II**12 Lectures**

Image pre-processing: Local pre-processing, Image smoothing, Edge detectors, Zero- crossings of the second derivative, Scale in image processing, Canny edge detection, Parametric edge models, Edges in multi-spectral images, pre-processing in the frequency domain, Line detection by local pre-processing operators – Image restoration.

UNIT-III**10 Lectures**

Object detection using Deep Learning: Object detection, Object detection methods, Deep Learning framework for Object detection, bounding box approach, Intersection over Union (IoU)

Deep Learning Architectures: R-CNN-Faster-R-CNN, You Only Look Once(YOLO), Salient features, Loss Functions, YOLO architectures

UNIT-IV**10 Lectures**

Face recognition and gesture recognition: Face Recognition, Introduction, Applications of Face Recognition, Process of Face Recognition, DeepFace solution by Facebook, FaceNet for Face

Recognition, Implementation using FaceNet, Gesture Recognition.

UNIT-V

08 Lectures

Video analytics: Video Processing, use cases of video analytics, Vanishing Gradient and exploding gradient problem, RestNet architecture, RestNet and skip connections, Inception Network, GoogleNet architecture, Improvement in Inception v2, Video analytics, RestNet and Inception v3.

Text Books:

1. Image Processing, Analysis, and Machine, Vision, Milan Sonka, Vaclav Hlavac, Roger Boyle 4th edition, Thomson Learning, 2013
2. Vaibhav Verdhhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras, Apress 2021

Reference Books:

1. Richard Szeliski, —Computer Vision: Algorithms and Applications, Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, —Video Analytics for Business Intelligence, Springer, 2012.
3. D. A. Forsyth, J. Ponce, —Computer Vision: A Modern Approach, Pearson Education, 2003.
E. R. Davies, (2012), —Computer & Machine Vision, Fourth Edition, Academic Press.

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview
2. <https://www.coursera.org/learn/introduction-computer-vision-watson-opencv/home/module/1>

CYBERSECURITY AND DIGITAL FORENSICS

[Professional Elective]

Course Code: 24CA11PE02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline the basics of cyber security and foundations of digital forensics. (L2)

CO2: Classify different types of cybercrimes, legal remedies, and how to report them. (L2)

CO3: Summarize various tools and methods used in cyber security and digital forensics and their practices. (L2)

CO4: Apply knowledge on digital forensic evidence acquisition. (L3)

CO5: Explain various evidence methods used in digital forensics. (L2)

UNIT-I

10 Lectures

Introduction to Cybercrime: Introduction, Cybercrime Definition and Origin, Cybercrime and Information Security, Cyber Crimes History & Development, Classification of Cybercrimes, Impact of Cybercrimes, Cybercrime and the Indian ITA 2000, Global Perspectives.

UNIT-II

12 Lectures

Foundation for Cybersecurity & Digital Forensics: Assessing Vulnerabilities, Penetrating the System, How Criminals Plan the Attack, Social Engineering, Cyber Stalking, Botnets, Overview of Forensic Science, Procedure, Forensic Lab, legal Issues in Digital Forensics.

UNIT-III

10 Lectures

Tools and Methods: Scanning Systems, Hosts, Open ports, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, DoS and DDoS Attacks, SQL Injection, Forensic Investigation Methodology, The Cyber Kill Chain, Diamond Model Analysis.

UNIT-IV

10 Lectures

Evidence Acquisition: Collecting Network Evidence, Host Based Evidence, Remote Evidence Collection, Forensic Imaging.

UNIT-V

8 Lectures

Evidence Analysis: Analyzing Network Evidence, Analyzing System Memory, Analyzing System Storage, Analyzing Log Files, Prepare Forensic Report.

Textbooks:

1. Cyber Security - Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, Sunit Belapure, Kamlesh Bajaj, 2011, John Wiley & Sons, Inc
2. Digital Forensics and Incident Response, 2022, Packt Publishing Ltd., 3rd Edition, Gerard Johansesn, ISBN: 978-1-80323-867-8.

Reference Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011).

Web References:

1. <https://www.udemy.com/course/master-advanced-cyber-security/?kw=cyber+security+fore&src=sac&couponCode=IND21PM>

FOG AND EDGE COMPUTING

[Professional Elective]

Course Code: 24CA11PE03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Define basic concepts in fog and edge computing technology. (L1)

CO2: Outline suitable architectures for fog and edge computing applications. (L2)

CO3: Identify suitable network and storage models for fog and edge computing. (L3)

CO4: Apply concepts of serverless computing and its relationship with fog and edge computing. (L3)

CO5: Utilize fog and edge computing to expose modern tools and API to deploy relevant Infrastructures. (L3)

UNIT-I

8 Lectures

Introduction to New Computing Paradigms: Introduction, Relevant Technologies, Fog and Edge Computing Completing the Cloud, Security, Agility, Latency, Edge Controls (Inner, Middle, and Outer).

UNIT-II

12 Lectures

Architecture and Networking Models: Unified Architectures, Fog Cloud and Edge Cloud Architectures [Storage and Orchestration], Edge-as-a-Service (EaaS), Edge Node Resource Management (ENORM) Framework, Networking Challenges.

UNIT-III

10 Lectures

Management and Orchestration of Network Slices Fog and Edge: Mobile Edge Computing, Network Slicing in 5G, Network Function and Virtualization Layer, Service and Application Layer, Slicing Management and Orchestration (MANO), Virtual Network Functions Management, Network Slicing Management in Edge and Fog.

UNIT-IV

10 Lectures

Optimization Problems: Introduction, Preliminaries, Optimization in Fog Computing, Formal Modeling Framework for Fog Computing, Metrics, Performance, Resource Usage, Energy Consumption, Optimization Opportunities Fog Edge Architecture, Optimization Service Life Cycle.

UNIT-V

10 Lectures

Data Management and Real-world Applications: Data Management and Lifecycle, Data Acquisition, Lightweight Processing, Analysis, Data Pre-Processing and Analytics, Data Privacy. Applications: eHealth Environments, Smart Agriculture.

Text Books:

1. Fog and edge computing: principles and paradigms, Rajkumar Buyya, Satish Narayana Srirama
Hoboken, NJ, USA: John Wiley & Sons, Inc., 2019, ISBN 9781119524984 (hardcover).
2. Edge Computing: Models, technologies and applications, 2020, First Edition, Javid Taheri, and
Shuiguang Deng, Institution of Engineering and Technology Publication, ISBN-13: 978-1785619403.

Web References (e-Resources):

1. EC Council Material [<https://tinyurl.com/5urbybwh>]
2. <https://www.techtarget.com/iotagenda/definition/fog-computing-fogging>
3. Intel [<https://tinyurl.com/bdee2nbx>]

NO SQL DATABASES

[Professional Elective]

Course Code: 24CA11PE04

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Explain the fundamental concepts of NoSQL and its significance in modern database systems. (L2)

CO2: Apply aggregate data models, MapReduce, and distribution techniques to design scalable NoSQL database solutions. (L3)

CO3: Outline the detailed architecture and performance tune of Document-oriented NoSQL databases. (L2)

CO4: Explain performance tune of Key-Value Pair NoSQL databases. (L2)

CO5: Apply NoSQL development tools on different types of NoSQL Databases. (L3)

UNIT-I

10 Lectures

Introducing NoSQL: The big picture.

Why NoSQL: The Value of Relational Databases- Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL.

UNIT-II

10 Lectures

Aggregate Data Models: Aggregates, Key-Value and Document Data Models, Column- Family Stores, Aggregate-Oriented Databases.

Map-Reduce: Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations.

Distribution Models: Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT-III

10 Lectures

Document Databases: Document oriented Database Features-Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases- Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E- Commerce Applications, When not to use-Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure

UNIT-IV

10 Lectures

Column-Family Stores: Column-Family Data Store, Features-Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases- Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

UNIT-V

10 Lectures

Key-Value Databases: Key-Value Store, Key-Value Store Features-Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases- Storing Session Information, User Profiles, Preferences, Shopping Cart Data, When not to use- Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. **Graph Databases:** Graph Database. Features- Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases- Connected Data, Routing, Dispatch and Location- Based Services, Recommendation Engines.

Text Books:

1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Sadalage, P. & Fowler, Wiley Publications, 1st Edition, 2019.
2. NoSQL for dummies by Adam Fowler.

Web References (e-Resources):

1. <https://www.ibm.com/cloud/learn/nosql-databases>
2. <https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp>
3. <https://www.geeksforgeeks.org/introduction-to-nosql/>
4. <https://www.javatpoint.com/nosql-databa>

D A T A S C I E N C E

[Professional Elective]

Course Code: 24IA11PE01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1: Summarize** the fundamental concepts of data science, including the types of data, the role of a data scientist, and real-world applications (L2)
- CO2: Utilize** machine learning techniques in Data Science with Python for effective modelling, validation, and real-world applications like malicious URL detection and recommender systems (L3)
- CO3: Apply** NoSQL and Hadoop for big data processing and real-world cases like loan risk assessment and disease diagnosis. (L3)
- CO4: Explain** the concepts and applications of graph databases using Neo4j and Cypher, and demonstrate text mining and analytics using Python libraries like NLTK and SQLite, with a case study on classifying Reddit posts (L2)
- CO5: Build** eco-friendly applications using object-oriented programming concepts, and build a prototype application of Data Science (L3)

UNIT-I:

10 Lectures

Data Science Fundamentals: Structure, Objective, What is data?, Structured data, Unstructured data, Semi-structured data, What is data science?, What does a data scientist do?, Real-world use cases of data science.

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT-II:

10 Lectures

Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning. Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT-III:

10 Lectures

NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling.

UNIT-IV:

10 Lectures

Tools and Applications of Data Science: Introducing Neo4j for dealing with graph databases, graph query language Cypher, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts.

UNIT-V:

10 Lectures

Data Visualization and Prototype Application Development: Data Visualization options, crossfilter, the JavaScript Map Reduce library, creating an interactive dashboard with dc.js, Dashboard development tools, applying the DS process for respective engineering problem solving scenarios as a detailed case study

Textbook:

1. Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, —Introducing to Data Science using Python tools, Manning Publications Co, Dreamtech press, 2016.
2. Prateek Gupta, —Data Science with Jupyter, BPB publishers, 2019 for basics

Reference Books:

1. Joel Grus, —Data Science from Scratch, O'Reilly, 2019.
2. Doing Data Science: Straight Talk from The Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

Web References(e-Resources):

1. Data science for engineers, <https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs28/>

PRINCIPLES OF COMPILER DESIGN

[Professional Elective]

Course Code: 24IA11PE02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Summarize the phases of the Compiler and role of Lexical Analyzer. (L2)

CO2: Make use of different parsing techniques for the construction of parse tree. (L3)

CO3: Explain the semantic analysis Schemes and Intermediate code generation. (L2)

CO4: Outline the various Machine-Independent and dependent Optimization techniques of compiler. (L2)

CO5: Utilize the code generation techniques and role of the symbol table in the compiler design. (L3)

UNIT-I

8 Lectures

Introduction to Compiler: Language Processors, the structure of a compiler, the science of building a compiler, programming language basics, Compiler tools, Boot strapping.

Lexical Analysis: The Role of the Lexical Analyzer, Input Buffering, Recognition of Tokens, The Lexical-Analyzer Generator LEX, Design of a Lexical-Analyzer Generator.

UNIT-II

12 Lectures

Syntax Analyzer: Introduction to Context-Free Grammars, Introduction to Parsers, **Top-Down Parsing techniques:** Brute force parsing, Recursive Descent Parsing, Predictive Parsing. Bottom-Up Parsing: Shift reduce parsing, Simple LR, More Powerful LR (K) Parsers.

UNIT-III

10 Lectures

Semantic Analysis & Intermediate code Generation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, and Intermediate Code Generation, Three Address Code-Translation of Expressions, Control Flow.

UNIT-IV

10 Lectures

Code Optimization: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis. Loop Optimization, Basic Blocks & Flow Graphs, Local Optimization, DAG Representation of Basic Blocks, Applications of DAG, Unreachable Code Elimination, Dead Code Elimination, Machine Dependent Optimization: Peep-Hole Optimization.

UNIT-V

10 Lectures

Code Generation: Issues in Code Generation, Input to Code Generator, Instruction Selection, Register Allocation, Simple Target Machine Model, Program and Instruction Costs, Register allocation & Assignments, Code Generation Algorithm, Symbol Table & Run time environment: Structure of Symbol Table, declarations, Run time Environment, Stack allocation of space, Heap Management, garbage collection.

Text Books:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson.
2. Compilers:, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Pearson Principles, Techniques and Tools, Second Edition.
3. Kenneth C Loudon, Cengage Compiler Construction-Principles and Practice, Learning. ISBN: 9788131501320.

Reference Books:

1. C, Andrew W Appel, Revised edition Modern compiler implementation in, Cambridge University Press.
2. Loudon: "Compiler Construction, Principles & Practice", 1st Edition, Thomson Press, 2006.
3. J. P. Tremblay and P. G. Sorenson, TMH The Theory and Practice of Compiler writing,
4. R. Mak, 3rd edition, Wiley student Writing compilers and interpreters edition.

Web References (e-Resources):

1. <https://nptel.ac.in/courses/106104123>
2. <https://cse.iitkgp.ac.in/~rkumar/advcc/resources.html>

NATURAL LANGUAGE PROCESSING (NLP)

[Professional Elective]

Course Code: 24IA11PE03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Illustrate key NLP methodologies, including rule-based, statistical, and deep learning-based approaches. (L2)

CO2: Utilize neural embeddings and deep learning techniques to enhance text classification performance. (L3)

CO3: Make use of Transformer-based models in combination with traditional NLP techniques to optimize Information Extraction (IE) performance. (L3)

CO4: Build chatbot applications using various dialog system components and frameworks like Rasa NLU. (L3)

CO5: Formulate the effectiveness of NLP applications in different domains. (L4)

UNIT-I:

10 Lectures

NLP: A Primer:

NLP in the Real World, Building Blocks of Language, Machine Learning, Deep Learning, and NLP: An Overview, Approaches to NLP, An NLP Walkthrough: Conversational Agents.

NLP Pipeline:

Data Acquisition, Text Extraction and Cleanup, Pre-Processing, Feature Engineering, Modelling, Evaluation, Post-Modelling Phases.

Case Study: Customer Obsession Ticketing Assistant (COTA)

UNIT-II:

10 Lectures

Text Representation:

Vector Space Models, Basic Vectorization Approaches, Distributed Representations, Distributed Representations Beyond Words and Characters, Universal Text Representations, Visualizing Embeddings.

Text Classification:

Applications, A Pipeline for Building Text Classification Systems, One Pipeline, Many Classifiers, Using Neural Embeddings in Text Classification, Deep Learning for Text Classification, Interpreting Text Classification Models, Learning with No or Less Data and Adapting to New Domains.

Case Study: A corporate ticketing system.

UNIT-III:

10 Lectures

Information Extraction:

IE Applications, IE Tasks, The General Pipeline for IE, Keyphrase Extraction, Named Entity Recognition, Named Entity Disambiguation and Linking, Relationship Extraction, Other Advanced IE Tasks.

Transformer Anatomy:

The Transformer Architecture, The Encoder, The Decoder, Meet the Transformers.

UNIT-IV:

10 Lectures

Chatbots:

Applications, A Taxonomy of Chatbots, A Pipeline for Building Dialog Systems, Dialog Systems in Detail, Deep Dive into Components of a Dialog System, Other Dialog Pipelines, Rasa NLU.

UNIT-V:

14 Lectures

NLP Applications:

Search and Information Retrieval, Topic Modelling, Text Summarization, Recommender Systems for Textual Data, Machine Translation, Question-Answering Systems.

Textbook:

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta and Harshit Surana, —Practical Natural Language Processing, O'Reilly Media Inc., 2021, ISBN: 978-93- 8588-918-9.
2. Lewis Tunstall, Leandro von Werra, & Thomas Wolf, Natural Language Processing with Transformers ISBN: 978-1098136789.

Reference Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin -Pearson Publication, 2014.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. <https://www.coursera.org/specializations/natural-language-processing>

AI CHATBOTS

[Professional Elective]

Course Code: 24AI11PE01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Summarize how AI chatbots transform customer interactions in banking and insurance by enhancing efficiency, personalization, and compliance with data privacy regulations. (L2)

CO2: Interpret how conversational flow impacts user interactions in chatbot applications. (L2)

CO3: Explain the role of NLP, NLU, and NLG techniques in chatbot applications. (L2)

CO4: Make use of integration modules in chatbot deployment. (L3)

CO5: Develop AI chatbots using cloud platforms. (L3)

UNIT-I

12 Lectures

Processes in the Banking and Insurance Industries: Banking and Insurance Industries, A Customer-Centric Approach in Financial Services, Benefits from Chatbots for a Business, Chatbots in the Insurance Industry, Conversational Chatbot Landscape.

Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR).

UNIT-II

7 Lectures

Chatbot Development Essentials: Customer Service-Centric Chatbots, Chatbot Development Approaches, Conversational Flow, Key Terms in Chatbots, Use Case: 24 * 7 Insurance Agent.

Building a Chatbot Solution: Business Considerations, Business Benefits of Chatbots, Success Metrics, Managing Risks in Chatbots Service.

UNIT-III

12 Lectures

Natural Language Processing, Understanding, and Generation: Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.

Introduction to Microsoft Bot, RASA, and Google Dialogflow: Microsoft Bot Framework, Introduction to RASA, Introduction to Dialogflow.

UNIT-IV

7 Lectures

Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module, Demonstration of Askiris , Chatbot in Facebook Messenger.

UNIT-V

12 Lectures

Deployment and a Continuous Improvement Framework: Deployment to the Cloud, Smart IRIS Alexa Skill Creation in Less Than 5 Minutes, Continuous Improvement Framework.

Transformer Anatomy: The Transformer Architecture, The Encoder, The Decoder, Meet the Transformers.

Text Books:

1. Abhishek Singh, Karthik Ramasubramanian, Shrey Shivam – Building an Enterprise Chatbot (Apress, 2019).
2. Lewis Tunstall, Leandro von Werra, & Thomas Wolf, Natural Language Processing with Transformers (O'Reilly 2022).

Reference Books:

1. Amir Shevat, “Designing Bots: Creating Conversational Experiences” (O'Reilly Media 2017)
2. Sumit Raj, “Building Chatbots with Python” (Apress , 2018).

Web References (e-Resources):

1. Rasa Open Source (<https://rasa.com/>) Framework for building and deploying conversational AI chatbots.

MODERN CRYPTOGRAPHY AND NETWORK SECURITY**[Professional Elective]****Course Code: 24AI11PE02**

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline security attacks, services, mechanisms, network security models, and classical encryption techniques. (L2)

CO2: Utilize symmetric key cryptography principles, including modern block ciphers, DES, AES, Blowfish, IDEA, and block cipher operations, for secure communication. (L3)

CO3: Make use of public key cryptography, number theory, cryptographic hash functions, and digital signatures for secure communication and authentication. (L3)

CO4: Demonstrate key management, compare key distribution methods, and evaluate security protocols for secure communication. (L2)

CO5: Apply transport-level security (TLS, SSL) and system security measures, including IDS, firewalls, and malicious program protection for secure communication. (L3)

UNIT-I**8 Lectures**

Computer and network security concepts: Security Attacks, Security Services & Mechanisms, A model for network security, Classical Encryption Techniques – Substitution techniques, Transposition techniques.

UNIT-II**12 Lectures**

Symmetric Key Cryptography: Introduction to Modern Symmetric Key ciphers, Modern Block Ciphers, Components of Modern Block Ciphers, Traditional Block Cipher structure, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Blowfish, IDEA, and Block Cipher Operations.

UNIT-III**12 Lectures**

Public Key Cryptography: Principles of public key Cryptography, Mathematics of Asymmetric key cryptography-Introduction to Number Theory-Prime numbers and Relatively Prime Numbers, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms, The RSA Algorithm, Diffie Hellman key exchange. Cryptographic Hash Functions-Application of Cryptographic Hash functions, Requirements & Security, SHA, Message Authentication Codes, Digital Signatures.

UNIT-IV

10 Lectures

Key Management: Symmetric Key Distribution, Kerberos, Public Key Distribution. **E-mail & IP Security:** Internet Mail architecture, E-mail security using PGP, IPSec-IP Security-Overview, IP Security policy, Encapsulating Security Payload (ESP), Authentication Header (AH).

UNIT-V

8 Lectures

Transport Level Security: Web Security considerations, Transport Layer Security (TLS), Secure Socket Layer (SSL). **System Security:** Malicious Programs, Intrusion Detection Systems Firewalls: Characteristics, Types of Firewalls.

Text Books:

1. Cryptography and Network Security-Principles and Practise by William Stallings, Seventh Edition
2. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, McGrawHill, 3rd Edition.2015.

Reference Books:

1. Cryptography and Network Security- by Atul Kahate

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc25_cs16/preview

REINFORCEMENT LEARNING

[Professional Elective]

Course Code: 24AI11PE03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Explain core RL concepts such as rewards, policies, value functions, and Bellman equations, demonstrating a strong theoretical foundation. (L2)

CO2: Develop and implement policy-based and value-based RL algorithms, understanding their trade-offs and practical applications. (L3)

CO3: Make Use of Deep Q-Networks (DQNs) and optimize them using experience replay, target networks, and other enhancements. (L3)

CO4: Apply actor-critic methods (A2C, PPO) to solve complex RL tasks in continuous and discrete action spaces. (L3)

CO5: Utilize RL models for efficiency and performance, using parallelization techniques and hyper parameter tuning. (L3)

UNIT-I

10 Lectures

Introduction: Reinforcement Learning Algorithms: policy-based, value-based, model-based algorithms and combined methods. On-policy and off-policy algorithms. Reinforcement learning examples- tic tac toe and multi-armed bandits.

UNIT-II

10 Lectures

Policy-Based and Value-Based Learning: REINFORCE-policy, the objective function, the policy gradient, Monte Carlo sampling, REINFORCE algorithm and its implementation.

SARSA: the Q- and V-functions, temporal difference learning, exploration and exploitation, SARSA algorithm and its implementation.

UNIT-III

10 Lectures

Deep Q-Networks (DQN) and Enhancements: Deep Q-Networks: learning the Q-function, action selection, DQN algorithm and its implementation. **Improving DQN:** target networks, double DQN, prioritized experience replay (PER), modified DQN implementation.

UNIT-IV

10 Lectures

Combined Methods Advantage Actor-Critic (A2C): the actor, the critic, the advantage function, A2C algorithm and its implementation. **Proximal Policy Optimization (PPO):** surrogate objective, PPO algorithm and its implementation.

UNIT-V

10 Lectures

Parallelization Methods and Getting Deep RL to Work: Synchronous and asynchronous parallelization, training an A3C agent, debugging tips and hyperparameter tables.

Text Books:

1. Foundations of Deep Reinforcement Learning: Theory and Practice in Python, Graesser & Keng (2019), Addison-Wesley.
2. Reinforcement Learning: An Introduction, Sutton & Barto (2018), Bradford Books.

Reference Books:

1. Maxim Lapan (2020) —Deep Reinforcement Learning, 2nd Edition, Packt Publishing.

Web References (e-Resources):

1. <https://www.cse.iitm.ac.in/~ravi/nptel-courses/reinforcement-learning>
2. <https://www.coursera.org/specializations/reinforcement-learning>

SOFTWARE ENGINEERING

[Professional Elective]

Course Code: 24AI11PE04

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline the basics of Software Designing Models (L2)

CO2: Demonstrate the importance of agility process and illustrate the usage of Software Architecture. (L2)

CO3: Make use of the Software Testing terminology to test different kinds of software processes. (L3)

CO4: Apply the principles and techniques of black box and white box techniques. (L3)

CO5: Examine the need for automation and choose the best suited testing tool. (L4)

UNIT-I

10 Lectures

Introduction to Software Engineering: The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology.

UNIT-II

12 Lectures

Agile Process: Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge, Core Principles, Requirements Engineering, Eliciting Requirements, Developing Use Cases, Building the Requirements Model.

Design within the Context of Software Engineering: The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow.

UNIT-III

10 Lectures

Software Testing: Introduction, Evolution, Myths & Facts, Goals, Psychology, Definition, Model for testing, Effective Vs Exhaustive Software Testing. Software Testing Terminology and Methodology: Software Testing Terminology, Software Testing Life Cycle, relating test life cycle to development life cycle Software Testing Methodology.

UNIT-IV

10 Lectures

Dynamic Testing: Black Box testing techniques: Boundary Value Analysis, Equivalence class Testing, State Table based testing, Decision table-based testing, Cause-Effect Graphing based testing, White-Box Testing: need, Logic coverage criteria, Basis path testing, Graph matrices, Loop testing, data flow testing, mutation testing.

UNIT-V

8 Lectures

Automation and Testing Tools: need for automation, categorization of testing tools, selection of testing tools, Cost incurred, Guidelines for automated testing, overview of some commercial testing tools. Testing Web based Systems: Challenges in testing for web-based software, quality aspects, web engineering, testing of web-based systems, Testing mobile systems.

Text Books:

1. Software Engineering a practitioner's approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education.
2. Software Testing: Principles and Practices - Naresh Chauhan, Oxford.

Reference Books:

1. Software Engineering, Ian Sommerville, Ninth Edition, Pearson.
2. Software testing techniques – Boris Beizer, Dreamtech, second edition.

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs61/preview

INTRODUCTION TO AI CHATBOTS

[Open Elective]

Course Code: 24AI11EL01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Summarize how AI chatbots transform customer interactions in banking and insurance by enhancing efficiency, personalization, and compliance with data privacy regulations (L2)

CO2: Interpret how conversational flow impacts user interactions in chatbot applications. (L2)

CO3: Explain the role of NLP, NLU, and NLG techniques in chatbot applications. (L2)

CO4: Make use of integration modules in chatbot deployment. (L3)

CO5: Develop AI chatbots using cloud platforms. (L3)

UNIT-I

12 Lectures

Processes in the Banking and Insurance Industries: Banking and Insurance Industries, A Customer-Centric Approach in Financial Services, Benefits from Chatbots for a Business, Chatbots in the Insurance Industry, Conversational Chatbot Landscape.

Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR).

UNIT-II

7 Lectures

Chatbot Development Essentials: Customer Service-Centric Chatbots, Chatbot Development Approaches, Conversational Flow ,Key Terms in Chatbots, Use Case: 24 * 7 Insurance Agent.

Building a Chatbot Solution: Business Considerations, Business Benefits of Chatbots, Success Metrics, Managing Risks in Chatbots Service.

UNIT-III

12 Lectures

Natural Language Processing, Understanding, and Generation: Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.

Introduction to Microsoft Bot, RASA, and Google Dialogflow: Microsoft Bot Framework, Introduction to RASA, Introduction to Dialogflow.

UNIT-IV

7 Lectures

Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module, Demonstration of Askiris , Chatbot in Facebook Messenger.

UNIT-V

12 Lectures

Deployment and a Continuous Improvement Framework: Deployment to the Cloud, Smart IRIS Alexa Skill Creation in Less Than 5 Minutes, Continuous Improvement Framework.

Transformer Anatomy: The Transformer Architecture, The Encoder, The Decoder, Meet the Transformers.

Text Books:

1. Abhishek Singh, Karthik Ramasubramanian, Shrey Shivam – Building an Enterprise Chatbot (Apress , 2019).
2. Lewis Tunstall, Leandro von Werra, & Thomas Wolf, Natural Language Processing with Transformers (O'Reilly 2022).

Reference Books:

1. Amir Shevat, "Designing Bots: Creating Conversational Experiences" (O'Reilly Media 2017)
2. Sumit Raj, "Building Chatbots with Python" (Apress , 2018).

Web References (e-Resources):

1. Rasa Open Source (<https://rasa.com/>) Framework for building and deploying conversational AI chatbots.

NATURAL LANGUAGE PROCESSING AND APPLICATIONS

[Open Elective]

Course Code: 24AI11EL02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Illustrate key NLP methodologies, including rule-based, statistical, and deep learning-based approaches. (L2)

CO2: Utilize neural embeddings and deep learning techniques to enhance text classification performance. (L3)

CO3: Make use of Transformer-based models in combination with traditional NLP techniques to optimize Information Extraction (IE) performance. (L3)

CO4: Build chatbot applications using various dialog system components and frameworks like Rasa NLU. (L3)

CO5: Formulate the effectiveness of NLP applications in different domains. (L4)

UNIT-I

10 Lectures

NLP: A Primer: NLP in the Real World, Building Blocks of Language, Machine Learning, Deep Learning, and NLP: An Overview, Approaches to NLP, An NLP Walkthrough: Conversational Agents.

NLP Pipeline: Data Acquisition, Text Extraction and Cleanup, Pre-Processing, Feature Engineering, Modelling, Evaluation, Post-Modelling Phases.

Case Study: Customer Obsession Ticketing Assistant (COTA)

UNIT-II

10 Lectures

Text Representation: Vector Space Models, Basic Vectorization Approaches, Distributed Representations, Distributed Representations Beyond Words and Characters, Universal Text Representations, Visualizing Embeddings.

Text Classification: Applications, A Pipeline for Building Text Classification Systems, One Pipeline, Many Classifiers, Using Neural Embeddings in Text Classification, Deep Learning for Text Classification, Interpreting Text Classification Models, Learning with No or Less Data and Adapting to New Domains.

Case Study: A corporate ticketing system.

UNIT-III

10 Lectures

Information Extraction: IE Applications, IE Tasks, The General Pipeline for IE, Keyphrase Extraction, Named Entity Recognition, Named Entity Disambiguation and Linking, Relationship Extraction, Other Advanced IE Tasks.

Transformer Anatomy: The Transformer Architecture, The Encoder, The Decoder, Meet the Transformers.

UNIT-IV

10Lectures

Chatbots: Applications, A Taxonomy of Chatbots, A Pipeline for Building Dialog Systems, Dialog Systems in Detail, Deep Dive into Components of a Dialog System, Other Dialog Pipelines, Rasa NLU.

UNIT-V

10 Lectures

NLP Applications: Search and Information Retrieval, Topic Modelling, Text Summarization, Recommender Systems for Textual Data, Machine Translation, Question-Answering Systems.

Text Books:

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta and Harshit Surana, “Practical Natural Language Processing”, O’Reilly Media Inc., 2021, ISBN: 978-93- 8588-918-9.
2. Natural Language Processing with Transformers – Lewis Tunstall, Leandro von Werra, & Thomas Wolf, ISBN: 978-1098136789.

Reference Books:

1. Daniel Jurafsky, James H. Martin -Pearson Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Publication, 2014.

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. <https://www.coursera.org/specializations/natural-language-processing>

PYTHON FOR DATA SCIENCE

[Open Elective]

Course Code: 24AI11EL03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline the fundamentals of data, the role of data science, its real-world applications, and the data science process, including data handling and analysis using Python. (L2)

CO2: Apply NumPy functions for mathematical operations, statistical analysis, sorting, set operations, and file input/output. (L3)

CO3: Identify the use of Pandas data structures for efficient data manipulation, and explain data trends using descriptive statistics, correlation, and covariance. (L3)

CO4: Make use of Matplotlib and Seaborn to create various visualizations, including line plots, bar plots, histograms, density plots, and scatter plots. (L3)

CO5: Utilize data wrangling techniques such as cleaning, transforming, merging, reshaping, and pivoting to preprocess raw datasets. (L3)

UNIT-I

10 Lectures

Introduction to Data Science: Structure, Objective, What is data?, Structured data, Unstructured data, Semi-structured data, What is data science?, What does a data scientist do? Real-world use cases of data science, Why Python for data science?

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

UNIT-II

10 Lectures

Numpy: The NumPy ndarray, A Multidimensional Array Object- Creating ndarrays, Data Types for ndarrays, Arithmetic with NumPy Arrays, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes , Pseudorandom Number Generation, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays- Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Set operations, File Input and Output with Arrays, Linear Algebra.

10 Lectures

UNIT-III

Pandas: Introduction to pandas Data Structures - Series, DataFrame, Index Objects, Essential Functionality- Reindexing, Dropping Entries from an Axis, Indexing, Selection, Filtering, Function Application and Mapping, Sorting and Ranking, Axis Indexes with Duplicate Labels, Summarizing and Computing Descriptive Statistics-Correlation and Covariance, Unique Values, Value Counts, and Membership.

UNIT-IV

10 Lectures

Plotting and Visualization: A Brief matplotlib API Primer- Figures and Subplots, Colors, Markers, and Line Styles Ticks, Labels, and Legends Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration, Plotting with pandas and seaborn- Line Plots, Bar Plots, Histograms and Density Plots Scatter or Point Plots, Facet Grid's and Categorical Data.

UNIT-V

10 Lectures

Data Preprocessing: Data Loading, Storage, and File Formats - Reading and Writing data in text format, binary data formats, interacting with html and web api, interacting with databases;

Data Wrangling: Clean, Transform, Merge, Reshape - Combining and Merging Data Sets, Reshaping and Pivoting, Data Transformation, String Manipulation; Data Aggregation and Group Operations – Group by Mechanics, Data Aggregation, Groupby Operations and and Transformations, Pivot Tables and Cross Tabulation.

Text Books:

1. Python For Data Analysis (O Reilly, Wes Mckinney)
2. Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, “Introducing to Data Science using Python tools”, Manning Publications Co, Dreamtech press, 2016
3. Prateek Gupta, “Data Science with Jupyter” BPB publishers, 2019 for basics

Reference Books:

1. Python: The Complete Reference, Martin C. Brown, McGraw Hill Education
2. Head First Python, Paul Barry, O'Reilly
3. Data Science for Beginners: Comprehensive Guide to Most Important Basics in Data Science(Alex Campbell)

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc19_cs40/preview
2. https://onlinecourses.nptel.ac.in/noc19_cs41/preview

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

[Minor Course in CSE (AI&ML)]

Course Code: 24AI11MN01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** **Tell** the basic knowledge of Artificial Intelligence and **Relate** the role of AI in various problem solving methods using informed and uninformed strategies. (L2)
- CO2:** **Make use of** logic concepts, including propositional and predicate logic to formalize reasoning and problem-solving tasks. (L3)
- CO3:** **Make use of** rules in knowledge representation techniques to encode knowledge in the evolution of AI and **Illustrate** the fundamental concepts of machine learning. (L2, L3)
- CO4:** **Build** variety of supervised learning models. (L3)
- CO5:** **Experiment** with the clustering techniques and dimensionality reduction models using the concept of Unsupervised Learning. (L3)

UNIT-I

10 Lectures

Introduction to Artificial Intelligence: Introduction, Brief History, Intelligent Systems, Foundations of AI, Applications, Tic-Tac-Toe Game Playing.

Problem Solving: General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques (Hill Climbing, Best-First Search, A* Algorithm), Iterative Deepening A*, Constraint Satisfaction

UNIT-II

12 Lectures

Logic Concepts: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Axiomatic System, Semantic Tableau System in Propositional Logic, Resolution Refutation in Propositional Logic.

Predicate Logic: Representing Simple Facts in Logic, Representing Instance and is-a Relationships, Computable Functions and Predicates, Resolution.

UNIT-III

12 Lectures

Knowledge Representation: Approaches to Knowledge Representation, Knowledge Representation Using Semantic Network, Extended Semantic Networks for KR, Knowledge Representation Using Frames.

Introduction to Machine Learning: Artificial intelligence, machine learning, and deep learning. Why use machine Learning? Types of machine learning systems, main challenges of machine learning, testing and validating machine learning systems.

UNIT-IV

10 Lectures

Introduction to Artificial Neural Networks: Backpropagation algorithm, solving classification and regression problems using ANNs.

Supervised Learning: Binary, multiclass and multilabel classification problems. Performance measures. Linear regression, gradient descent

UNIT-V

8 Lectures

Unsupervised Learning: Dimensionality Reduction: the curse of dimensionality, main approaches for dimensionality reduction, principal component analysis, incremental, randomized, and kernel PCA algorithms.

Text Books:

1. Artificial Intelligence - Saroj Kaushik, CENGAGE Learning. ISBN-13: 978-81-315-1099, ISBN 10: 81-315-1099-9.
2. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow,” 3rd Edition, O’Reilly Publications, 2022 Prateek Gupta, “Data Science with Jupyter” BPB publishers, 2019 for basics

Reference Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

Web References (e-Resources):

1. <https://nptelac.in/courses/106105077>
2. <https://nptel.ac.in/courses/106106126>
3. <https://aima.cs.berkeley.edu>
4. https://ai.berkeley.edu/project_overview.html
5. <http://www.zuj.edu.jo/download/machine-learning-tom-mitchell-pdf/>
6. <http://www.ntu.edu.sg/home/egbhuang/pdf/ieee-is-elm.pdf>
7. https://swayamgov.in/ndl_noc20_cs73/preview

BIG DATA AND HADOOP

[Minor Course in CSE (AI&ML)]

Course Code: 24AI11MN02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Outline the building blocks of Hadoop. (L2)

CO2: Experiment with writing basic MapReduce programs. (L3)

CO3: Demonstrate PIG Architecture and Develop PIG scripts. (L2)

CO4: Apply Hive queries to create, update, delete, and manage data in databases. (L3)

CO5: Analyze Spark architecture, apply transformations, manage RDDs, and perform operations for efficient data processing. (L4)

UNIT-I

10 Lectures

Introduction to Big Data and Hadoop: Introduction to Big Data Platform, Challenges of Conventional Systems, History of Hadoop, building blocks of Hadoop (Namenode, Datanode, Secondary Namenode, JobTracker, TaskTracker), Hadoop Distributed File System- The Design of HDFS, HDFS Concepts, Basic Filesystem Operations, Anatomy of a Map Reduce Job run, Map Reduce Types and Formats..

UNIT-II

10 Lectures

Writing MapReduce Programs: A Weather Dataset, Basic programs of Hadoop MapReduce- Driver code, Mapper code, Reducer code, RecordReader, Combiner, Partitioner

UNIT-III

8 Lectures

Pig: Hadoop Programming Made Easier: Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.

UNIT-IV

10 Lectures

Hive: Introduction to Hive, data types, file formats, HiveQL data definition, HiveQL data manipulation, joins, Window functions, Table partitioning, Bucketing, Indexing, User-Defined Functions.

UNIT-V

10 Lectures

Apache spark- Introduction to Spark - Spark's Basic Architecture, Transformations- Narrow and Wide, lazy evaluation, Actions, Advantages over Hadoop

Basic Structured Operations: Schemas, Records and Rows, DataFrame Transformations,

Resilient Distributed Datasets (RDDs) - Creating RDDs, Manipulating RDDs, Transformations, Actions, Saving Files, Classification Models in MLlib: Naïve Bayes, Random Forest.

Text Books:

1. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
2. Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk, Bruce Brown, Rafael Coss
3. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018 Edition

Reference Books:

1. Programming Hive, O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
2. Programming Pig, O'Reilley, Alan Gates, 2011

Web References (e-Resources):

1. <https://archive.nptel.ac.in/courses/106/104/106104189/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126052684230082561692_shared/overview
3. <https://sparkbyexamples.com/>

FUNDAMENTALS OF BUSINESS ANALYTICS

[Minor Course in CSE (AI&ML)]

Course Code: 24AI11MN03

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: **Outline** the process of business enterprises and their work flow for business Analytics. (L2)

CO2: **Make use of** probability and Random variable methods for data analysis. (L3)

CO3: **Apply** data analytics and decision support systems for Business enterprises. (L3)

CO4: **Explain** business problems and analyze the data using Machine Learning Techniques. (L2)

CO5: **Outline** the various visualization techniques. (L2)

UNIT-I

10 Lectures

Introduction: What is business analytics? Historical overview, Non-technical overview, Tooling, Implementation.

Variability: Summarizing data, Probability theory and the binomial distribution, Other distributions and the central limit theorem, Parameter estimation.

UNIT-II

10 Lectures

Probability: Discrete probability, Monte Carlo simulations for categorical data, Independence, Conditional probabilities, Addition and multiplication rules, Combinations and permutations, Examples, Infinity in practice, Continuous probability

UNIT-III

10 Lectures

Data Wrangling: Introduction to data wrangling, Reshaping data, Joining tables ,Web scraping, String processing

UNIT-IV

10 Lectures

Decision Support systems and Business Analytics: Introduction, Decision Support Trends, Decision Support systems, Management Information Systems, Online Analytical Processing, Using Decision Support Systems, Data Mining for Decision Support, Executive Information Systems , Business Analytics.

Artificial intelligence Technologies in Business: Business and AI, An Overview of Artificial Intelligence, Expert Systems, Developing Expert Systems , Genetic Algorithms, Intelligent Agents

UNIT-V

10 Lectures

Data visualization: Introduction to data visualization, ggplot2-The components of a graph, ggplot objects, Geometries, Aesthetic mappings, Layers, Global versus local aesthetic mappings, Scales, Labels and titles, Categories as colors, Annotation, shapes, and adjustments, Add-on packages, Grids of plots.

Visualizing Data Distribution: Histograms, Boxplots, ggplot2 geometries - BarPlots, Density Plots, QQ Plots.

Text Books:

1. An Introduction to Business Analytics- Ger Koole.
2. Introduction to Data Science – Rafael A. Irizarry.
3. Management Information Systems-Ramesh Behl, James A.O'Brien,George M.Marakas.

Reference Books:

1. Business Analytics Using R - A Practical Approach - Dr. Umesh R. Hodeghatta and Umesha Nayak
2. Essentials of business analytics, Cochran, Anderson, Williams and others, Cengage learning publication.

Web References (e-Resources):

1. <https://rafalab.dfci.harvard.edu/dsbook/>

INTRODUCTION TO DEEP LEARNING

[Minor Course in CSE (AI&ML)]

Course Code: 24AI11MN04

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Summarize the basic principles of artificial neural networks. (L2)

CO2: Interpret the various difficulties in training deep neural networks. (L2)

CO3: Develop deep learning models to computer vision problems and time series analysis. (L3)

CO4: Build deep learning models for generative AI. (L3)

CO5: Apply deep learning techniques in reinforcement learning. (L3)

UNIT-I

9 Lectures

Introduction to ANNs with Keras: Biological and artificial neurons, implementing multilayer perceptrons with Keras, fine-tuning neural network hyperparameters.

UNIT-II

9 Lectures

Training Deep Neural Networks: The vanishing/exploding gradients problems, Glorot and He initializations, batch normalization, reusing pretrained models, faster optimizers, avoiding overfitting through regularization

UNIT-III

14 Lectures

CNNs and RNNs: The architecture of the visual cortex, convolutional layers, pooling layers, famous CNN architectures, object detection, fully convolutional networks, YOLO, semantic segmentation. Recurrent neurons and layers, training RNNs, forecasting a time series, stacking recurrent layers, using bidirectional RNNs, handling long sequences using LSTMs and GRUs.

UNIT-IV

9 Lectures

Generative deep learning: Efficient data representations, stacked, convolutional, recurrent, denoising, sparse and variational autoencoders, generative adversarial networks, basic introduction to transformers and stable diffusion.

UNIT-V

9 Lectures

Deep Reinforcement Learning: Essential theory of reinforcement learning, Markov decision processes, the optimal policy, essential theory of deep Q-learning networks, defining a DQN agent.

Text Books:

1. Aurélien Géron (2022), —Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow,|| 3rd Edition, O'Reilly Publications.
2. Krohn et al (2020) , —Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence,|| Pearson Education.

Reference Books:

1. Francois Chollet (2021), —Deep Learning with Python,|| 2nd Edition.

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs62/preview
2. <https://www.coursera.org/specializations/deep-learning>

REINFORCEMENT LEARNING TECHNIQUES

[Minor Course in CSE (AI&ML)]

Course Code: 24AI11MN05

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: **Explain** core RL concepts such as rewards, policies, value functions, and Bellman equations, demonstrating a strong theoretical foundation. (L2)

CO2: **Develop** and implement policy-based and value-based RL algorithms, understanding their trade-offs and practical applications. (L3)

CO3: **Make Use of** Deep Q-Networks (DQNs) and optimize them using experience replay, target networks, and other enhancements. (L3)

CO4: **Apply** actor-critic methods (A2C, PPO) to solve complex RL tasks in continuous and discrete action spaces. (L3)

CO5: **Utilize** RL models for efficiency and performance, using parallelization techniques and hyperparameter tuning. (L3)

UNIT-I

10 Lectures

Introduction: Reinforcement Learning Algorithms: policy-based, value-based, model-based algorithms and combined methods. On-policy and off-policy algorithms. Reinforcement learning examples- tic tac toe and multi-armed bandits.

UNIT-II

10 Lectures

Policy-Based and Value-Based Learning: Reinforce- policy, the objective function, the policy gradient, Monte Carlo sampling, REINFORCE algorithm and its implementation.

SARSA: the Q- and V-functions, temporal difference learning, exploration and exploitation, ARSA algorithm and its implementation.

UNIT-III

10 Lectures

Deep Q-Networks (DQN) and Enhancements: Deep Q-Networks: learning the Q-function, action selection, DQN algorithm and its implementation. **Improving DQN:** target networks, double DQN, prioritized experience replay (PER), modified DQN implementation.

UNIT-IV

10 Lectures

Combined Methods: Advantage Actor-Critic (A2C): the actor, the critic, the advantage function, A2C algorithm and its implementation.

Proximal Policy Optimization (PPO): surrogate objective, PPO algorithm and its implementation.

UNIT-V

10 Lectures

Parallelization Methods and Getting Deep RL to Work: Synchronous and asynchronous parallelization, training an A3C agent, debugging tips and hyperparameter tables.

Text Books:

1. Foundations of Deep Reinforcement Learning: Theory and Practice in Python, Graesser & Keng (2019), Addison-Wesley.
2. Reinforcement Learning: An Introduction, Sutton & Barto (2018), Bradford Books.

Reference Books:

1. Maxim Lapan (2020) —Deep Reinforcement Learning, 2nd Edition, Packt Publishing.

Web References (e-Resources):

1. <https://www.cse.iitm.ac.in/~ravi/nptel-courses/reinforcement-learning/>
2. <https://www.coursera.org/specializations/reinforcement-learning>

BIG DATA AND HADOOP LAB

[Minor Course in CSE (AI&ML)]

Course Code: 24AI11MN06

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

CO1: Develop MapReduce programs for large-scale data processing. (L3)

CO2: Apply Pig Latin scripts to sort, filter, group, and join data. (L3)

CO3: Create and manage Hive tables, indexes, functions, and perform table alterations. (L6)

CO4: Understand and work with PySpark RDDs and apply transformations. (L2)

CO5: Build any one machine learning model using the PySpark ML library. (L3)

Module-1:

Implement the following file management tasks in Hadoop:

- a) Adding files and directories
- b) Retrieving files
- c) Deleting files

Module-2:

Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm

Module-3:

Write a Map Reduce program that mines weather data.

Module-4:

Write a Map Reduce program that Compute Average and Total Salary by Gender for an Enterprise.

Module-5:

Write a pig latin scripts to wordcount

Module-6:

Write a pig latin scripts to sort, group, join, filter your data.

Module-7:

Run Hive then use Hive to create, alter, and drop databases

Module-8:

Working on hive tables

- i. Creating hive tables (External and internal)
- ii. Loading data to external hive tables from sql tables
- iii. Performing hive operations like filter and updations
- iv. Performing Join (inner, outer etc)

Module-9:

Implement the following pyspark operations

- i. SparkSession
- ii. SparkContext
- iii. ways to Create RDD

Module-10:

Perform the following pyspark transformations

- i. Convert RDD to DataFrame
- ii. PySpark Read CSV file into DataFrame
- iii. drop() & drop Duplicates()
- iv. orderBy() and sort()
- v. map and flatMap
- vi. PySpark Groupby, sort and join

Module-11:

Build any Machine Learning model using pyspark ml library.

Case Study: Select any one practical application mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

1. Patient Disease Prediction

Analyze patient records to predict diseases based on symptoms. Use MapReduce for data cleaning, Hive for structured storage, and PySpark ML for classification models (e.g., Decision Trees).

2. Drug Effectiveness Analysis

Process clinical trial data to compare drug effectiveness. MapReduce can aggregate patient responses, Hive can store trial data, and PySpark can run statistical tests or survival analysis.

3. Hospital Resource Optimization

Analyze hospital admission data to optimize resource allocation. Use MapReduce to process logs, Hive to store patient flow data, and PySpark to predict resource needs using regression models.

4. Electronic Health Record (EHR) Analytics

Process massive EHR datasets to identify common treatment patterns. MapReduce for initial aggregation, Hive for structured queries, and PySpark for clustering patients with similar medical histories.

5. Outbreak Prediction and Monitoring

Analyze disease spread patterns using historical data. MapReduce for geographical data aggregation, Hive for time-series records, and PySpark for building predictive models to forecast outbreaks.

6. Crop Yield Prediction

Analyze weather and soil data to predict crop yields. MapReduce for data preprocessing, Hive to store historical records, and PySpark to train a regression model for yield forecasting.

7. Precision Farming Analytics

Process IoT sensor data from fields to recommend optimal farming practices. MapReduce to clean sensor logs, Hive for storage, and PySpark for anomaly detection or clustering regions with similar conditions.

8. Pest and Disease Detection

Analyze image or sensor data to detect crop diseases. MapReduce for initial image data processing, Hive for metadata storage, and PySpark with ML models for image classification.

9. Market Price Prediction for Crops

Analyze historical crop prices to help farmers decide what to plant. MapReduce for price aggregation, Hive for storing market data, and PySpark for time-series forecasting.

10. Water Usage Optimization

Monitor water usage across farms to suggest efficient irrigation strategies. MapReduce to clean sensor readings, Hive for water usage history, and PySpark to build prediction models for optimal water schedules.

11. Student Performance Prediction

Analyze student records to predict academic success. MapReduce to clean exam data, Hive to store student details, and PySpark to train classification models based on attendance, scores, and participation.

12. Course Recommendation System

Recommend courses based on student interests and past performance. MapReduce to preprocess course enrollments, Hive to store course metadata, and PySpark for collaborative filtering recommendation models.

13. Library Usage Analysis

Track library book checkouts to find popular books and peak usage times. MapReduce to aggregate checkout logs, Hive to store records, and PySpark for clustering frequent book borrowers.

14. Online Learning Engagement Analytics

Analyze interaction logs from online platforms to measure engagement. MapReduce to count interactions, Hive to store event logs, and PySpark to cluster students based on engagement patterns.

15. Fraud Detection in Transactions

Identify suspicious transactions in real-time. MapReduce to preprocess logs, Hive to store transaction history, and PySpark MLlib to train fraud detection models (e.g., anomaly detection).

16. Customer Segmentation for Marketing

Segment customers for targeted marketing campaigns. MapReduce for initial customer data aggregation, Hive for structured customer profiles, and PySpark for clustering (like K-means).

17. Credit Risk Assessment

Predict the likelihood of loan default based on customer attributes. MapReduce to clean application data, Hive to store historical records, and PySpark to train a classification model (e.g., logistic regression).

18. Stock Price Trend Analysis

Analyze historical stock prices to predict future trends. MapReduce for data aggregation, Hive for structured storage, and PySpark for building time-series forecasting models.

Reference Books:

1. Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
2. Programming Hive, O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
3. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018 Edition

Web References (e-Resources):

1. <https://archive.nptel.ac.in/courses/106/104/106104189/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0126052684230082561692_shared/overview
3. <https://sparkbyexamples.com/>

MACHINE LEARNING TECHNIQUES LAB

[Minor Course in CSE (AI&ML)]

Course Code: 24AI11MN07

L	T	P	C
0	0	3	1.5

Course Outcomes: At the end of the Course, the student shall be able to:

- CO1 :** Apply exploratory data analysis techniques to understand the data and make it ready for model building. (L3)
- CO2 :** Build ML models based on classic algorithms like kNN, linear regression and logistic regression. (L3)
- CO3 :** Develop SVM and Ensemble Learning Models from scratch. (L3)
- CO4 :** Construct Neural Network based MLP Model (L3)
- CO5 :** Make use of Deep learning Techniques to construct CNN, RNN, LSTM and VGG16 models. (L3)

Module-1: Exploratory Data Analysis

Illustrate Exploratory Data Analysis using Pandas or Matplotlib: Getting a quick statistical summary of a dataset, Checking Missing Values, Removing Duplicates, Showing Correlations, and Looking for Outliers using BoxPlots.

Module-2: k-Nearest Neighbors algorithm

Use sklearn's k-Nearest Neighbors algorithm to classify the iris dataset. Print both correct and wrong predictions. You need to print the attributes values for wrong predictions.

Module-3: Linear Regression

Use linear regression algorithm to predict median price of a district by training a regression model on the Boston housing dataset.

Module-4: Logistic Regression

Use logistic regression algorithm to classify a handwritten digit as even or odd by training a logistic regression model on the MNIST dataset.

Module-5: Support Vector Machines

Implement, visualize and test Support Vector Machines in Python (not allowed to use sklearn's Support Vector classes).

Module-6: Random Forest algorithm

Run decision tree classification and random forest algorithms on a dataset and confirm that ensembling indeed improves performance significantly reducing the variance component (using bias- variance decomposition). Also, print feature importances as found by the random forest algorithm.

Module-7: Gradient Boosting algorithm

Use sklearn's GradientBoostingRegressor and demonstrate the use of early stopping to find the optimal number of trees in the GBRT ensemble.

Module-8: Multilayer Perceptron MLP

Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.

Module-9: Convolution, Pooling and Strides

Build a Convolution Neural Network for MNIST Hand written Digit Classification. Try with both convolution and pooling layers, with just convolution layers (possibly with stride greater than 1).

Module-10: Recurrent Neural Networks

Implement a deep Recurrent Neural Network for a time series analysis.

Module-11: LSTM and GRU Networks

Implement a deep LSTM and GRU networks for a time series analysis.

Module-12: Transfer Learning

Use a pre-trained convolution neural network (VGG16) for image classification.

Case Study: Select any practical application mentioned below

Note: A report has to be submitted by every student at the end of the semester that includes design, coding, output, etc.

- 1. Customer Segmentation for a Retail Business**
Concepts: Clustering (k-Means, EM), PCA
Description: Analyze customer purchase history and segment customers for personalized marketing strategies.
- 2. Credit Card Fraud Detection**
Concepts: Logistic Regression, Random Forest, Decision Trees, Gradient Boosting
Description: Use transaction data to predict fraudulent transactions, improving fraud detection mechanisms.
- 3. Predicting House Prices**
Concepts: Linear Regression, PCA, Gradient Boosting
Description: Build a model to predict house prices based on historical housing data.
- 4. Fake News Detection**
Concepts: NLP, Logistic Regression, Decision Trees, SVM
Description: Classify news articles as real or fake using text-based features.
- 5. Movie Recommendation System**
Concepts: k-NN, PCA
Description: Build a recommendation system based on user preferences and ratings.
- 6. Stock Market Price Prediction**
Concepts: Linear Regression, Gradient Boosting
Description: Predict stock prices based on historical trends and market indicators.
- 7. Healthcare Readmission Prediction** Concepts:
Logistic Regression, Decision Trees
Description: Predict which patients are at high risk of hospital readmission.
- 8. Air Quality Prediction**
Concepts: Linear Regression, PCA, Decision Trees
Description: Predict air pollution levels based on meteorological and traffic data.
- 9. Energy Consumption Forecasting**
Concepts: Linear Regression, Gradient Boosting
Description: Predict energy consumption trends for efficient energy planning.

10. Traffic Accident Severity Prediction

Concepts: Decision Trees, k-NN, PCA

Description: Predict accident severity based on road conditions, weather, and driver behavior.

11. Disease Diagnosis from Symptoms

Concepts: Decision Trees, Random Forest, SVM

Description: Predict diseases based on patient symptoms.

12. Customer Churn Prediction for Telecom

Concepts: Logistic Regression, Decision Trees, Categorical Encoding

Description: Predict which customers are likely to switch telecom providers.

13. Handwritten Signature Verification

Concepts: MLP, CNN, Transfer Learning Description:

Develop a deep learning model to verify handwritten signatures and detect forgeries.

14. Skin Disease Classification

Concepts: CNN, Transfer Learning, Data Augmentation

Description: Use a CNN-based model to classify different types of skin diseases from medical images.

15. Real-Time Face Mask Detection

Concepts: CNN, Transfer Learning (VGG16), Data Augmentation

Description: Build a model that detects whether a person is wearing a mask or not in real-time.

16. Sentiment Analysis of Social Media Posts

Concepts: Multiclass Classification, RNN, LSTM

Description: Classify tweets or social media posts into positive, negative, or neutral sentiments.

Reference Books:

1. Aurélien Géron (2022), —Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition, O'Reilly Publications.
2. Yuxi Liu (2024), —Python Machine Learning By Example, Packt Publishing.

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc25_cs46/preview
2. <https://www.coursera.org/specializations/machine-learning-introduction>

QUANTUM COMPUTING

Honors Course

[Common to CSE, CSE (AI&ML, IT)]

Course Code: 24CT11HN01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Demonstrate the basic concepts of Quantum Computing. (L2)

CO2: Classify the Matrices and Operators. (L2)

CO3: Illustrate the Boolean Algebra, Logic Gates and Quantum Information Processing. (L2)

CO4: Explain the Quantum Error Correction. (L2)

CO5: Demonstrate the Quantum Cryptography. (L2)

UNIT-I

10 Lectures

Quantum Computing Basic Concepts: Introduction - Complex Numbers, Vector Space, and Dirac Notation, Inner Product, Linearly Dependent and Independent Vectors, Dual Vector. Basics of Quantum Mechanics - Limitations of Classical Physics, Photoelectric, Effect, Classical Electromagnetic Theory, Postulates of Quantum Mechanics

UNIT-II

10 Lectures

Matrices and Operators: Matrices, Square Matrices, Diagonal (or Triangular) Matrix, Operators, Linear Operator, Commutator, Matrix Representation of a Linear Operator, Symmetric Matrix, Transpose Operation, Orthogonal Matrices, Identity Operator, Adjoint Operator, Hermitian Operator, Unitary Operators, Properties of Unitary Operators, Projection Operator.

UNIT-III

10 Lectures

Boolean Algebra, Logic Gates, and Quantum Information Processing: Boolean Algebra, Classical Circuit Computation Model, Universal Logic Gates, Quantum Computation, The Quantum Bit and Its Representations, Superposition in Quantum Systems, Quantum Register

Quantum Gates and Circuits: X Gate, Y Gate, Z Gate, (Square Root of NOT) Gate, Hadamard Gate, Phase Gate, T Gate, Reversible Logic, CNOT Gate, Controlled-U Gate, and Reversible Gates.

Tensor Products, Superposition: Tensor Products, Multi-Qubit Systems, Superposition

UNIT-IV

8 Lectures

Quantum Error Correction: Classical Error-Correcting Codes, Quantum Error Correcting Codes, Shor's 3-Qubit Bit-Flip Code, Error Correction, Bit-Flip Error Correction, Phase Error Correction, Shor's 9 Qubit Code

UNIT-V

10 Lectures

Quantum Algorithms: Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Grover's Search Algorithm, Details of Grover's Algorithm, Shor's Factoring Algorithm Quantum Cryptography: Principles of Information Security, One-Time Pad, Public Key Cryptography, RSA Coding Scheme, Quantum Cryptography, Quantum Key Distribution.

Text Books:

1. Parag K Lala, Mc Graw Hill Education, First edition (2020), —Quantum Computing, A Beginners Introduction.
2. Chris Bernhardt, The MIT Press; Reprint edition (2020), —Quantum Computing for Everyone.

Reference Books:

1. Michael A. Nielsen, Issac L. Chuang, —Quantum Computation and Quantum Information, Tenth Edition, Cambridge University Press, 2010.
2. Scott Aaronson, —Quantum Computing Since Democritus, Cambridge University Press, 2013.
3. N. David Mermin, —Quantum Computer Science: An Introduction, Cambridge University Press, 2007

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc19_cy31
2. <https://archive.nptel.ac.in/courses/106/106/106106232>

SOCIAL MEDIA ANALYTICS

Honors Course

[Common to CSE, CSE (AI&ML, IT)]

Course Code: 24CT11HN02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Define the levels of SNA and network measures. (L1)

CO2: Outline various network growth models and different rank methods. (L2)

CO3: Illustrate different community structures and link prediction models. (L2)

CO4: Explain cascade behaviour and anomaly detection in networks. (L2)

CO5: Apply data analysis techniques to Predict and recommend in online social networks. (L3)

UNIT-I

8 Lectures

Introduction: Definition of Social Media – Understanding Social Media – Significance of Social Media – Categories of Social Media – Mainstream Media Vs Alternative Media, Introduction to Social Network Analysis, Applications, Preliminaries, Three Levels of SNA, Historical Development, Graph Visualization Tools

Network Measures: Network Basics, Node Centrality, Assortativity, Transitive and Reciprocity, Similarity, Degeneracy.

UNIT-II

10 Lectures

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,

Link Analysis: Applications, Signed networks, Strong and weak Ties, Link analysis and algorithms, Page Rank, Personalized Page Rank, Divrank, Simrank, PathSim.

UNIT-III

12 Lectures

Community Structure in Networks: Applications, Types of communities, Community detection methods, Disjoint community detection, overlapping community detection, local community detection, community detection vs community search, evaluation.

Link Prediction: Applications, temporal changes in a network, Problem definition, Evaluating link prediction networks, Heuristic Models, probabilistic Models, Supervised Random walk, Information- theoretic model.

UNIT-IV

9 Lectures

Cascade Behaviours and Network Effects: Preliminaries, Cascade model, case study, Probabilistic cascades, epidemic models, Independent cascade models, Cascade prediction.

Anomaly Detection in Static Networks: Outliers vs Network-based anomalies, challenges, Anomaly detection in static and dynamic networks

UNIT-V

9 Lectures

Graph Representation Learning: Machine learning pipelines, Intuition behind representation learning, benefits of Representation Learning, criteria of Graph Representation Learning (GRL), GRL pipelines, representation learning methods.

Application and Case Studies: Malicious activities on OSNs, Sockpuppets in OSNs, Collusion on online social networks, Modelling the spread of COVID 19, Suicidal tendency prediction on X(twitter) posts, Recommendation System.

Text Books:

1. Social Network Analysis, Tanmoy Chakraborty, Wiley, 2021
2. "The Social Media Age" by Zoetanya Sujon, SAGE Publications, 2021

Reference Books:

1. Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faust
2. Network Science, Albert-Lazslo Barabasi

Web References (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc22_cs117/preview
2. <http://web.stanford.edu/class/cs224w/>

HIGH PERFORMANCE COMPUTING

Honors Course

[Common to CSE, CSE (AI&ML)]

Course Code: 24CA11HN01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Illustrate high performance versions of standard single threaded algorithms and architectural features of GPU. (L2)
- CO2:** Demonstrate the concepts of GPU Programming. (L2)
- CO3:** Make use of Many Integrated Cores (MIC) concepts to extract maximum performance in a multicore environment processor. (L3)
- CO4:** Analyse Symmetric and Distributed architectures and Demonstrate Open MP Architecture. (L4)
- CO5:** Develop large scale parallel programs on tightly coupled parallel systems using the message passing paradigm. (L3)

UNIT-I

12 Lectures

Graphics Processing Units: Introduction to Heterogeneous Parallel Computing, GPU architecture, Thread hierarchy, GPU Memory Hierarchy.

UNIT-II

12 Lectures

GPU Programming: Vector Addition, Matrix Multiplication algorithms. 1D, 2D, and 3D Stencil Operations, Image Processing algorithms – Image Blur, Gray scaling. Histogramming, Convolution, Scan, Reduction techniques.

UNIT-III

12 Lectures

Many Integrated Cores: Introduction to Many Integrated Cores. MIC, Xeon Phi architecture, Thread hierarchy, Memory Hierarchy, Memory Bandwidth and performance considerations.

UNIT-IV

10 Lectures

Shared Memory Parallel Programming: Symmetric and Distributed architectures, Open MP, Introduction, Thread creation, Parallel regions. Work sharing, Synchronization.

UNIT-V

7 Lectures

Message Passing Interface: MPI Introduction, Collective communication, Data grouping for communication.

Text Books:

1. Programming Massively Parallel Processors A Hands-on Approach, 3e, Wen-Mei W Hwu, David B Kirk and Morgan Kaufmann-2019.
2. Introduction to High Performance Computing for Scientists and Engineers, Georg Hager and Gerhard Wellein, CRC Press
3. Intel Xeon Phi Coprocessor Architecture and Tools, Rezaur Rahman, Apress Open, 1st edition 2013. Using Open MP, Barbara Chapman, Gabriele Jost, Rudd Vander Pas, MIT Press, 2008.
4. Using Open MP: Portable Shared Memory Parallel Programming Barbara Chapman, Gabriele Jost, Rudd Vander Pas, MIT Press, 2008.

Reference Books:

1. A Parallel Algorithm Synthesis Procedure for High-Performance Computer Architectures by Dunn Ian N, 2003

Web References (e-Resources):

1. <https://nptel.ac.in/courses/106/108/106108055/>

BUSINESS ANALYTICS

Honors Course
CSE (AI&ML)

Course Code: 24AI11HN01

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: **Outline** the process of business enterprises and their work flow for business Analytics (L2)

CO2: **Make use of** probability and Random variable methods for data analysis (L3)

CO3: **Apply** data analytics and decision support systems for Business enterprises (L3)

CO4: **Explain** business problems and analyze the data using Machine Learning Techniques (L2)

CO5: **Outline** the various visualization techniques (L2)

UNIT-I

10 Lectures

Introduction: What is business analytics? Historical overview, Non-technical overview, Tooling, Implementation.

Variability: Summarizing data, Probability theory and the binomial distribution, Other distributions and the central limit theorem, Parameter estimation.

UNIT-II

10 Lectures

Probability: Discrete probability, Monte Carlo simulations for categorical data, Independence, Conditional probabilities, Addition and multiplication rules, Combinations and permutations, Examples, Infinity in practice, Continuous probability

UNIT-III

10 Lectures

Data Wrangling: Introduction to data wrangling, Reshaping data, Joining tables, Web scraping, String processing

UNIT-IV

10 Lectures

Decision Support systems and Business Analytics: Introduction, Decision Support Trends, Decision Support systems, Management Information Systems, Online Analytical Processing, Using Decision Support Systems, Data Mining for Decision Support, Executive Information Systems, Business Analytics.

Artificial intelligence Technologies in Business: Business and AI, An Overview of Artificial Intelligence, Expert Systems, Developing Expert Systems , Genetic Algorithms, Intelligent Agents

UNIT-V

10 Lectures

Data Visualization: Introduction to data visualization, ggplot2-The components of a graph, ggplot objects, Geometries, Aesthetic mappings, Layers, Global versus local aesthetic mappings, Scales, Labels and titles, Categories as colors, Annotation, shapes, and adjustments, Add-on packages,, Grids of plots.

Visualizing Data Distribution: Histograms, Boxplots, ggplot2 geometries - BarPlots, Density Plots, QQ Plots.

Text Books:

1. An Introduction to Business Analytics- Ger Koole.
2. Introduction to Data Science – Rafael A. Irizarry.
3. Management Information Systems-Ramesh Behl, James A.O'Brien,George M.Marakas.

Reference Books:

1. Business Analytics Using R - A Practical Approach - Dr. Umesh R. Hodeghatta and Umesha Nayak
2. Essentials of business analytics, Cochran, Anderson, Williams and others, Cengage learning publication.

Web References (e-Resources):

1. <https://rafalab.dfci.harvard.edu/dsbook/>

DATA VISUALIZATION

Honors Course
CSE (AI&ML)

Course Code: 24CA11HN02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

CO1: Recall fundamental concepts of data visualization and aesthetics. (L2)

CO2: Interpret data distributions using bar plots, histograms, and related techniques. (L2)

CO3: Explain visual methods for associations, proportions, and time series. (L2)

CO4: Make use of suitable techniques to visualize uncertainty and geospatial data. (L3)

CO5: Apply the principle of proportional ink and overlapping data handling methods in visual design. (L3)

UNIT-I

10 Lectures

INTRODUCTION TO VISUALIZATION: Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values, Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x-y relationships, Geospatial Data

UNIT-II

10 Lectures

VISUALIZING DISTRIBUTIONS: Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots- Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

UNIT-III

10 Lectures

VISUALIZING ASSOCIATIONS & TIME SERIES: Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose– Response Curves, Time Series of Two or More Response Variables

UNIT-IV

10 Lectures

VISUALIZING UNCERTAINTY: Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots

UNIT-V

10 Lectures

PRINCIPLE OF PROPORTIONAL INK: The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points- Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information, Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

Text Books:

- 1.Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”, 1st edition, O’Reilly Media Inc, 2019.
- 2.Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018

Reference Books:

- 1.Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization, O’Reilly, 2016

EVOLUTIONARY COMPUTING

Honors Course
CSE (AI&ML)

Course Code: 24AI11HN02

L	T	P	C
3	0	0	3

Course Outcomes: At the end of the Course, the student shall be able to

- CO1:** Explain the origins, motivation, and core components of evolutionary computing and evolutionary algorithms to solve AI problems.
Explain different solution representations, variation operators, fitness evaluation
- CO2:** methods, selection mechanisms, population management models, and the role of diversity in evolutionary algorithms.
- CO3:** Explain and compare major evolutionary algorithm variants and swarm-based optimisation techniques.
Outline evolutionary algorithm parameters, the need for parameter tuning and
- CO4:** control, and the basic concepts of algorithm performance, robustness, and quality measures.
Demonstrate the concepts of multi-objective and interactive evolutionary
- CO5:** algorithms, including Pareto optimality, dominance, and their basic application areas.

UNIT-I

10 Lectures

Problems to Be Solved: Optimisation, Modelling, and Simulation Problems, Search Problems, Optimisation Versus Constraint Satisfaction, The Famous NP Problems.

Evolutionary Computing - The Origins: The Main Evolutionary Computing Metaphor, Brief History, The Inspiration from Biology, Why Evolutionary Computing?

Components of Evolutionary Algorithms: What Is an Evolutionary Algorithm, Components of Evolutionary Algorithms, Representation (Definition of Individuals), Evaluation Function (Fitness Function), Population, Parent Selection Mechanism, Variation Operators (Mutation and Recombination), Survivor Selection Mechanism(Replacement), Initialisation, Termination Condition.

UNIT-II

10 Lectures

Representation, Mutation, and Recombination: Representation and the Roles of Variation Operators, Binary Representation, Integer Representation, Real-Valued or Floating-Point Representation, Permutation Representation, Tree Representation.

Fitness, Selection, and Population Management: Population Management Models, Parent Selection, Survivor Selection, Selection Pressure, Multimodal Problems, Selection, and the Need for Diversity.

UNIT-III

10 Lectures

Popular Evolutionary Algorithm Variants: Genetic Algorithms, Evolution Strategies, Evolutionary Programming, Genetic Programming, Learning Classifier Systems, Differential Evolution, Particle Swarm Optimisation, Estimation of Distribution Algorithms.

UNIT-IV

10 Lectures

Parameters and Parameter Tuning: Evolutionary Algorithm Parameters, EAs and EA Instances, Designing Evolutionary Algorithms, the Tuning Problem,

Parameter Control: Introduction, Examples of Changing Parameters, Changing the Mutation Step Size, Changing the Penalty Coefficients, Classification of Control Techniques, Examples of Varying EA Parameters.

Algorithm Quality: Performance and Robustness, Tuning Methods, Performance Measures.

UNIT-V

10 Lectures

Multi-objective Evolutionary Algorithms: Multi-objective Optimisation Problems, Dominance and Pareto Optimality, EA Approaches to Multi-objective Optimisation, Example Application: Distributed Coevolution of Job Shop Schedules.

Interactive Evolutionary Algorithms: Characteristics of Interactive Evolution, The Effect of Time, Algorithmic Approaches to the Challenges of IEAs, Interactive Evolutions Design vs. Optimisation, Example Application: Automatic Elicitation of User Preferences.

Text Books:

1. A.E. Eiben, J.E Smith, "Introduction to Evolutionary Computing", 2nd edition, Springer, 2015.

Reference Books:

1. Deb, K, "Optimization for Engineering Design", PHI India, 2000.
2. Deb, K. "Multi-objective Optimization using Evolutionary Algorithms", Wiley, Uk, 2001.
3. Melanie Mitchell, "An Introduction to Genetic Algorithms", MIT Press, 1996.
4. John Koza, "Genetic Programming", MIT Press, 1992.
5. David Fogel, "Evolutionary Computation", the Fossil Record, IEEE Press, 1998.
6. Goldberg D. E, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison- Wesley, Massachusetts, 1989.