



**FUTURE
UNIVERSITY**

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FUTURE UNIVERSITY, BAREILLY

(Established under the Uttar Pradesh Private Universities (Third Amendment) Act, 2024)

COURSE CURRICULUM

AND

EVALUATION SCHEME

B.Tech. C.A.I.M.D

For the Students Admitted in Academic Session **2025-26**
Effective From

Academic Session **2025-26**

Prepared By
Future University, Bareilly

Approved By
Academic Council
Future University, Bareilly

Published By
Office of the Registrar
Future University, Bareilly
Academic Session: **2025-26**



*(This Curriculum and Evaluation Scheme shall be applicable to all students admitted to the B.Tech. Programme from the Academic Session **2025-26** onwards and shall remain in force until amended or revised by the Academic Council of Future University, Bareilly.)*



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UNIVERSITY**
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FUTURE UNIVERSITY, BAREILLY

(Established under the Uttar Pradesh Private Universities (Third Amendment) Act, 2024)

COURSE CURRICULUM

AND

EVALUATION SCHEME

B.Tech. (Automotive)

For the Students Admitted in Academic Session 2025-26

Effective From

Academic Session 2025-26

Prepared By

Future University, Bareilly

Approved By

Academic Council
Future University, Bareilly

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Future University, Bareilly

Academic Session: 2025-26



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FUTURE UNIVERSITY
(Established under Govt. of U. P. Act No. 12, 2024)

Study & Evaluation Scheme Of

Bachelor of Technology

B. TECH. (AI and ML)
[Applicable w.e.f. Academic Session 2025-26]
Approved by Academic Council



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FUTURE UNIVERSITY

18th Milestone, Bareilly-Lucknow Highway NH-24
Near Faridpur, Bareilly, Uttar Pradesh 243503
Website: www.futureuniversity.in



Dean
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Future University
Bareilly

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Future University
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SUMMARY

Programme	Bachelor of Technology B. Tech. (AI and ML)				
Duration	Four years Full Time (Eight semesters)				
Medium	English				
Minimum Required Attendance	75%				
Maximum Credit	170				
Minimum Credit (required for the degree)	160				
Assessment (Theory)	Internal		External		Total
	30%		70%		100%
Assessment (Practical)	Internal		External		Total
	50%		50%		100%
Internal Evaluation (Theory Papers)	Class Test I	Class Test 2	Assignment(s)	Other Activity (including attendance)	Total
	10 marks	10 marks	5 marks	5 marks	30 marks
Internal Evaluation (Practical Papers)	Experiment File Viva	Exam	Attendance	Total	
	10 marks	30 marks	10 marks	50 marks	
Duration of Examination (Theory)	External		Internal		
	3 hrs.		1 ½ hrs		
Duration of Examination (Practical)	As per the requirement of the practical paper				

To qualify the course a student is required to secure a minimum of 40% marks in aggregate including the semester end examination and teachers' continuous evaluation. (i.e. both internal and external).
 A candidate who secures less than of 40% of marks in a course shall be deemed to have failed in that course.
 The student should have at least 50% marks in aggregate to clear the semester. In case a student has more than 40% in each course, but less than 50% overall in a semester, he/she shall re-appear in courses where the marks are less than 50% to achieve the required aggregate percentage of 50% in the semester.

Question Paper Structure

1. *The question paper shall consist of six questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question No. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer any five (weight age 4 marks each).*
2. *Out of the rest five questions, students shall be required to attempt all five questions, but there will be an internal choice of A or B. Each question will be from one unit of the syllabus. The weight age of Question No. 2 to 6 shall be 10 marks each.*

Faculty of Engineering and Technology (Code: 05)

Department of Computer Science and Engineering

Bachelor of Technology in AI and ML

Credit Framework for the B. Tech. (AI and ML) -NEP-2020, Future University									Total
Sem.	Major (Core)	Minor Stream	Multidisciplinary	Ability Enhancement Course	Skill Enhancement Course	Value Added	Summer Internship	Research Project/ Dissertation	
1	10	4	5	0	2	2			23
2	10	2	5	0	2	2			21
Students exiting the programme after securing 40 credits will be awarded UG Certificate in the relevant Discipline / Subject provided they secure 4 credits in work based vocational courses offered during summer term or internship / Apprenticeship in addition to 6 credits from skill-based courses earned during first and second semester									
3	10	1	2	2	2				17
4	15	1		3					19
Students exiting the programme after securing 80 credits will be awarded UG Diploma in the relevant Discipline / Subject provided they secure 4 credits in skill based vocational courses offered during first year or second year summer term.									
5	17	4			4				25
6	17	1							18
Students who want to undertake 3-year UG Programme will be awarded UG Degree in the relevant Discipline/ Subject Upon securing 120 credits									
7	14	1						06	21
8	9	1						16	26
Students will be awarded UG Degree(Honors) with Research in the relevant Discipline/ Subject provided they secure 160 credits (As per NEP guidelines)									

Total= 170 credit

Future University													
B. Tech. in AI and ML (Undergraduate Regular)													
Course Structure 2025-2029													
Program Name			B. Tech. (AI and ML)							Program Code : 07			
			Total Credit of Program: 170							Branch Code : 06			
		Theory				Week		Evaluation Scheme			Total		Credit
SN	Course Category	Code	Course Title		L	T	P	C	A	E			
Semester –I													
1	Multidisciplinary Course	HSS1101	Engineering Mathematics-I			3	0	0	30	70	100	3	
2	Minor Course	HSS1102	Advanced Engineering Physics			2	0	0	30	70	100	2	
3	Major Core Courses	EEE1103/EEC1103	Essentials of Electrical Engineering / Essentials of Electronics Engineering			3	0	0	30	70	100	3	
4	Major Core Courses	ECS1104/EME1104	Principles of Problem Solving Using Advance C / Elements of Mechanical Engineering			3	0	0	30	70	100	3	
5	Value Added Course	ECS1105	AI for Everyone			2	0	0	30	70	100	3	
	Minor Course	ECS1106	MOOC			Self-Paced Learning					100	3	
Practical													

6	Minor Course	HSS1170	Advanced Engineering Physics LAB	0	0	2	50	50	100	1
7	Major Core Courses	ECS1171/EME1171	Programming using Advanced C LAB /EME Lab	0	0	2	50	50	100	1
8	Major Core Courses	EEE1172/EECI172	Essentials of Electrical Engineering LAB / Essentials of Electronics Engineering LAB	0	0	2	50	50	100	1
9	Skill Enhancement Course	EME1173/EME1173	Workshop Practice Lab / Engineering Graphics Lab	0	1	2	50	50	100	2
10	Multidisciplinary Course	IKS1101	IKS-1 (Indian Knowledge System-1)	1	0	0	50		50	1
TOTAL				14	2	8	400	550	1050	23

S N	Course Category	Code	Theory Course Title	Week			Evalu ation Schem e		Tot al	Cre dit
				L	T	P	C A	EE		
Semester –II										
1	Multidisciplinary Course	HSS1201	Engineering Mathematics – II	3	0	0	30	70	100	3
2	Minor Course	HSS1202	Environmental Science	2	0	0	30	70	100	2
3	Major Core Courses	EEC1203/EE1203	Essentials of Electronics Engineering / Essentials of Electrical Engineering	3	0	0	30	70	100	3
4	Major Core Courses	EME1204/ECS1204	Elements of Mechanical Engg. / Principles of Problem Solving Using Advance C	2	1	0	30	70	100	3
5	Value Added Course	EAI1205	AI for Engineers	2	0	0	30	70	100	3
	Minor Course	ECS1206	MOOC	Self-Paced Learning					100	3

Practical										
6	Major Core Courses	EME1271/E CS1271	EME Lab/Programming using advanced C Lab	0	0	2	50	50	100	1
7	Major Core Courses	EEC1272/E EE1272	Essentials of Electronics Engineering Lab / Essentials of Electrical Engineering Lab	0	0	2	50	50	100	1
8	Skill Enhancement Course	EME1273/E ME1273	Engineering Graphics Lab / Workshop Practice Lab	0	0	2	50	50	100	1
9	Skill Enhancement Course	LSM1210	LSM-I (Life Skill & Mentoring I)	0	0	0				1
			TOTAL	14	3	6	340	560	900	21

SN	Course Category	Code	Course Title	Week			Evaluation Scheme		Total	Credit
				L	T	P	CA	EE		
Semester –III										
1	Multidisciplinary Course	HSS2302	Mathematics-III	2	0	0	30	70	100	2
2	Major Core Course	EAI2302	Data Structures & Algorithms	3	0	0	30	70	100	3
3	Major Core Course	EAI2303	Cyber Security	3	0	0	30	70	100	3
4	Skill Enhancement Course	EAI2304	Python Programming	2	1	0	30	70	100	3

Syllabus Applicable

Syllabus Applicable w.e.f. Academic Session 2025-2026

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5	Minor Course	EAI2305	AI Ethics and Governance	3	0	0	30	70	100	3
Practical										
6	Major Core Course	EAI2371	Data Structures & Algorithms Lab	0	0	4	50	50	100	2
7	Major Core Course	EAI2373	Python Programming Lab	0	0	4	50	50	100	2
			TOTAL	13	1	8	250	450	700	18

				WEEK			Evaluation Scheme			
S N	Course Category	Code	Course Title	L	T	P	C A	E E	Total	Credit
Semester-IV										
1	Major Core Course	EAI2401	Introduction to Machine learning	2	1	0	30	70	100	3
2	Major Core Course	EAI2402	AI and Intelligent Agents	3	0	0	30	70	100	3
3	Major Core Course	EAI2403	Object Oriented Programming with JAVA	2	1	0	30	70	100	3
4	Ability Enhancement Course	EAI2404	Recent Advances in Technology	3	0	0	30	70	100	3
5	Major Course	HSS2405	Discrete Mathematics	3	0	0	30	70	100	3
Practical										
6	Major Core Course	EAI2471	Machine Learning Lab	0	0	4	50	50	100	2
7	Major Core Course	EAI2472	Object Oriented Programming with Java Lab	0	0	4	50	50	100	2

SN	Course Category		Course Title	Week			Evaluation Scheme		Total	Credit
				L	T	P	C A	E E		
Semesters-VI										
1	Major Course	EAI3601	Research Methodology	3	0	0	30	70	100	3
2	Major Core Course	EAI3602	Internet of Things	2	0	0	30	70	100	2
3	Major Core Course	EAI3603	Introduction to Robotic Process Automation Tools	2	0	0	30	70	100	2
4	Major Core Course	EAI3604	Elective-II	3	0	0	30	70	100	3
5	Minor Course	EAI3605	Compiler Design	3	0	0	30	70	100	3
Practical										
6	Major Core Course	EAI3671	Internet of Things Lab	0	0	4	50	50	100	2
7	Major Core Course	EAI3672	Introduction to Robotic Process Automation Tools Lab	0	0	4	50	50	100	2
			TOTAL	13	0	8	250	450	700	17

				Week			Evaluation Scheme			
SN.	Course Category	Code	Course Title	L	T	P	C A	E E	Total	Credit
Semester –VII										
1	Major Core Course	EAI4701	Fuzzy Logic & Application	3	0	0	30	70	100	3
2	Major Course	EAI4702	R Programming	3	0	0	30	70	100	3
3	Major Core Course	EAI4703	Deep Learning	3	0	0	30	70	100	3
4	Major Core Course	EAI4704	Elective-III	3	0	0	30	70	100	3
Practical										
6	Major Core Course	EAI4771	R Programming Lab	0	0	4	50	50	100	2
7	Research Project/ Dissertation	EAI4772	Project Part-I	0	0	12	50	50	100	6
			TOTAL	12	0	16	220	380	600	20

SN	Codes	Elective -I
1	EAI3504	Information Security
2	EAI3506	Database Security
3	EAI3507	Business Intelligence
4	EAI3508	Smart Industry Connectivity
5	EAI3509	Data Visualization

SN	Codes	Elective-II
1	EAI3604	Blockchain Technology
2	EAI3606	Cyber Security and AI
3	EAI3607	Management Information System
4	EAI3608	Signal & Image Processing
5	EAI3609	Meta Learning

SN	Codes	Elective -III
1	EAI4704	Orientation program in Entrepreneurship
2	EAI4706	Meta Verse
3	EAI4707	AI Ethics and Governance
4	EAI4708	Unmanned Aerial Vehicles
5	EAI4709	Formal Language & Automata Theory

SN	Codes	Elective-IV
1	EAI4802	Quantum Computing
2	EAI4805	AI in Bioinformatics
3	EAI4806	Big Data Analytics

4	EAI4807	Evolutionary Algorithms
5	EAI4808	Computer Vision





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HSS1101	ENGINEERING MATHEMATICS-I	L	T	P	3 credits
		3	0	0	

CO	Description
CO1	To visualize and conceptualize the engineering problems.
CO2	To model the engineering problem mathematically using theory of calculus and matrices.
CO3	To determine the solution of the studied engineering problem from application point of view.
CO4	To validate the solution.
CO5	To implement the solution for engineering problem.

DETAILED SYLLABUS

Unit- I

Matrices: Elementary transformations, Inverse of a matrix, Rank of matrix, Solution of system of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Linear Dependence and Independence of vectors, Eigen values and Eigen vectors, Complex Matrices, Hermitian, Skew-Hermitian and Unitary Matrices, Applications to Engineering problems.

Unit-II

Differential Calculus-I: Successive Differentiation (nth order derivatives), Leibnitz theorem, Curve tracing, Partial derivatives, Euler's Theorem for homogeneous functions, Total derivative, Change of variables, Change of variables

Unit-III

Differential Calculus-II: Expansion of functions by Taylor's and Maclaurin's theorems for functions of one and two variables, Maxima and Minima of functions of several variables, Lagrange's method of multipliers, Jacobians, Approximation of errors.

Unit-IV

Multiple Integration: Double integral, Triple integral, Change of order of integration, Change of variables, Beta and Gamma function and their properties, Dirichlet's integral and its applications to area and volume, Liouville's extensions of Dirichlet's integral.

Unit-V

Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives.

Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem and Stoke's theorem (without proof) and their applications.

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Dr. Arif

Text Books:

1. B. V. Ramana, *Higher Engineering Mathematics*, McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger, *Advance Engineering Mathematics*, Narosa Publishing House, 2002.

Reference Books:

1. E. Kreyszig, *Advance Engineering Mathematics*, John Wiley & Sons, 2005.
2. Peter V. O'Neil, *Advance Engineering Mathematics*, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, *Thomas' Calculus*, Eleventh Edition, Pearson.
4. Veerarajan T., *Engineering Mathematics for first year*, McGraw-Hill, New Delhi, 2008.



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HSS1102	Advanced Engineering Physics	L	T	P	2 credits
		2	0	0	

Course Outcome (CO)

CO	Description
CO1	Demonstrate knowledge of interference, diffraction, and polarization along with their engineering applications.
CO2	Explain the basics of lasers and optical fibers and their use in industrial applications.
CO3	Understand concepts and principles in quantum mechanics and relate them to physics applications.
CO4	Understand semiconductor theory and its applications in semiconductor devices.
CO5	Summarize fundamentals of magnetism and superconductivity to explore technological applications.

Detailed Syllabus**Unit-I**

Quantum Mechanics: Limitations of classical mechanics, Planck's theory of black body radiation, Compton effect, de Broglie concept of matter waves, Davisson and Germer experiment, phase velocity and group velocity, time-dependent and time-independent Schrödinger wave equations, physical interpretation of wave function, particle in a one-dimensional box.

Unit-II

Electromagnetic Field Theory: Basic concepts of Stokes' theorem and divergence theorem, fundamental laws of electricity and magnetism, continuity equation for current density, displacement current, Maxwell's equations in integral and differential form, Maxwell's equations in vacuum and conducting medium, Poynting vector and Poynting theorem, plane electromagnetic waves in vacuum and their transverse nature, relation between electric and magnetic fields of an electromagnetic wave, plane electromagnetic waves in conducting medium, skin depth.

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Dr. M. A. Khan

Unit-III

Wave Optics: Coherent sources, interference in uniform and wedge-shaped thin films, necessity of extended sources, Newton's rings and their applications, introduction to diffraction, Fraunhofer diffraction at single slit and double slit, absent spectra, diffraction grating, spectra with grating, dispersive power, resolving power, Rayleigh's criterion of resolution, resolving power of grating.

Unit-IV

Fiber Optics & Laser: **Fiber Optics:** Principle and construction of optical fiber, acceptance angle, numerical aperture, acceptance cone, step index and graded index fibers, fiber optic communication principle, attenuation, dispersion, applications of fiber. **Laser:** Absorption of radiation, spontaneous and stimulated emission of radiation, population inversion, Einstein's coefficients, principles of laser action, solid-state laser (Ruby laser) and gas laser (He-Ne laser), laser applications.

Unit-V

Superconductors and Nano-Materials: **Superconductors:** Temperature dependence of resistivity in superconducting materials, Meissner effect, temperature dependence of critical field, persistent current, Type I and Type II superconductors, high-temperature superconductors, properties and applications of superconductors. **Nano Materials:** Introduction and properties of nano materials, basic concepts of quantum dots, quantum wires, and quantum wells, fabrication of nano materials - top-down approach (CVD) and bottom-up approach (Sol-Gel), properties and applications of nano materials.

Reference Books:

1. Concepts of Modern Physics – Aurthur Beiser (Mc-Graw Hill)
2. Optics – Brijlal & Subramanian (S. Chand)
3. Engineering Physics: Theory and Practical – Katiyar and Pandey (Wiley India)
4. Applied Physics for Engineers – Neeraj Mehta (PHI Learning, New)



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EEE1103	ESSENTIALS OF ELECTRICAL ENGINEERING	L 3	T 0	P 0	3 credits
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Course Outcome (CO)	
CO1	Analysis of Resistive Circuits and Solution of resistive circuits with independent sources
CO2	Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuits.
CO3	Analysis of Single Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
CO4	Awareness of general structure of power systems.

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12-10-1994

1. Die folgenden Aussagen sind wahr oder falsch? Begründen Sie!
 a) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 b) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 c) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
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 f) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
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 q) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 r) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 s) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 t) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 u) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 v) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 w) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 x) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 y) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.
 z) Die Funktion $f: \mathbb{R} \rightarrow \mathbb{R}$ ist durch $f(x) = x^2 + 1$ gegeben.

10-10-2014

1. Die erste Gruppe ist die Gruppe der "Kleinrentner", die aus den Rentnern besteht, die eine monatliche Rente von weniger als 1000 Mark erhalten. Diese Gruppe ist die größte und umfasst etwa 60% der gesamten Rentnerbevölkerung.

電話 09-768-3333

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1998

1. Einleitung (Zusammenfassung des Problems und Zielsetzung)
 2. Grundlagen (Theoretische Grundlagen und Definitionen)
 3. Methodik (Beschreibung der verwendeten Methoden und Verfahren)
 4. Ergebnisse (Darstellung der Ergebnisse und Diskussion)
 5. Schlussfolgerungen (Zusammenfassung der Ergebnisse und Ausblick)
 6. Literaturverzeichnis (Liste der verwendeten Literatur)
 7. Anhang (Zusätzliche Informationen und Tabellen)

100

1. Einleitung
 2. Grundlagen
 3. Methoden
 4. Ergebnisse
 5. Diskussion
 6. Fazit
 7. Literaturverzeichnis
 8. Anhang
 9. Index
 10. Abbildung
 11. Tabelle
 12. Formel
 13. Diagramm
 14. Skizze
 15. Zeichnung
 16. Bild
 17. Fotografie
 18. Video
 19. Audio
 20. Text
 21. Diagramm
 22. Skizze
 23. Zeichnung
 24. Bild
 25. Fotografie
 26. Video
 27. Audio
 28. Text
 29. Diagramm
 30. Skizze
 31. Zeichnung
 32. Bild
 33. Fotografie
 34. Video
 35. Audio
 36. Text
 37. Diagramm
 38. Skizze
 39. Zeichnung
 40. Bild
 41. Fotografie
 42. Video
 43. Audio
 44. Text
 45. Diagramm
 46. Skizze
 47. Zeichnung
 48. Bild
 49. Fotografie
 50. Video
 51. Audio
 52. Text
 53. Diagramm
 54. Skizze
 55. Zeichnung
 56. Bild
 57. Fotografie
 58. Video
 59. Audio
 60. Text
 61. Diagramm
 62. Skizze
 63. Zeichnung
 64. Bild
 65. Fotografie
 66. Video
 67. Audio
 68. Text
 69. Diagramm
 70. Skizze
 71. Zeichnung
 72. Bild
 73. Fotografie
 74. Video
 75. Audio
 76. Text
 77. Diagramm
 78. Skizze
 79. Zeichnung
 80. Bild
 81. Fotografie
 82. Video
 83. Audio
 84. Text
 85. Diagramm
 86. Skizze
 87. Zeichnung
 88. Bild
 89. Fotografie
 90. Video
 91. Audio
 92. Text
 93. Diagramm
 94. Skizze
 95. Zeichnung
 96. Bild
 97. Fotografie
 98. Video
 99. Audio
 100. Text

Test Bank

- [illegible]

Review Questions

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

[Faint handwritten notes]



2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.



EECI103	ESSENTIALS OF ELECTRONICS ENGINEERING	L 3	T 0	P 0	3 credits
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Course Outcome (CO)	
CO1	To give knowledge of some basic electronic components and circuits.
CO2	To introduce basics of diode and transistor circuits
CO3	To understand working of some IC based circuits
CO4	To study logic gates and their usage in digital circuits
CO5	To expose the students to working of some power electronic devices, transducers and application of transducers.

Detailed Syllabus:

Unit-I

Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche). Diode Application: Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits. Special Purpose two terminal Devices: Light-Emitting Diodes, Photo Diodes, Varactor Diodes, Tunnel Diodes.

Unit-II

Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration. Field Effect Transistor: Construction and Characteristic of JFETs. Transfer Characteristic. MOSFET (MOS) (Depletion and Enhancement) Type, Transfer Characteristic.

Unit-III

Operational Amplifiers: Introduction, Op-Amp basic, Practical Op-Amp Circuits (Inverting Amplifier, Non-inverting Amplifier, Unit Follower, Summing Amplifier, Integrator, Differentiator). Differential and Common-Mode Operation, Comparison.

Unit-IV

Digital Electronics: Number system & representation, Binary arithmetic, Introduction of Basic Universal Gates, Using Boolean algebra simplification of Boolean function. K Map

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Minimization up to 6 Variables.

Unit-V

Fundamentals of Communication Engineering: Basics of signal representation and analysis, Electromagnetic spectrum, Elements of a Communication System, Need of modulation and typical applications. Fundamentals of amplitude modulation and demodulation techniques. Introduction to Wireless Communication: Overview of wireless communication, cellular communication, different generations and standards in cellular communication systems, Fundamentals of Satellite & Radar Communication

Text Books:

1. Robert L. Boylestand / Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education.
2. George Kennedy, "Electronic Communication Systems", McGraw Publication
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press
4. Jacob Millman, C.C. Halkias, Satyabratajit, "Electronic Devices and Circuits", McGraw Hill
5. A. Anand Kumar, "Fundamental of Digital Circuits", PHI 4th edition, 2018



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ECS1104	PRINCIPLES OF PROBLEM SOLVING USING ADVANCED C	L T P 3 0 0	3 credits
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Course Outcome (CO)	
CO1	Control the sequence of the program and give logical outputs, Manage I/O operations in your C program.
CO2	Implement strings in your C program.
CO3	Store different data types in the same memory, Apply code reusability with functions and pointer.
CO4	Repeat the sequence of instructions and points for a memory location, Explain the uses of pre-processors and various memory models.
CO5	Understand the basics of file handling mechanisms.

Detailed Syllabus:

Unit-I

Introduction to Components of a Computer System: Memory, Processor, I/O Devices, Storage, Operating System, Concept of Assembler, Compiler, Interpreter, Loader and Linker. **Idea of Algorithm:** Representation of Algorithm, Flowchart, Pseudo Code with Examples, From Algorithms to Programs, Source Code. **Programming Basics:** Structure of C Program, Writing and Executing the First C Program, Syntax and Logical Errors in Compilation, Object and Executable Code. Components of C Language. Standard I/O in C, Fundamental Data types, Variables and Memory Locations, Storage Classes.

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Unit-II

Arithmetic Expressions and Precedence: Operators and Expression Using Numeric and Relational Operators, Mixed Operands, Type Conversion, Logical Operators, Bit Operations,

Assignment Operator, Operator precedence and Associativity. **Conditional Branching:** Applying if and Switch Statements, Nesting if and Else and Switch.

Unit-III

Iteration and Loops: Use of While, do While and for Loops, Multiple Loop Variables, Use of Break, Goto and Continue Statements. **Arrays:** Array Notation and Representation, Manipulating Array Elements, using Multi-Dimensional Arrays. Character Arrays and Strings, Structure, Union, Enumerated Data types, Array of Structures, Passing Arrays to Functions.

Unit-IV

Functions: Introduction, Types of Functions, Functions with Array, Passing Parameters to Functions, Call by Value, Call by Reference, Recursive Functions. **Basic of Searching and Sorting Algorithms:** Searching & Sorting Algorithms (Linear Search, Binary Search, Bubble Sort, Insertion and Selection Sort).

Unit-V

Pointers: Introduction, Declaration, Applications, Introduction to Dynamic Memory Allocation (Malloc, Calloc, Realloc, and Free), String and String functions, Use of Pointers in Self-Referential Structures, Notion of Linked List (No Implementation). **File Handling:** File I/O Functions, Standard C Preprocessors, Defining and Calling Macros and Command-Line Arguments.

Text Books:

1. **Schaum's Outline of Programming with C** by Byron Gottfried, *McGraw-Hill*
2. **The C programming** by Kernighan Brian W. and Ritchie Dennis M., *Pearson Education*
3. **Computer Basics and C Programming** by V. Rajaraman, *PHI Learning Pvt. Limited, 2015*

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EME1104	ELEMENTS OF MECHANICAL ENGINEERING	L 3	T 0	P 0	3 cred
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Course Outcome (CO)	
CO1	Define the basic terminologies and fundamentals of engineering mechanics.
CO2	Recall the basic concepts of mechanical engineering.
CO3	Understand the concepts of machine tools, metal cutting operations and hydraulic machines.
CO4	Understand the fundamentals of solid mechanics, thermal engineering & RAC.
CO5	Apply the concepts & knowledge to solve the engineering problems.

DETAILED SYLLABUS

Unit-I

Introduction to Engineering Mechanics: Force moment and couple, principle of transmissibility, Varignon's theorem. Resultant of force system—concurrent and non-concurrent coplanar forces, Types of supports (Hinge, Roller) and loads (Point, UDL, UVL), free body diagram, equilibrium equations and Support Reactions.

Unit-II

Properties of Engineering Materials: Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.

Unit-III

Introduction to Thermo dynamics, RAC and IC Engines: Thermodynamics: Introduction - Basic Concepts: System, Control Volume, Surroundings, Boundaries, Universe, Types of Systems, Concept of Zeroth, First and Second law of thermodynamics Refrigeration: Refrigeration, Ton of Refrigeration; Coefficient of performance, construction and working of domestic refrigerator. Air-Conditioning: Its meaning and application, humidity, dry bulb, wet bulb, and dew point temperatures, construction and working of window air conditioner. IC Engine: Basic definition of engine and Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits.

Unit-IV

Introduction to Fluid Mechanics and Applications: Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law and Continuity Equation. Working principles of hydraulic turbines (Pelton Wheel and Francis) & pumps (Centrifugal and Reciprocating) and their classifications and hydraulic lift.

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Unit-V

Measurement and Mechatronics: Introduction to Measurement: Concept of Measurement, Error in measurements, Calibration, measurements of pressure (Bourdon Tube Pressure and U-Tube Manometer), temperature (Thermocouple and Optical Pyrometer), mass flow rate (Venturi Meter and Orifice Meter), strain (Bonded and Unbonded Strain Gauge), force (Proving Ring) and torques (Prony Brake Dynamometer); Concepts of accuracy, precision and resolution. Introduction to Mechatronic Systems: Evolution, Scope, Advantages and disadvantage Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics.

Reference Books:

1. Basic Mechanical Engineering, G. Shanmugam, S. Ravindran, McGraw Hill
2. Basic Mechanical Engineering, M. P. Poonia and S. C. Sharma, Khanna Publishers
3. Mechatronics: Principles, Concepts and Applications, Nitaigour Mahalik, McGraw Hill
4. Mechatronics, As per AICTE: *Integrated Mechanical Electronic Systems*, K. P. Ramachandran, G. K. Vijayaraghavan, M. S. Balasundaram, Wiley India
5. Mechanical Measurements & Control, Dr. D. S. Kumar, Metro Polytan Book Company
6. Fluid Mechanics and Hydraulic Machines, Mahesh Kumar, Pearson India

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ECS1105	AI for Everyone	L 2	T 1	P 0	3 credits
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Course Objectives:

CO1	Introduce fundamental concepts of Artificial Intelligence (AI) and its real-world applications.
CO2	Familiarize students with basic AI techniques such as machine learning, natural language processing, and computer vision.
CO3	Enhance understanding of ethical considerations and societal impacts of AI.
CO4	Develop problem-solving skills using AI tools and frameworks.
CO5	Encourage critical thinking about the future of AI in various domains such as healthcare, education, business, and security.

Unit-I

Introduction to AI (Concept + Hands-on): What is AI? Understanding AI vs. Machine Learning vs. Deep Learning, AI in daily life: Smart assistants, AI in social media, AI in e-commerce, Prompt Engineering, Real Life Applications of AI. Tools: Explore AI-based tools (Google AI, ChatGPT, MetaAI, Gemini).

Unit-II

Introduction to Machine Learning and Deep Learning: Introduction to learning theory, Methods and Models. Supervised vs. Unsupervised Learning (Examples from real life), Reinforcement Learning, Introduction to ANN and Deep Learning.

Unit-III

Computer Vision & Image Processing: Introduction to Image processing and Computer Vision ?, Hardware used, Face Recognition, Object Detection, and AI-powered Cameras, How AI understands text & speech, AI in Chatbots, Sentiment Analysis, and AI-based Translation Practical

Unit-IV

AI in Automation & Robotics: AI-powered automation in businesses, How AI is used in robotics and smart homes, Ethical AI & Responsible AI, Bias in AI and fairness in decision-making, How to use AI responsibly.

Unit-V

Mini AI Projects (Without Coding): Hands-on Project Options: AI for Image Classification: Train an AI model to recognize objects Create an AI Chatbot: Use Dialog flow or Chatbot.com, AI in Business: Automate tasks using AI-based productivity tools.

* Students will present their AI Project (Simple AI-based tool using existing platforms) Complete an AI-based quiz & get a certification.

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Text books and References:

1. **Stuart Russell & Peter Norvig** – *Artificial Intelligence: A Modern Approach* (Pearson, 4th Edition)
2. **John Paul Mueller & Luca Massaron** – *Artificial Intelligence For Dummies* (Wiley)“A beginner-friendly guide to AI concepts, applications, and future trends.”
3. **Thomas H. Davenport & Nitin Mittal** – *All in on AI: How Smart Companies Win Big with Artificial Intelligence* (Harvard Business Review Press), Explains AI strategies in business and industry.

COURSE OUTCOMES:

CO1	Understand the fundamental principles and applications of AI in different industries.
CO2	Explain key AI techniques, including supervised and unsupervised learning, deep learning, and neural networks.
CO3	Analyze ethical challenges and biases in AI systems and their impact on society.
CO4	Apply AI-driven solutions in fields like healthcare, finance, and automation.
CO5	Critically evaluate the benefits and risks associated with AI technologies.

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HSS1170	Advanced Engineering Physics LAB	L 0	T 0	P 1	1 credits
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(CO)	Description
CO1	Prepare and perform individually a wide spectrum of experiments.
CO2	Present experimental data in various appropriate forms like tabulation and plots.
CO3	Analyse, interpret and summarize the experimental results
CO4	Communicate clearly the understanding of various experimental principles, instruments/setup, and procedure

List of Experiments

Group A

1. To determine the wavelength of sodium light using Newton's rings.
2. To determine wavelength of spectral lines using plane transmission diffraction grating.
3. To determine specific rotation of sugar solution by using a polarimeter.
4. To determine the focal length of combination of two lenses separated by a distance and verify the formula for the focal length of combination.
5. To study the characteristics of tunnel diode.
6. To find the refractive index of the material of prism using a spectrometer.
7. To study the truth tables of various logic gates (OR, AND, NOT, NOR and NAND).
8. To study the transistor characteristics in CE mode of bipolar transistor.
9. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's bridge.
10. To determine the value of acceleration due to gravity and radius of gyration using a bar pendulum.

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ECS1171	PROGRAMMING USING ADVANCED C LAB	L	T	P	1 credits
		0	0	1	

Course Outcome (CO)

CO	Description
CO1	Apply the knowledge of advanced C programming concepts to implement given requirement specification or to solve real world problem.
CO2	Implement, interpret, debug and test any given advanced C program.
CO3	Read, understand and trace the execution of programs written in C language.
CO4	Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.
CO5	Write programs that perform operations using derived data types.

DETAILED SYLLABUS

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula $C/5 = (F-32)/9$.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
 - Between 90-100% ---- Print 'A'
 - 80-90% ----- Print 'B'
 - 60-80% ----- Print 'C'
 - Below 60% ----- Print 'D'

11. WAP that takes two operands and one operator from the user, perform the operation, and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.

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EME1171	EME LAB	L 0	T 0	P 1	1 credits
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Course Outcome (CO)

CO	Description
CO1	Analyze the performance of heat exchangers.
CO2	Measure the coefficients of heat transfer
CO3	Discuss the working of Air conditioning and refrigeration systems
CO4	Experiment with the working of gyroscopes and identify the effects of forces and moments on their motion
CO5	Demonstrate the working of governor apparatus and illustrate the effects of forces and moments on their motion

Objectives:

To understand the principle and performance characteristics of different materials.

- To know about material properties.
- List of Experiments: (At least 8 of the following)
 1. To Study Strength test of a given mild steel specimen on UTM.
 2. To Study Impact test on impact testing machine like Charpy, Izod or both.
 3. To Study Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
 4. To Study Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge to the calculated one, and/or evaluation of young's modulus of beam.
 5. To Study Torsion test of a rod using torsion testing machine.
 6. Study of NDT (non-destructive testing) methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.
 7. Study of two stroke and four stroke petrol engine.
 8. Study of two stroke and four stroke Diesel engine.
 9. Study of Models of Boiler.
 10. Study of Hydraulic Turbines.
 11. Study of Hydraulic Pumps.
 12. Study of Refrigeration and Air Conditioning system.

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EEE1172	ESSENTIALS OF ELECTRICAL ENGINEERING LAB	LTP 0 0 1	1 credits
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Course Outcome (CO)

CO	Description
CO1	Calibrate Ammeter and Wattmeter.
CO2	Demonstrate the measuring instrument and electrical machines.
CO3	Conduct open circuit and short circuit test of single-phase transformer.
CO4	Measure 3 phase power using two Wattmeter.
CO5	Identify the components of LT switchgear. Understand the characteristic of RLC series and parallel circuit.

DETAILED SYLLABUS

LIST OF EXPERIMENTS

Note: A minimum of **EIGHT** experiments from the following should be performed.

1. Verification of Kirchoff's laws
2. Measurement of power and power factor in:
 - i. a single phase AC series inductive circuit
 - ii. study improvement of power factor using capacitor
3. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
4. Connection and measurement of power consumption of a fluorescent lamp (tube light).
5. Measurement of power in 3-phase circuit by two-wattmeter method and determination of power factor for star as well as delta connected load.
6. Determination of parameters of AC single phase series RLC circuit
7. Determination of:
 - i. Voltage ratio
 - ii. Polarity
 - iii. Efficiency by load test of a single phase Transformer
8. Determination of efficiency of a DC shunt motor by load test
9. To study running and speed reversal of a three-phase induction motor and record speed in both directions.
10. Demonstration of cut-out sections of machines:
 - DC machine
 - Three phase induction machine
 - Single-phase induction machine
 - Synchronous machine

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EECI172	ESSENTIALS OF ELECTRONICS ENGINEERING LAB	L 0	T 0	P 1	1 credits
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Course Outcome (CO)

CO	Description
CO1	To apply the concepts and analytical principles to analyze electronic (diodes, transistors) circuits.
CO2	To understand the operation of diodes and transistors in order to build circuits.
CO3	To learn the characteristics of Transistor.
CO4	To learn the basics of Amplifiers.
CO5	The students are able to design Op-amp circuits.

DETAILED SYLLABUS

Suggestive List of Experiments

1. To study the characteristics of pn junction diode and to calculate static and dynamic resistances.
2. To study the characteristics of zener diode under forward and reverse biasing.
3. To study input and output characteristics of bipolar junction transistor.
4. To study output and transfer characteristics of a field effect transistor.
5. To study the behaviour of a zener diode as voltage regulator.
6. To verify truth tables of OR, AND, NOT, NOR, NAND and XOR logic gates.
7. To verify truth tables of half adder and full adder circuits.
8. To verify truth tables of half subtractor and full subtractor circuits.
9. Study of various types of Active & Passive Components.
10. Study of Lab Equipment and Components:
 - CRO
 - Power supply
 - Multimeter
 - A/F oscillator

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IKS1101	IKS-I (INDIAN KNOWLEDGE SYSTEM – I)	L	T	P	1
		1	0	0	credits

Course Outcomes (CO)

CO	Description
CO1	Creating awareness amongst the youths about the true history and rich culture of the country.
CO2	Understanding the scientific value of the traditional knowledge of Bharata.
CO3	Promoting the youths to do research in the various fields of Bhartiya knowledge system.
CO4	Converting the Bhartiya wisdom into the applied aspect of the modern scientific paradigm.
CO5	Adding career, professional, and business opportunities to the youths.

DETAILED SYLLABUS

Unit-I

Indian Education:

- *Vedic Education*: Focus on the traditional learning system during the Vedic period.
- *Spiritual and Moral Development*: Education's role in ethics and spiritual growth.
- *Intellectual Growth*: Contributions of Vedic education to intellectual advancement.
- *Social and Cultural Refinement*: Cultural impact of education on society.

Unit-II

Methodology of Indian Knowledge System: - *Pramana*: Means of obtaining and validating knowledge in Indian philosophy. *Nyaya*: Logical reasoning and debate in the Indian knowledge tradition.

Unit-III

Indian Metallurgy

- *Indian Text for Metallurgy*: Ancient scriptures related to metallurgy.
- *Important Specimens*: Notable preserved/found metalwork examples from Indian history.
- *Vedic References*: Mentions of metals in Vedic texts and their significance.

Unit-IV

Indian Health Sciences

Literature

- *Vedic Foundations of Ayurveda*: Ancient texts forming the basis of Ayurveda.
- *Ayurveda Concern for Good Health*: Holistic well-being focus.
- *Key Concepts*: Three Guna, Three Dosha, Panch Mahabhoot, Sapta Dhatu, Six Rasa.
- *Daily/Seasonal Regimens*: Dinacharya & Ritucharya.

Practical

- *Sushruta Samhita*: Ancient surgery text.
- *Charaka Samhita*: Ayurvedic medicine text.
- *Ashtanga Hridaya – Sutra Sthana*: Ayurvedic classic.
- *Qualities of a Surgeon*: Attributes of a good surgeon.
- *Surgical Practices*: Ancient surgical methods.

Unit-V

Foundational Literature of Indian Civilization

- *Key Texts*: Vedang, Ayurveda, Natya Shastra, Dharma Shastra, Arthashastra.
- *Covered Areas*: Linguistics, health, arts, law, politics.

Unit-VI

Bharata Varsha — A Land of Rare Natural Endowments

- *Topics*: Seasons, Land Variations, Heritage, Natural Resources, Geographical Isolation.

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HSS1201	Engineering Mathematics – II	L 3	T 0	P 0	3 credits
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DETAILED SYLLABUS

Course Outcome (CO)

CO1	Calculate a root of algebraic and transcendental equations. Explain relation between the finite difference operators
CO2	Compute interpolating polynomial for the given data.
CO3	Solve ordinary differential equations numerically using Euler's and RK method.
CO4	Find Fourier series and Fourier transforms for certain functions.
CO5	Identify/classify and solve the different types of partial differential equations.

Unit-I

Ordinary Differential Equation of Higher Order: Linear differential equation of n th order with constant coefficients. Simultaneous linear differential equations. Second order linear differential equations with variable coefficients. Solution by changing independent variable. Method of variation of parameters. Cauchy-Euler equation. Application of differential equations in solving engineering problems.

Unit-II

Laplace Transform: Laplace transform. Existence theorem. Properties of Laplace Transform. Laplace transform of derivatives and integrals. Unit step function. Laplace transform of periodic function. Inverse Laplace transform. Convolution theorem. Application of Laplace Transform to solve ordinary differential equations and simultaneous differential equations.

Unit-III

Sequence and Series: Definition of Sequence and series with examples. Convergence of series. Tests for convergence of series. Ratio test. D'Alembert's test. Raabe's test. Comparison test. Fourier series. Half range Fourier sine and cosine series.

Unit-IV

Complex Variable – Differentiation: Functions of complex variable. Limit. Continuity and differentiability. Analytic functions. Cauchy-Riemann equations (Cartesian and Polar form). Harmonic function. Method to find Analytic functions. Milne's Thompson Method. Conformal mapping. Mobius transformation and their properties.

Unit-V

Complex Variable – Integration: Complex integration. Cauchy-Integral theorem. Cauchy integral formula. Taylor's and Laurent's series. singularities and its classification. zeros of analytic functions. Residues. Cauchy's Residue theorem and its application.

Text Books:

1. B. V. Ramana, *Higher Engineering Mathematics*, Tata McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger, *Advance Engineering Mathematics*, Narosa Publishing House, 2002.

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HSS1202	ENVIRONMENTAL SCIENCE	L	T	P	2 credits
		2	0	0	

Course Outcome (CO)	
CO1	Gain knowledge about environment and ecosystem.
CO2	Students will learn about natural resource, its importance and environmental impacts of human activities on natural resource.
CO3	Gain knowledge about the conservation of biodiversity and its importance.
CO4	Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.
CO5	Students will learn about increase in population growth and its impact on environment.

DETAILED SYLLABUS

Unit-I

Environment: Definition, Types of Environment, Components of environment, Segments of environment, Scope and importance, Need for Public Awareness. **Ecosystem:** Definition, Types of ecosystem, Structure of ecosystem, Food Chain, Food Web, Ecological pyramid, Balance Ecosystem. Effects of Human Activities such as Food, Shelter, Housing, Agriculture, Industry, Mining, Transportation, Economic and Social security on Environment, Environmental Impact Assessment, Sustainable Development.

Unit-II

Natural Resources: Introduction, Classification. **Water Resources:** Availability, sources and Quality Aspects, Water Borne and Water Induced Diseases, Fluoride and Arsenic Problems in Drinking Water. **Mineral Resources:** Material Cycles; Carbon, Nitrogen and Sulfur cycles. **Energy Resources:** Conventional and Non-conventional Sources of Energy. **Forest Resources:** Availability, Depletion of Forests, Environment impact of forest depletion on society.

Unit-III

Pollution and their Effects; Public Health Aspects of Environmental: Water Pollution, Air Pollution, Soil Pollution, Noise Pollution, Solid waste management.

Unit-IV

Current Environmental Issues of Importance: Global Warming, Green House Effects, Climate Change, Acid Rain, Ozone Layer Formation and Depletion, Population Growth and Automobile pollution, Burning of paddy straw.

Unit-V

Environmental Protection: Environmental Protection Act 1986, Initiatives by Non-Governmental Organizations (NGO's), Human Population and the Environment: Population growth, Environmental Education, Women Education.

Textbooks and Reference Books:

1. *Textbook of Environment and Ecology* by Dave, Katewa & Singh, 2nd Edition, Cengage Learning India Pvt. Ltd. Delhi.
2. *Environmental Studies* by S Deswal, Dhanpat Rai & Co.
3. *Environmental Studies* by K V Ahluwalia, 2nd Edition, TERI Press, and New Delhi.
4. *Environmental Studies* by R Rajagopalan, Oxford University Press.
5. *Environment & Ecology* by Singh & Maliyea, Ace Learning.

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EEEC1203	ESSENTIALS OF ELECTRONICS ENGINEERING	L 3	T 0	P 0	3 credi ts
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Course Outcome (CO)

CO1	To give knowledge of some basic electronic components and circuits.
CO2	To introduce basics of diode and transistor circuits
CO3	To understand working of some IC based circuits
CO4	To study logic gates and their usage in digital circuits
CO5	To expose the students to working of some power electronic devices, transducers and application of transducers.

DETAILED SYLLABUS

Unit-I

Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche). Diode Application: Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits. Special Purpose two terminal Devices: Light-Emitting Diodes, Photo Diodes, Varactor Diodes, Tunnel Diodes.

Unit-II

Bipolar Junction Transistor: Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration. Field Effect Transistor: Construction and Characteristic of JFETs. Transfer Characteristic. MOSFET (MOS) (Depletion and Enhancement) Type, Transfer Characteristic.

Unit-III

Operational Amplifiers: Introduction, Op-Amp basic, Practical Op-Amp Circuits (Inverting Amplifier, Non-inverting Amplifier, Unit Follower, Summing Amplifier, Integrator, Differentiator). Differential and Common-Mode Operation, Comparator.

Unit-IV

Digital Electronics: Number system & representation, Binary arithmetic, Introduction of Basic and Universal Gates, using Boolean algebra simplification of Boolean function. K Map Minimization up to 6 Variables.

Unit-V

Fundamentals of Communication Engineering: Basics of signal representation and analysis, Electromagnetic spectrum, Elements of a Communication System, Need of modulation and typical applications. Fundamentals of amplitude modulation and demodulation techniques. Introduction to Wireless Communication: Overview of wireless communication, cellular communication, different generations and standards in cellular communication systems, Fundamentals of Satellite & Radar Communication

Text Books:

1. Robert L. Boylestand / Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education.
2. George Kennedy, "Electronic Communication Systems", McGraw Publication
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press
4. Jacob Millman, C.C. Halkias, Satyabratajit, "Electronic Devices and Circuits", McGraw Hill
5. A. Anand Kumar, "Fundamental of Digital Circuits", PHI 4th edition, 2018

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EEE1203	ESSENTIALS OF ELECTRICAL ENGINEERING	L 3	T 0	P 0	3 credits
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Course Outcome (CO)	
CO1	Analysis of Resistive Circuits and Solution of resistive circuits with independent sources
CO2	Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuits.
CO3	Analysis of Single Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
CO4	Awareness of general structure of power systems.

DETAILED SYLLABUS

Unit-I

DC Circuits: Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity, unilateral and bilateral elements. Kirchhoff's laws, Mesh and nodal methods of analysis.

Unit-II

Steady State Analysis of Single Phase AC Circuits: Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors. Analysis of single phase AC Circuits consisting R-L-C combination (Series and Parallel) Apparent, active & reactive power, Power factor. Concept of Resonance in series & parallel circuits, bandwidth and quality factor. Three phase balanced circuits, voltage and current relations in star and delta connections.

Unit-III

Transformers: Magnetic circuits, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency

Unit-IV

Electrical Machines: DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems). Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only). Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications. Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Unit-V

Electrical Installations: Introduction of Switch Fuse Unit (SFU), MCB, ELCB, MCCB, ACB. Types of Wires, Cables and Bus-bars. Fundamentals of earthing and lightning protection. Types of Batteries

Text Books:

5. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House, 2018.
6. P.V. Prasad, S. Sivanagaraju, "Electrical Engineering: Concepts and Applications", Cengage, 2018
7. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
8. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

Reference Books:

3. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.

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EME1204	ELEMENTS OF MECHANICAL ENGINEERING	L 3	T 0	P 0	3 credits
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Course Outcome (CO)

CO1	Define the basic terminologies and fundamentals of engineering mechanics.
CO2	Recall the basic concepts of mechanical engineering.
CO3	Understand the concepts of machine tools, metal cutting operations and hydraulic machines
CO4	Understand the fundamentals of solid mechanics, thermal engineering & RAC.
CO5	Apply the concepts & knowledge to solve the engineering problems.

DETAILED SYLLABUS

Unit-I

Introduction to Engineering Mechanics: Force moment and couple, principle of transmissibility, Varignon's theorem. Resultant of force system—concurrent and non-concurrent coplanar forces, Types of supports (Hinge, Roller) and loads (Point, UDL, UVL), free body diagram, equilibrium equations and Support Reactions.

Unit-II

Properties of Engineering Materials: Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; **Hardness:** Rockwell, Brinell and Vickers and their relation to strength.

Unit-III

Introduction to Thermo dynamics, RAC and IC Engines: **Thermodynamics:** Introduction - Basic Concepts: System, Control Volume, Surroundings, Boundaries, Universe, Types of Systems, Concept of Zeroth, First and Second law of thermodynamics **Refrigeration:** Refrigeration, Ton of Refrigeration; Coefficient of performance, construction and working of domestic refrigerator. **Air-Conditioning:** Its meaning and application, humidity, dry bulb, wet bulb, and dew point temperatures, construction and working of window air conditioner. **IC Engine:** Basic definition of engine and Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits.

Unit-IV

Introduction to Fluid Mechanics and Applications: Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law and Continuity Equation. Working principles of hydraulic turbines (Pelton Wheel and Francis) & pumps (Centrifugal and Reciprocating) and their classifications and hydraulic lift.

Unit-V

Measurement and Mechatronics: **Introduction to Measurement:** Concept of Measurement, Error in measurements, Calibration, measurements of pressure (Bourdon Tube Pressure and U-Tube Manometer), temperature (Thermocouple and Optical Pyrometer), mass flow rate (Venturi Meter and Orifice Meter), strain (Bonded and Unbonded Strain Gauge), force (Proving Ring) and torques (Prony Brake Dynamometer); Concepts of accuracy, precision and resolution. **Introduction to Mechatronic Systems:** Evolution, Scope, Advantages and disadvantage Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics and avionics and their applications. Sensors and Transducers: Types of

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sensors, types of transducers and their characteristics.

Reference Books:

1. **Basic Mechanical Engineering**, G. Shanmugam, S. Ravindran, McGraw Hill
2. **Basic Mechanical Engineering**, M. P. Poonia and S. C. Sharma, Khanna Publishers
3. **Mechatronics: Principles, Concepts and Applications**, Nitaigour Mahalik, McGraw Hill
4. **Mechatronics**, As per AICTE: *Integrated Mechanical Electronic Systems*, K. P. Ramachandran, G. K. Vijayaraghavan, M. S. Balasundaram, Wiley India
5. **Mechanical Measurements & Control**, Dr. D. S. Kumar, Metro Polytan Book Company
6. **Fluid Mechanics and Hydraulic Machines**, Mahesh Kumar, Pearson India

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ECS1204	PRINCIPLES OF PROBLEM SOLVING USING ADVANCED C	L T P 3 0 0	3 credits
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Course Outcome (CO)

CO1	Control the sequence of the program and give logical outputs, Manage I/O operations in your C program.
CO2	Implement strings in your C program.
CO3	Store different data types in the same memory, Apply code reusability with functions and pointer.
CO4	Repeat the sequence of instructions and points for a memory location, Explain the uses of pre-processors and various memory models.
CO5	Understand the basics of file handling mechanisms.

Detailed Syllabus:

Unit-I

Introduction to Components of a Computer System: Memory, Processor, I/O Devices, Storage, Operating System. Concept of Assembler, Compiler, Interpreter, Loader and Linker. **Idea of Algorithm:** Representation of Algorithm, Flowchart, Pseudo Code with Examples, From Algorithms to Programs, Source Code. **Programming Basics:** Structure of C Program, Writing and Executing the First C Program, Syntax and Logical Errors in Compilation, Object and Executable Code. Components of C Language. Standard I/O in C, Fundamental Data types, Variables and Memory Locations, Storage Classes.

Unit-II

Arithmetic Expressions and Precedence: Operators and Expression Using Numeric and Relational Operators, Mixed Operands, Type Conversion, Logical Operators, Bit Operations, Assignment Operator, Operator precedence and Associativity. **Conditional Branching:** Applying if and Switch Statements, Nesting if and Else and Switch.

Unit-III

Iteration and Loops: Use of While, do While and for Loops, Multiple Loop Variables, Use of Break, Goto and Continue Statements. **Arrays:** Array Notation and Representation, Manipulating Array Elements, using Multi-Dimensional Arrays. Character Arrays and Strings, Structure, Union, Enumerated Data types, Array of Structures, Passing Arrays to Functions.

Unit-IV

Functions: Introduction, Types of Functions, Functions with Array, Passing Parameters to Functions, Call by Value, Call by Reference, Recursive Functions. **Basic of Searching and Sorting Algorithms:** Searching & Sorting Algorithms (Linear Search, Binary Search, Bubble Sort, Insertion and Selection Sort).

Unit-V

Pointers: Introduction, Declaration, Applications, Introduction to Dynamic Memory Allocation (Malloc, Calloc, Realloc, and Free), String and String functions, Use of Pointers in Self-Referential Structures, Notion of Linked List (No Implementation). **File Handling:** File I/O Functions, Standard C Preprocessors, Defining and Calling Macros and Command-Line Arguments.

Text Books:

1. Schaum's Outline of Programming with C by Byron Gottfried, McGraw-Hill
2. The C programming by Kernighan Brian W. and Ritchie Dennis M., Pearson Education
3. Computer Basics and C Programming by V. Rajaraman, PHI Learning Pvt. Limited, 2015

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ECS1205	AI for Engineers	L	T	P	
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Course Objectives:

CO1	To understand the concepts of Artificial Intelligence (AI).
CO2	To understand strength of and weakness of searching algorithms.
CO3	To learn and compare the searching techniques for AI applications.
CO4	To acquaint with the various knowledge representation & experts' systems.
CO5	To understand basic probability notations in artificial Intelligence/ Game theory.

Unit-I

Introduction: History & overview of Artificial Intelligence, Different Definitions, Problem Solving Strategies, Applications, Physical Symbol System Hypothesis, production systems, Characteristics of production, Agents and Environments, Concept of rationality, Nature of environments, Structure of agents.

Unit-II

Searching Techniques: Search Strategies- Informed-Uninformed Search, depth first search, breadth first search, Heuristic Search Strategies, Evolutionary algorithms Local Search Algorithms, Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning.

Unit-III

KNOWLEDGE REPRESENTATION: Syntax and semantics of First Order Logic, Prolog, Programming, Forward Chaining Backward Chaining Resolution, Knowledge Based Agents Example, Propositional Logic, Reasoning Patterns in Propositional Logic, Inference in First Order Logic Knowledge Base Reasoning Systems for Categories.

Unit-IV

Game Playing: Constraint Satisfaction Problems(CSP), constraint propagation, backtracking search for CSP, local search for CSP, structure of CSP, Minimax & Alpha-Beta Pruning Algorithm, Imperfect Real-time decisions.

Unit-V

APPLICATIONS: AI applications, Language Models, Information Retrieval, Information Extraction, Natural Language Processing, Machine Translation, Speech Recognition, Robot, Hardware, Perception, Planning & Moving. Fuzzy logic, Probabilistic Reasoning Structured knowledge, graphs, frames and related structures.

Text books and References:

1. Artificial Intelligence by Luger (Pearson Education).
2. Artificial Intelligence, A Modern Approach. Stuart Russell and Peter Norvig.
3. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill.
4. Introduction to AI & Expert System: Dan W. Patterson, PHI.

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COURSE OUTCOMES:

CO1	To understand the fundamentals of Artificial Intelligence.
CO2	To design search systems using different search strategies of Artificial Intelligence.
CO3	To analyze various basic probability notations, game theory.
CO4	Implement Artificial Intelligence activities using logical reasoning.
CO5	To apply various algorithms for Artificial Intelligence application development.

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EME1271	EME LAB	L 0	T 0	P 1	1 credits
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Course Outcome (CO)

CO	Description
CO1	Analyze the performance of heat exchangers.
CO2	Measure the coefficients of heat transfer
CO3	Discuss the working of Air conditioning and refrigeration systems
CO4	Experiment with the working of gyroscopes and identify the effects of forces and moments on their motion
CO5	Demonstrate the working of governor apparatus and illustrate the effects of forces and moments on their motion

Objectives:

To understand the principle and performance characteristics of different materials.

- **To know about material properties.**
- **List of Experiments: (At least 8 of the following)**
 1. To study Strength test of a given mild steel specimen on UTM.
 2. To study Impact test on impact testing machine like Charpy, Izod or both.
 3. To study Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
 4. To study Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge to the calculated one, and/or evaluation of young's modulus of beam.
 5. To study Torsion test of a rod using torsion testing machine.
 6. Study of NDT (non-destructive testing) methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.
 7. Study of two stroke and four stroke petrol engine.
 8. Study of two stroke and four stroke Diesel engine.
 9. Study of Models of Boiler.
 10. Study of Hydraulic Turbines.
 11. Study of Hydraulic Pumps.
 12. Study of Refrigeration and Air Conditioning system.

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ECS1271	PROGRAMMING USING ADVANCED C LAB	L 0	T 0	P 1	1 credits
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Course Outcome (CO)

CO	Description
CO1	Apply the knowledge of advanced C programming concepts to implement given requirement specification or to solve real world problem.
CO2	Implement, interpret, debug and test any given advanced C program.
CO3	Read, understand and trace the execution of programs written in C language.
CO4	Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.
CO5	Write programs that perform operations using derived data types.

DETAILED SYLLABUS

11. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
12. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
13. WAP to calculate the area and circumference of a circle.
14. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula $C/5 = (F-32)/9$.
15. WAP that swaps values of two variables using a third variable.
16. WAP that checks whether the two numbers entered by the user are equal or not.
17. WAP to find the greatest of three numbers.
18. WAP that finds whether a given number is even or odd.
19. WAP that tells whether a given year is a leap year or not.
20. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:

- Between 90-100% ---- Print 'A'
- 80-90% ----- Print 'B'
- 60-80% ----- Print 'C'
- Below 60% ----- Print 'D'

22. WAP that takes two operands and one operator from the user, perform the operation, and prints the result by using Switch statement.
23. WAP to print the sum of all numbers up to a given number.
24. WAP to find the factorial of a given number.
25. WAP to print sum of even and odd numbers from 1 to N numbers.
26. WAP to print the Fibonacci series.
27. WAP to check whether the entered number is prime or not.
28. WAP to find the sum of digits of the entered number.
29. WAP to find the reverse of a number.
30. WAP to print Armstrong numbers from 1 to 100.
31. WAP to convert binary number into decimal number and vice versa.

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32. WAP that simply takes elements of the array from the user and finds the sum of these elements.



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EEC1272	ESSENTIALS OF ELECTRONICS ENGINEERING LAB	L 0	T 0	P 1	1 credits
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Course Outcome (CO)

CO	Description
CO1	To apply the concepts and analytical principles to analyze electronic (diodes, transistors) circuits.
CO2	To understand the operation of diodes and transistors in order to build circuits.
CO3	To learn the characteristics of Transistor.
CO4	To learn the basics of Amplifiers.
CO5	The students are able to design Op-amp circuits.

DETAILED SYLLABUS

Suggestive List of Experiments

11. To study the characteristics of pn junction diode and to calculate static and dynamic resistances.
12. To study the characteristics of zener diode under forward and reverse biasing.
13. To study input and output characteristics of bipolar junction transistor.
14. To study output and transfer characteristics of a field effect transistor.
15. To study the behaviour of a zener diode as voltage regulator.
16. To verify truth tables of OR, AND, NOT, NOR, NAND and XOR logic gates.
17. To verify truth tables of half adder and full adder circuits.
18. To verify truth tables of half subtractor and full subtractor circuits.
19. Study of various types of Active & Passive Components.
20. Study of Lab Equipment and Components:
 - CRO
 - Power supply
 - Multimeter
 - A/F oscillator

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EEE1272	ESSENTIALS OF ELECTRICAL ENGINEERING LAB	L 0	T 0	P 1	1 credits
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Course Outcome (CO)

CO	Description
CO1	Calibrate Ammeter and Wattmeter.
CO2	Demonstrate the measuring instrument and electrical machines.
CO3	Conduct open circuit and short circuit test of single-phase transformer.
CO4	Measure 3 phase power using two Wattmeter.
CO5	Identify the components of LT switchgear. Understand the characteristic of RLC series and parallel circuit.

DETAILED SYLLABUS

LIST OF EXPERIMENTS

Note: A minimum of EIGHT experiments from the following should be performed.

1. Verification of Kirchhoff's laws
2. Measurement of power and power factor in:
 - i. a single phase AC series inductive circuit
 - ii. study improvement of power factor using capacitor
3. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
4. Connection and measurement of power consumption of a fluorescent lamp (tube light).
5. Measurement of power in 3-phase circuit by two-wattmeter method and determination of power factor for star as well as delta connected load.
6. Determination of parameters of AC single phase series RLC circuit
7. Determination of:
 - i. Voltage ratio
 - ii. Polarity
 - iii. Efficiency by load test of a single phase Transformer
8. Determination of efficiency of a DC shunt motor by load test
9. To study running and speed reversal of a three-phase induction motor and record speed in both directions.
10. Demonstration of cut-out sections of machines:
 - DC machine
 - Three phase induction machine
 - Single-phase induction machine
 - Synchronous machine

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EME1273	ENGINEERING GRAPHICS LAB	L 0	T 0	P 1	1 credit
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Course Outcome (CO)

CO	Description
CO1	Get acquainted with the knowledge of various lines, geometrical constructions and construction of various kinds of scales, and Ellipse.
CO2	Improve their imagination skills by gaining knowledge about points, lines and planes.
CO3	Become proficient in drawing the projections of various solids.
CO4	Gain knowledge about orthographic and isometric
CO1	Get acquainted with the knowledge of various lines, geometrical constructions and construction of various kinds of scales, and Ellipse.

DETAILED SYLLABUS

S. No.	Content
1	Introduction to Engineering Drawing and Orthographic Projections Principles of Engineering Graphics and their significance. Dimensioning, Lettering. Scales: Plain, Diagonal and Engineering Scales. Orthographic Projection, Projection of Point, Projection of Lines: Projection of straight lines; Projection of lines inclined to one plane and both planes.
2	Projection of Planes and Solids Projection of polygonal surface and circular lamina located in first quadrant inclined to one or both reference planes. Classification of solids, Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.
3	Sections of Regular Solids and development of Surfaces Sections of Solids: Right regular solids and Auxiliary views for the true shape of the sections such as Prism, Cylinder, Pyramid, and Cone. Development of surfaces for various regular solids such as Prism, Cylinder, Pyramid and Cone.
4	Isometric Projection Isometric Projection: Isometric scales, Isometric projections of simple and combination of solids. Perspective Projection: Orthographic representation of perspective views — Plane figures and simple solids—Visual Ray Method. Conversion of pictorial view in to ortho graphic Projection.
5	Introduction to Computer Aided Design Introduction to AutoCAD: Basic commands for 2Ddrawing: Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style, etc. Transformation of Projections: Conversion of Isometric Views to Orthographic Views and Vice-Versa in Auto CAD. Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blue print form.

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EME1274	WORKSHOP PRACTICE LAB	L T P	1 credits
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Course Outcome (CO)

CO	Description
CO1	Demonstrate and produce different types of fitting models.
CO2	Gain knowledge of development of sheet metal models with an understanding of their applications.
CO3	Perform soldering and welding of different sheet metal & welded joints.
CO4	Understand the Basics of Workshop practices.

DETAILED SYLLABUS

S. No.	Content
1	Introduction to Mechanical workshop material, tools and machines - Study layout, safety measures, and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel, cast iron, etc.) used in workshop. - Study and use of tools, equipment, devices & machines used in fitting, sheet metal, and welding sections. - Learn Vernier caliper, Vernier height gauge, micrometer (screw gauge), and take readings over metallic pieces.
2	Machine shop - Demonstration of working, construction, and accessories for Lathe machine. - Perform operations on Lathe: Facing, Plane Turning, Step Turning, Taper Turning, Threading, Knurling, and Parting. - Introduction to Milling Machine: Facing, Chamfering, Slotting, and Profiling.
3	Fitting Shop - Practice marking operations. - Prepare U or V-shape Male-Female workpiece including Filing, Sawing, Drilling, and Grinding.
4	Carpentry Shop - Study of Carpentry tools, equipment, and different joints. - Make Cross Half Lap Joint, Half Lap Dovetail Joint, Mortise Tenon Joint.
5	Welding Shop - Introduction to BIS standards and reading of welding drawings. - Practice of operations: Butt Joint, Lap Joint, TIG Welding, MIG Welding.

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LSM1210	Life Skills & Mentoring - I	L	T	P	0 credits
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Course Outcome (CO)	
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession.
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO3	Understand the value of harmonious relationship based on trust and respect in their life and profession.
CO4	Understand the role of a human being in ensuring harmony in society and nature.
CO5	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

DETAILED SYLLABUS

Unit-I

Overview of Life Skills: Meaning and significance of life skills. Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, Problem solving, Effective communication, Interpersonal relationship, Coping with stress, Coping with emotion. **Life skills for professionals:** Positive thinking, right attitude, attention to detail, having the big picture, learning skills, research skills, perseverance, setting goals and achieving them, helping others, leadership, motivation, self-motivation, and motivating others, personality development, IQ, EQ, and SQ.

Unit-II

Self-awareness: Definition, need for self-awareness; Coping with Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback. **Stress Management:** Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion-oriented, acceptance-oriented, resilience, Gratitude Training. **Coping with emotions:** Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques. **Morals, Values and Ethics:** Integrity, Civic Virtue, Respect for Others, Living Peacefully, Caring, Sharing, Honesty, Courage, Valuing Time, Time management, Cooperation, Commitment, Empathy, Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.

Unit-III

21st century skills: Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking vs Creative thinking, Functions of Left Brain & Right Brain, Convergent & Divergent Thinking, Critical Reading & Multiple Intelligence. **Steps in problem solving:** Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections, Analytical Thinking, Numeric, symbolic, and graphical reasoning, Scientific temperament and Logical thinking.

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HSS-2302	Mathematics-III	L 2	T 1	P 0	3 credits
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Course Objectives:

CO1	The idea of partial differentiation and types of partial differential equations.
CO2	The idea of classification of second partial differential equations, wave, heat equation and transmission lines.
CO3	The basic ideas of statistics including measures of central tendency, correlation, regression and their properties.
CO4	The ideas of Numerical Techniques methods for finding roots of transcendental and polynomial equations..
CO5	To develop the ability to apply numerical techniques for solving systems of linear equations,

Unit-I Partial Differential Equations:

Origin of Partial Differential Equations, Linear and Non Linear Partial Equations of first order,

Lagrange's Equations, Charpit's method, Cauchy's method of Characteristics, Solution of Linear Partial Differential Equation of Higher order with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients.

Unit-II Applications of Partial Differential Equations:

Classification of linear partial differential equation of second order, Method of separation of variables, Solution of wave and heat conduction equation up to two dimension, Laplace equation in two dimensions, Equations of Transmission lines.

Unit-III Statistical Techniques :

Introduction: Measures of central tendency, Moments, Moment generating function (MGF), Skewness, Kurtosis, Curve Fitting, Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves, Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions coefficients and non linear regression.

Unit-IV Numerical Techniques-I: Zeroes of transcendental and polynomial equations using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite differences, Newton's forward and backward interpolation, Lagrange's and Newton's divided difference formula for unequal intervals.

Unit-V: Numerical Techniques-II

Numerical Techniques-II: Solution of system of linear equations, Matrix Decomposition methods, Jacobi method, Gauss-Seidel method. Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson's one third and three-eighths rules, Solution of ordinary differential equations (first order, second order and simultaneous) by Euler's, Picard's and fourth-order Runge-Kutta methods.

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Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
3. S. Ross: A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

Reference Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
2. T. Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi.
3. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing House, New Delhi.
4. J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.
5. S.S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning Pvt. Ltd, New Delhi.

COURSE OUTCOMES:

CO1	Remember the concept of partial differential equation and to solve partial differential equation
CO2	Analyze the concept of partial differential equations to evaluate the problems concerned with partial differential equations
CO3	Understand the concept of correlation, moments, skewness and kurtosis and curve fitting
CO4	Remember the concept of Numerical methods for finding roots of transcendental and polynomial equations.
CO5	Apply the concept of numerical techniques for solving systems of linear equations.

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EAI2302	Data Structures & Algorithms	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	Introduce the concept of data structures through ADT including List, Stack, Queues
CO2	To understand concepts about searching and sorting techniques.
CO3	To understand basic concepts about stacks, queues, lists, trees and graphs.
CO4	Able to analyze algorithms and determine their time complexity
CO5	To enable them to write algorithms for solving problems with the help of fundamental data structures.

Unit-I

Introduction: Basic Terminology, Elementary Data Organization, Algorithm, Time and space complexity of algorithms. Asymptotic notations, Abstract data types.

Arrays: Representation of arrays, insertion and deletion operations, Single and Multidimensional Arrays, Sparse Matrices and their representations.

Searching: Sequential search, Binary Search, Comparison and Analysis

Unit-II

Stacks: Primitive Stack operations: Push & Pop Array and Linked Implementation of Stack. Application of stack: Prefix and Postfix Expressions conversion, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Problem solving using recursion with examples such as binary search, Fibonacci numbers, and towers of Hanoi. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues, Dequeue and Priority Queue.

Unit-III

Linked List: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Garbage collection and memory compaction.

Unit-IV

Trees : Basic terminology used with Binary Trees, Binary Tree Representation, Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Binary Search Tree: Operation of Insertion, Deletion, Searching in Binary Search tree . Threaded Binary trees, Traversing Threaded Binary trees. Concept & Basic Operations of AVL Tree. B Tree: definitions, algorithms and analysis.

Unit-V

Sorting: Bubble sort, Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Two Way Merge Sort, and Heap Sort. Performance and Comparison among all the methods. Hashing: Hash Function, Collision Resolution Strategies Graphs: Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm.

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Text books and References:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++", PHI
2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication
3. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill
4. R. Kruse et al, "Data Structures and Program Design in C", Pearson Education
5. Lipschutz, "Data Structures" Schaum's Outline Series, TMH
6. G A V Pai, "Data Structures and Algorithms", TMH

COURSE OUTCOMES:

CO1	For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
CO2	For a given Search problem (Linear Search and Binary Search) student will able to implement it.
CO3	For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
CO4	Able to analyze algorithms and determine their time complexity
CO5	Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

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EAI2303	CYBER SECURITY	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	Understand the basic concepts and importance of Cyber Security.
CO2	Explain different types of cyber threats, attacks, and vulnerabilities.
CO3	Develop skills to apply security mechanisms for protecting systems and networks.
CO4	Gain knowledge of cryptography techniques and secure communication methods.
CO5	Understand security policies, ethical issues, and incident response in Cyber Security.

Unit-I

INTRODUCTION TO CYBER CRIME: Cybercrime – Definition and Origins of the word Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. **Cyber offenses:** How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cybercafé and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

Unit-II

CYBER CRIME: Mobile and Wireless Devices – Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era.

Unit-III

TOOLS AND METHODS USED IN CYBER CRIME: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan-horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **Phishing and Identity Theft:** Introduction to Phishing, Identity Theft (ID Theft).

Unit-IV

UNDERSTANDING COMPUTER FORENSICS: Introduction, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation. **Forensics and Social Networking Sites:** The Security/Privacy Threats, Challenges in Computer Forensics.

Unit-V

INTRODUCTION TO SECURITY POLICIES AND CYBER LAWS: Need for an Information Security Policy, Introduction to Indian Cyber Law, Objective and Scope of the Digital Personal Data Protection Act 2023, Intellectual Property Issues, Overview of Intellectual Property Related Legislation in India, Patent, Copyright, Trademarks.

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Text books and References:

1. Sunit Belapure and Nina Godbole, *Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives*, Wiley India Pvt Ltd, ISBN: 978-81-265-2179-1, Publish Date 2013.
2. Basta, Basta, Brown, Kumar, *Cyber Security and Cyber Laws*, 1st edition, Cengage Learning Publication.
3. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. *Introduction to information security and cyber laws*, Dreamtech Press, ISBN: 9789351194736, 2015.
4. *Cyber Security and Data Privacy* by Krishan Kumar Goyal, Amit Garg, Saurabh Singhal, HP HAMILTON LIMITED Publication, ISBN: 13-978-1913936020.

COURSE OUTCOMES:

CO1	Understand the basic concepts of Cyber Security and common types of cyber threats.
CO2	Learn about different security mechanisms such as authentication, authorization and encryption.
CO3	Understand network security principles and identify vulnerabilities in systems.
CO4	Apply knowledge of malware analysis, phishing attacks and cyber defense techniques.
CO5	Understand security policies, risk management and legal/ethical issues in Cyber Security.



EAI2304	Python Programming	L	T	P	3 credits
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Course Objectives:

CO1	Introduce students to the fundamentals of Python programming language.
CO2	Develop the ability to design and implement algorithms using Python.
CO3	Provide hands-on experience with Python for solving real-world problems.
CO4	Enhance programming skills using Python's data structures and object-oriented features.
CO5	Familiarize students with modules, file handling, and exception handling in Python.

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Unit-I
Introduction to Python: Python variables, Python basic Operators, Understanding python blocks, Python Data Types, Declaring and using Numeric data types: int, float etc.

Unit-II

Python Program Flow Control Conditional blocks: if, else and else if, Simple for loops in python, For loop using ranges, string, list and dictionaries. Use of while loops in python, Loop manipulation using pass, continue, break and else. Programming using Python conditional and loop blocks.

Unit-III

Python Complex data types: Using string data type and string operations, Defining list and list slicing, Use of Tuple data type. String, List and Dictionary, Manipulations Building blocks of python programs, string manipulation methods, List manipulation. Dictionary manipulation, Programming using string, list and dictionary in-built functions. Python Functions, Organizing python codes using functions.

Unit-IV

Python File Operations: Reading files, Writing files in python, Understanding read functions, read(), readline(), readlines(). Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming, using file operations.

Unit-V

Python packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc. GUI Programming: Tkinter introduction, Tkinter and Python Programming, Tk Widgets, Tkinter examples. Python programming with IDE.

Text Books – Python Programming

1. Python Programming: An Introduction to Computer Science, John Zelle, Franklin Beedle & Associates.
2. Core Python Programming, Wesley J. Chun, Prentice Hall.
3. Learning Python, Mark Lutz, O'Reilly Media.

Reference Books – Python Programming

1. Learning Python, Mark Lutz, O'Reilly Media.
2. Core Python Programming, Wesley J. Chun, Prentice Hall.
3. Python Programming: An Introduction to Computer Science, John Zelle, Franklin Beedle & Associates.

COURSE OUTCOMES – Python Programming

CO1:	Understand the basic syntax and fundamental concepts of Python programming.
CO2:	Develop programs using control structures, functions and modules in Python.
CO3:	Apply Python data structures such as lists, tuples, dictionaries and sets.
CO4:	Implement object-oriented programming concepts using Python.
CO5:	Design Python programs using file handling and exception handling for real-world applications.

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EAI2305	AI ETHICS GOVERNANCE	L	T	P	3 credits
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CO1	Understand the fundamental concepts of ethical issues in Artificial Intelligence.
CO2	Identify bias, fairness, transparency and accountability in AI systems.
CO3	Learn data privacy, security and responsible use of AI technologies.
CO4	Apply ethical guidelines and governance frameworks in AI-based applications
CO5	Understand legal, social and professional responsibilities related to AI deployment.

UNIT I

Introduction to AI Ethics: Fundamentals of Ethics in Artificial Intelligence, Ethical Issues in AI Systems, Responsible AI Principles, Bias and Fairness in AI, Transparency and Explainability.

UNIT II

Data Privacy and Security: Data Protection Principles, Privacy in AI Applications, Data Governance and Management, Security Risks in AI Systems, Ethical Data Collection and Usage.

UNIT III

Fairness and Accountability: Algorithmic Bias, Fairness in Machine Learning Models, Accountability in AI Systems, Ethical Decision-Making Frameworks, Human Oversight in AI.

UNIT IV

AI Governance Frameworks: AI Policies and Regulations, Governance Models for AI Deployment, Risk Management in AI, Compliance and Standards, Auditing and Monitoring AI Systems.

UNIT V

Social and Legal Implications:

Legal Issues in AI, Social Impact of AI Technologies, Ethical Use of Autonomous Systems, Professional Responsibility in AI Development, Future Trends in Ethical AI.

Text Books:

1. AI Ethics: A Textbook, Springer, 2023.
2. AI Ethics and Governance: Black Mirror and Order, Springer, 2022.
3. Ethics, Governance, and Policies in Artificial Intelligence, Springer, 2021.
4. Ethics and Governance of Artificial Intelligence: Frameworks, Risks, and Society, Chapman & Hall/CRC, 2026.

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Reference Books:

1. Ethics, Governance, and Policies in Artificial Intelligence, Luciano Floridi, Springer, 2021.
2. AI Ethics and Governance: Black Mirror and Order, Zhiyi Liu & Yejie Zheng, Springer, 2022.
3. Principles of AI Governance and Model Risk Management, James Sayles, Springer, 2024.

COURSE OUTCOMES

CO1:	Understand the fundamental concepts and ethical issues in Artificial Intelligence.
CO2:	Identify bias, fairness, transparency and accountability in AI systems.
CO3:	Analyze data privacy, security and responsible use of AI technologies.
CO4:	Apply ethical guidelines and governance frameworks in AI-based applications.
CO5:	Evaluate legal, social and professional responsibilities in AI deployment.



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EAI2371	Data Structures & Algorithms Lab	L 0	T 0	P 4	2 credits
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List of Programs to be implemented in C language:

1. Implementation of Linear Search
2. Implementation of Binary Search.
3. Implementation of Largest and second largest in array
4. Implementation of Bubble Sort
5. Implementation of Selection Sort
6. Implementation of Insertion sort
7. Implementation of transpose of sparse matrix
8. Implementation of Single Linked List.
9. Implementation of Double Linked List
10. Implementation of Circular Linked List.
11. Implementation of Stack Using Single Linked List.
12. Implementation of Stack Using Array.
13. Implementation of Circular Queue Using Array.

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14. Implementation of Queue Using Linked List.
15. Implementation of Tower of Hanoi
16. Implementation of Recursive Binary search
17. Implementation of Merge sort
18. Implementation of Quick Sort
19. Implementation of Heap sort
20. Implementation of Conversion of Infix Expression to Postfix Expression
21. Implementation of Postfix Expression Evaluation



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EAI2373	Python Programming Lab	L 0	T 0	P 4	2 credits
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List of Programs to be Implemented in Python language :

1. Write a Python program to perform basic arithmetic operations (Addition, Subtraction, Multiplication, Division).
2. Write a Python program to swap two numbers (with and without using a third variable).
3. Write a Python program to check whether a number is even or odd.
4. Write a Python program to find the largest of three numbers.
5. Write a Python program to find whether a given year is a leap year or not.
6. Write a Python program to display the multiplication table of a number.
7. Write a Python program to check if a number is prime or not.
8. Write a Python program to print the Fibonacci sequence up to 'n' terms.
9. Write a Python program to calculate the factorial of a number using a loop.
10. Write a Python program to print patterns using nested loops (e.g., stars, numbers, pyramid, etc.).
11. Write a Python program using user-defined functions to find factorial, prime, and palindrome.
12. Write a Python program to demonstrate default, keyword, and variable-length arguments (*args, **kwargs).
13. Write a Python program to demonstrate the use of lambda functions.
14. Write a Python program to import and use built-in modules (math, random, datetime).
15. Write a Python program to perform CRUD operations on a list.
16. Write a Python program to count the frequency of characters in a string.
17. Write a Python program to sort a dictionary by key and by value.
18. Write a Python program to remove duplicates from a list and convert it into a set.
19. Write a Python program to read and write data from/to a text file.
20. Write a Python class with constructor and methods to compute the area of a rectangle and a circle.

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EAI2401	Introduction to Machine learning	L 2	T 1	P 0	3 credits
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Course Objectives:

CO1	To provide a solid foundation in machine learning concepts and algorithms.
CO2	To introduce supervised and unsupervised learning techniques.
CO3	To develop understanding of model evaluation and performance metrics.
CO4	To enable students to implement machine learning algorithms using appropriate tools.
CO5	To apply machine learning to solve real-world problems.

Unit-I

Introduction to Machine Learning: Definition, applications, and history of ML, Types of learning: supervised, unsupervised, semi-supervised, reinforcement, Key concepts: features, labels, training/testing, overfitting/underfitting, Steps in a typical ML pipeline, Tools and platforms for ML: Python, Scikit-learn, TensorFlow (overview)

Unit-II

Supervised Learning – Regression: Linear Regression: model, cost function, gradient descent, Polynomial Regression, Evaluation metrics: MSE, RMSE, R^2 score, Applications of regression models, Hands-on implementation in Python

Unit-III

Supervised Learning – Classification: Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees and Random Forest, Evaluation metrics: accuracy, precision, recall, F1-score, ROC-AUC, Model selection and cross-validation

Unit-IV

Unsupervised Learning: Clustering: K-means, hierarchical clustering, Dimensionality reduction: PCA, t-SNE, Applications: customer segmentation, anomaly detection, Performance evaluation in unsupervised learning, Visualization techniques for high-dimensional data

Unit-V

Model Optimization and Applications: Bias-variance tradeoff, Feature selection and engineering, Hyper parameter tuning: grid search, random search, Introduction to neural networks and deep learning (overview only), Real-world applications: healthcare, finance, e-commerce, etc.

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Text books and References:

1. Tom M. Mitchell, *Machine Learning*, McGraw Hill, 1997.
2. Ethem Alpaydin, *Introduction to Machine Learning*, 3rd Edition, MIT Press, 2014.
3. Christopher M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006.
4. Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 2nd Edition, O'Reilly Media, 2019.
5. Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, MIT Press, 2016.

COURSE OUTCOMES:

CO1	Understand fundamental concepts and categories of machine learning.
CO2	Implement basic supervised learning algorithms such as regression and classification.
CO3	Apply unsupervised learning methods such as clustering and dimensionality reduction.
CO4	Evaluate model performance using appropriate metrics.
CO5	Apply machine learning techniques to solve practical problems using tools like Python and Scikit-learn.



EAI2402	AI AND INTELLIGENT AGENTS	L	T	P	3 credits
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Course Objectives:

CO1	To introduce the fundamental concepts of Artificial Intelligence (AI) and its real-world applications.
CO2	To understand the principles of intelligent agents, their architectures, and decision-making strategies.
CO3	To explore search algorithms, knowledge representation, and reasoning techniques in AI.
CO4	To analyze the role of machine learning and deep learning in building intelligent systems.
CO5	To develop AI-based solutions using programming tools and frameworks.

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Unit-I

Introduction: Introduction - What is intelligence? Foundations of artificial intelligence (AI). History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies.

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Unit-II

Informed Search Strategies - Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); **Game playing** - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning

Unit-III

Uncertainty - Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; **Decision making**- Utility theory, utility functions, Decision- theoretic expert systems.

Unit-IV

Learning Forms of Learning, Inductive Learning: - Learning Decision Trees, Statistical learning methods: - Naïve Bayes models, Bayesian network, EM algorithm, HMM, Instance based learning:-nearest neighbour models.

Unit-V

Intelligent Systems Expert System- Stages in the Development of an Expert System, Difficulties in Developing Expert System, Application of Expert System, Introduction to Evolutionary Programming, Swarm Intelligent Systems.



Text books and References:

1. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson Education Press, 2001.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.
3. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
4. Mils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.

COURSE OUTCOMES:

CO1	Understand the core principles and history of AI, including its applications in various domains.
CO2	Design and implement intelligent agents that can perceive, reason, and act autonomously.
CO3	Apply search algorithms, logic-based reasoning, and knowledge representation techniques.
CO4	Evaluate different AI models, including machine learning and deep learning approaches.
CO5	Develop and test AI-based applications using programming languages such as Python with AI libraries.

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EAI2403	Object Oriented Programming with JAVA	L 2	T 1	P 0	3 credits
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Course Objectives:

CO1	Understand the core principles of Object-Oriented Programming, including inheritance, polymorphism, abstraction, and encapsulation.
CO2	Learn to design and implement classes and objects effectively in Java.
CO3	Gain proficiency in Java's features, such as constructors, interfaces, and exception handling.
CO4	Develop skills in using collections, generics, and data structures within Java to solve problems.
CO5	Apply object-oriented design patterns and principles to create maintainable and reusable Java applications.

Unit-I

Introduction to Java : Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

Unit-II

Objects and Classes : Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference.

Unit-III

Inheritance and Polymorphism : Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package. Event and GUI programming : Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

Unit-IV

I/O programming : Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files, Introduction to java collections, Overview of java collection framework, commonly used collection classes □ Array List, Vector, Hash table, Stack.

Unit-V

Multithreading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.

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Text books and References:

1. Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.
2. Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.
3. Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.
4. Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.

COURSE OUTCOMES:

CO1	Understand the basic concepts of formal languages and automata.
CO2	Design and analyze finite automata for regular languages.
CO3	Apply context-free grammars and pushdown automata concepts.
CO4	Understand Turing machines and computability concepts.
CO5	Analyze different types of automata and their applications in computation.



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EAI2404	RECENT ADVANCES IN TECHNOLOGY	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	To introduce students to recent trends in Information Technology and emerging technologies.
CO2	To understand the concepts of Artificial Intelligence, Machine Learning and their applications.
CO3	To learn about Internet of Things and smart system technologies.
CO4	To gain knowledge of Cloud Computing and big data technologies.
CO5	To understand future technologies and their impact on society and industry.

DETAILED SYLLABUS

Unit-I

Introduction to Computer: Definition, Computer Hardware & Computer Software Components: Hardware – Introduction, Input devices, and Output devices, Central Processing Unit, Memory- Primary and Secondary. Software - Introduction, Types – System and Application. Computer Languages: Introduction, Concept of Compiler, Interpreter & Assembler. Problem solving concept: Algorithms – Introduction, Definition, Characteristics, Limitations, Conditions in pseudo-code, and Loops in pseudo code.

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Unit-II

Networking Fundamentals: Introduction to Computer Networks, Types of Networks (LAN, WAN, MAN), Network Topologies, OSI Model, IP Addressing and Subnetting, Basic Network Security. Databases and Data Management: Introduction to Databases, Relational vs. Non-Relational Databases, Data Warehousing. Cyber security: Importance of Cyber security, Types of Cyber Threats (Malware, Phishing, etc.), Cryptography Basics, Firewalls and Antivirus, Network Security Protocols. Artificial Intelligence and Machine Learning: Introduction to Artificial Intelligence (AI), Machine Learning Basics, AI Applications in Various Industries, Ethical Considerations in AI.

Unit-III

Internet: Overview, Architecture, Functioning, Basic services like WWW, FTP, Telnet, Gopher etc., Search engines, E-mail, Web Browsers. Internet of Things (IoT): Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.

Unit-IV

Block chain: Introduction, overview, features, limitations and application areas, fundamentals of Block Chain. Crypto currencies: Introduction, Applications and use cases Cloud Computing: IT nature and benefits, AWS, Google, Microsoft & IBM Services

Unit-V

Emerging Technologies: Introduction, overview, features, limitations and application areas of Augmented Reality, Virtual Reality, Grid computing, green computing, Big data analytics, Quantum Computing and Brain Computer Interface

Textbooks and Reference Books:

1. "Emerging Technologies: AI, IoT, and Blockchain" By Krittika Goyal and Rajeev Kumar
2. "Recent Trends in Engineering and Technology" By A. R. Bhalerao, S. D. Lokhande (Technical Publications)
3. Emerging Technologies: AI, IoT, and Blockchain By Rajeev Kumar & Krittika Goyal

COURSE OUTCOMES:

CO1	Understand the concepts of emerging technologies in Information Technology.
CO2	Explain applications of Artificial Intelligence and Machine Learning.
CO3	Analyze the working of Internet of Things and smart devices.
CO4	Apply knowledge of Cloud Computing and big data technologies.
CO5	Evaluate recent technological trends and their impact on industry and society.

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ECS2405	Discrete Mathematics	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	Introduce the fundamental concepts and structures of discrete mathematics.
CO2	Develop logical thinking and problem-solving skills.
CO3	Understand and apply principles of logic, set theory, relations, and functions..
CO4	Learn combinatory, graph theory, and trees essential for computer science
CO5	Provide a foundation for formal methods, algorithms, and theoretical computer science.

Unit-I

Logic and Proof Techniques: Propositional Logic and Truth Tables, Logical Connectives, Implications, Equivalences, Predicates and Quantifiers, Methods of Proof: Direct, Indirect, Contradiction, Contrapositive, Mathematical Induction.

Unit-II

Set Theory and Algebraic Structures: Sets, Subsets, Power Sets, Operations on Sets, Venn Diagrams, Set Identities, Cartesian Products, Relations and Their Properties, Functions: Types, Inverse, Composition, Partitions and Equivalence Relations.

Unit-III

Combinatorics and Recurrence: Counting Principles: Addition, Multiplication, Permutations and Combinations, Pigeonhole Principle, Inclusion-Exclusion Principle, Recurrence Relations and Solutions, Generating Functions.

Unit-IV

Graph Theory: **Introduction to Graphs:** Types and Representations, Graph Terminologies: Degree, Path, Cycle, Subgraphs, Special Graphs: Complete, Bipartite, Regular, Trees, Matrix Representation of Graphs, Graph Traversal: BFS, DFS, Eulerian and Hamiltonian Paths and Circuits, Planar Graphs and Graph Coloring.

Unit-V

Trees and Applications: Definition and Properties of Trees, Binary Trees, Binary Search Trees, Tree Traversals: Preorder, Inorder, Postorder, Spanning Trees, Kruskal's and Prim's Algorithms, Applications of Trees in Expression Parsing, File Structures, etc.

Text Books – Discrete Mathematics

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen, McGraw-Hill.
2. Discrete Mathematical Structures, C. L. Liu & D. P. Mohapatra, McGraw-Hill.
3. Discrete Mathematics with Applications, Susanna S. Epp, Cengage Learning.
4. Applied Discrete Structures, Alan Doerr & Kenneth Levasseur.
5. Discrete Mathematics: An Open Introduction, Oscar Levin.

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COURSE OUTCOMES:

CO1	Understand the basic concepts of logic, sets and relations.
CO2	Apply principles of functions, relations and mathematical reasoning.
CO3	Analyze combinatorial techniques and counting principles.
CO4	Understand graph theory concepts and their applications.
CO5	Apply discrete mathematical structures to solve computing problems.

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EAE2471	Machine Learning Lab	L 0	T 0	P 4	2 credits
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List of Experiments:

1. Implement Linear Regression on a dataset (e.g., housing prices) and evaluate using MSE and R^2 .
2. Implement Logistic Regression for binary classification (e.g., tumor classification or bank loan approval).
3. Implement K-Nearest Neighbors (KNN) algorithm for classification and visualize decision boundaries.
4. Implement Decision Tree Classifier and visualize the tree structure.
5. Implement Naïve Bayes Classifier for text classification (e.g., spam detection).
6. Implement Support Vector Machine (SVM) with linear and RBF kernels.
7. Implement K-Means Clustering and evaluate with inertia and silhouette score.
8. Implement Principal Component Analysis (PCA) for dimensionality reduction and visualization.
9. Implement Random Forest Classifier and compare with Decision Tree.
10. Apply Cross-Validation Techniques to evaluate model performance (k-fold, stratified k-fold).

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FAI2472	Object Oriented Programming with Java Lab	L T P 0 0 4	2 credits
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List of Programs to be Implemented:

1. WAP to show the concept of various principle of OOP's such as
 - a. Inheritance
 - b. Polymorphism
 - c. Encapsulation
 - d. Abstraction
2. WAP to create a calculator using class & inheritance?
3. WAP to print the matrix?
4. WAP to print the addition of two matrices?
5. WAP to print the multiplication of two matrices?
6. WAP to print the default value of instance variable?
7. WAP to demonstrate the scope of variables?
8. WAP to show the concept of up casting & down casting?(implicit & explicit typecasting)?
9. WAP to overload the constructor?(Compile time polymorphism)
10. WAP to calculate the sine series, i.e. create a user defined method of sine series?
11. WAP to overload the method? (Compile time polymorphism)
12. WAP to override the method (sine series method)?(Runtime polymorphism)
13. WAP to show the dynamic method dispatch?(Make all possible combination)
14. Demonstrate the calling of constructor?
15. WAP to Demonstrate concept of Automatic type conversion apply to overloading?
16. WAP to calculate the factorial using static methods?
17. WAP to use command line arguments?
18. WAP to show the use of this keyword of java?
19. WAP to show the two use of super keyword of java?
20. WAP to show the ways to call the static method in java?
21. WAP to demonstrate to handle the exception?
22. WAP to create user defined exception?
23. WAP to read its own java source file & write that file in another java file?
24. WAP to create multiple Threads & show how inter Thread communication is performed?
25. WAP to demonstrate the life cycle of an applet?
26. Draw following shapes on an applet:
 - a) Circle b) Rectangle
 - c) Square make sure that all shapes must have different colours.
27. WAP to create calculator GUI in java with proper event handling?
28. Create a notepad in java? (Menu driven)

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ECS3503	AUTOMATA	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	Students will understand the basic concepts of automata, formal languages, and grammar
CO2	Students will be able to design and analyze finite automata (DFA and NFA).
CO3	Students will understand regular expressions and their conversion to finite automata.
CO4	Students will learn context-free grammars and pushdown automata.
CO5	Students will understand Turing machines and the concept of computability.

UNIT - 1

Basic Concepts and Automata Theory: Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, NonDeterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ϵ -Transition, Equivalence of NFA's with and without ϵ -Transition, Finite Automata with output- Moore Machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata.

UNIT 2

Regular Expressions and Languages: Regular Expressions, Transition Graph, Kleen's Theorem, Finite Automata and Regular Expression- Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages- Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability- Decision properties, Finite Automata and Regular Languages

UNIT 3

Regular and Non-Regular Grammars: Context Free Grammar (CFG)- Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars- Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form (CNF), Greibach Normal Form (GNF), Chomsky Hierarchy, Programming problems based on the properties of CFGs.

UNIT 4

Push Down Automata and Properties of Context Free Languages: Nondeterministic Pushdown Automata (NPDA)- Definition, Moves, A Language Accepted by NPDA, Deterministic Pushdown Automata (DPDA) and Deterministic Context free Languages (DCFL), Pushdown Automata for Context Free Languages, Context Free grammars for Pushdown Automata, Two stack Pushdown Automata, Pumping Lemma for CFL, Closure properties of CFL, Decision Problems of CFL, Programming problems based on the properties of CFLs.

UNIT 5

Turing Machines and Recursive Function Theory : Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata.

Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem, Post's Correspondence Problem, Introduction to Recursive Function Theory.



Text Books – Automata Theory

1. Introduction to Automata Theory, Languages, and Computation – John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson.
2. Theory of Computer Science (Automata, Languages and Computation) – K. L. P. Mishra & N. Chandrasekaran, PHI.
3. Elements of the Theory of Computation – Harry R. Lewis & Christos H. Papadimitriou, Pearson.

COURSE OUTCOMES:

CO1	Understand the basic concepts of formal languages and automata.
CO2	Design finite automata for regular expressions and regular languages.
CO3	Apply context-free grammars and pushdown automata concepts.
CO4	Understand Turing machines and computability theory.
CO5	Analyze different computational models and their applications.



EAI3502	Cloud Computing & Edge AI	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	To understand the fundamentals of cloud computing and its architecture.
CO2	To explore virtualization, cloud storage, and AI-driven cloud services.
CO3	To introduce Edge AI concepts, its importance, and hardware requirements.
CO4	To analyze deployment and optimization of AI models on edge devices.
CO5	To integrate Cloud and Edge AI for real-time intelligent applications.

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Unit-I

Introduction to Cloud Computing & Edge AI: Overview of Cloud Computing and Edge AI, Cloud Computing vs. Edge Computing, Cloud Service Models: IaaS, PaaS, SaaS, Deployment Models: Public, Private, Hybrid, and Community Cloud, Basics of Virtualization and Containers (VMs, Docker, Kubernetes), Introduction to Edge AI and its importance in real-time processing, Applications of Cloud & Edge AI in IoT, Smart Cities, and Autonomous Systems.

Unit-II

Cloud Computing Architecture & Services: Cloud Architecture: Compute, Storage, and Networking, Cloud Service Providers: AWS, Microsoft Azure, Google Cloud Platform (GCP), Serverless Computing and Function-as-a-Service (FaaS), Data Storage in the Cloud: Blob Storage, Databases, Big Data Processing, Security & Privacy in Cloud Computing, Cloud-based Machine Learning & AI Services (AWS SageMaker, Azure AI, Google Vertex AI).

Unit-III

Edge AI: Concepts and Applications: Introduction to Edge AI: Definition, Benefits, and Challenges, Edge AI Hardware: NVIDIA Jetson, Google Coral, Intel Movidius, AI Models on Edge Devices: Running TensorFlow Lite, OpenVINO, PyTorch Mobile, Federated Learning and On-Device AI Processing, Case Studies: Smart Cameras, Industrial IoT, Healthcare AI at the Edge

Unit-IV

Edge AI and Cloud Integration: Hybrid Cloud & Edge AI Architecture, Federated Learning: Decentralized AI Training on Edge Devices, 5G and Edge AI: Enabling Low-Latency Processing, IoT & Edge AI: Data Collection, Processing, and Decision-Making at the Edge, Edge AI in Real-Time Video Analytics and Surveillance, Case Study: Deploying AI-based Object Detection on Edge Devices.

Unit-V

Future Trends, Security, and Real-World Applications: Cloud-Native AI and AutoML, AI at the Edge for Cyber security and Anomaly Detection, Ethical Considerations in Cloud & Edge AI, Quantum Computing and its impact on Cloud & Edge AI, Industry Applications: Smart Agriculture, Smart Homes, Healthcare, and Retail AI, Hands-on Project: Building a Cloud-Edge AI Pipeline for Real-Time Analytics.



Text books and References:

1. "Cloud Computing: Principles and Paradigms" – Rajkumar Buyya, James Broberg & Andrzej M. Goscinski, Covers cloud architectures, services, and deployment models.
2. "Edge AI: Deep Learning on Edge Devices" – Xiaofei Wang, Min Chen, Dusit Niyato, Explains AI deployment on edge devices with case studies.
3. "Architecting the Cloud" – Michael J. Kavis, Guides cloud solution architects on best practices.
4. "AI at the Edge: Solving Real-World Problems with Edge Machine Learning" – Daniel Situnayake & Jenny Plunkett, Discusses real-time AI applications on embedded and IoT devices.

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COURSE OUTCOMES:

CO1	Understand the principles of Cloud Computing and Edge AI.
CO2	Implement AI models on cloud platforms (AWS, Azure, and Google Cloud).
CO3	Deploy AI models on edge devices (Jetson Nano, Coral TPU, and Raspberry Pi).
CO4	Optimize AI models using techniques like quantization and pruning.
CO5	Develop real-world Cloud-Edge AI applications in IoT, healthcare, and smart cities.



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EA13503	Computational Intelligence	L 3	T 1	P 0	4 credits
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Course Objectives:

CO1	To introduce the fundamentals of biologically inspired computing models.
CO2	To study techniques such as neural networks, fuzzy logic, and evolutionary algorithms.
CO3	To understand hybrid systems and their applications.
CO4	To apply computational intelligence techniques to solve real-world problems.
CO5	To explore recent trends in soft computing and intelligent systems.

Unit-I

Introduction to Computational Intelligence: Definition and scope, Biological and artificial intelligence, Overview of soft computing vs hard computing, Components: Neural networks, fuzzy logic, evolutionary algorithms, Real-world applications

Unit-II

Artificial Neural Networks: Structure and types of neural networks, Learning rules: Hebbian, Delta, Perceptron, Multilayer Perceptron (MLP) and Backpropagation algorithm, Self-Organizing Maps (SOMs), Applications in classification and regression

Unit-III

Fuzzy Logic and Fuzzy Systems: Fuzzy sets vs crisp sets, Membership functions and linguistic variables, Fuzzy rules and reasoning, Fuzzy inference systems (Mamdani & Sugeno models), Applications in control systems and decision-making

Unit-IV

Evolutionary Computation and Genetic Algorithms: Introduction to optimization techniques, Genetic Algorithms (GA): encoding, selection, crossover, mutation, Fitness function and convergence, Particle Swarm Optimization (PSO) – basics, Applications in engineering and scheduling.

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Unit-V

Hybrid Intelligent Systems and Applications: Neuro-fuzzy systems, Genetic-fuzzy and neuro-evolutionary systems, Case studies: Forecasting, diagnosis, robotics, image processing, Tools and software: MATLAB, Python (libraries like SciKit-Fuzzy, TensorFlow), Future directions in computational intelligence



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Text books and References:

1. S. Rajasekaran and G.A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic, and Genetic Algorithms*, PHI Learning, 2003.
2. Simon Haykin, *Neural Networks and Learning Machines*, 3rd Edition, Pearson, 2009.
3. J.S.R. Jang, C.T. Sun, E. Mirutani, *Neuro-Fuzzy and Soft Computing*, Pearson Education, 1997.
4. David E. Goldberg, *Genetic Algorithms in Search, Optimization, and Machine Learning*, Pearson, 1989.
5. Timothy J. Ross, *Fuzzy Logic with Engineering Applications*, 4th Edition, Wiley, 2020.
6. Andries P. Engelbrecht, *Computational Intelligence: An Introduction*, Wiley, 2007.

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COURSE OUTCOMES:

CO1	Understand the principles of neural networks, fuzzy logic, and genetic algorithms. .
CO2	Analyze different types of learning in neural networks and apply them to pattern recognition problems.
CO3	Design fuzzy inference systems for approximate reasoning and decision making. .
CO4	Apply evolutionary algorithms for optimization problems.
CO5	Develop hybrid intelligent systems for practical applications in various domains.

ECS3502	Database Management System	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	Introduce fundamental concepts, terminology and application of databases.
CO2	Teach design concepts and creation of relational databases.
CO3	Teach basic and advanced SQL commands..
CO4	Provide overview of database programming and procedural languages.
CO5	Provide overview of transaction management, database recovery and security.

Unit-I

Introduction: Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree

Unit-II

Relational data Model and Language: Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and Their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL

Unit-III

Data Base Design & Normalization: Functional dependencies, normal forms, first, second, 8 third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.

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Unit-IV

Transaction Processing Concept: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.

Unit-V

Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.



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Text books and References:

1. Korth, H.F.,Silbertz, A., Database Concepts, McGraw Hill.
2. Desai, B.C., An introduction to Database Systems,Galgotia.
- 3 Majumdar, A. K. and Bhattacharya, P., Database Management System, Tata McGraw Hill.
4. Ramakrishnan, R., Gehrke, J., Database Management System, McGraw Hill

COURSE OUTCOMES:

CO1	Define the basics of data base systems, structure and architecture, data
CO2	Understanding different transaction processing concepts and different types of serialization techniques.
CO3	Apply different database recovery like shadow paging, deferred/immediate updates and Concurrency control techniques
CO4	Applying integrity and constraints using SQL and PL/SQL.
CO5	Analyzing the anomalies of database and removal of these anomalies using different normalization techniques.

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EAI3571	Computational Intelligence Lab	L 0	T 0	P 4	2 credits
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List of Experiments:

- 1 Implement a **Perceptron learning algorithm** for binary classification.
- 2 Implement a **Multilayer Perceptron (MLP)** using Backpropagation.
- 3 Design and train an **Artificial Neural Network (ANN)** for XOR logic gate.
- 4 Implement a **Self-Organizing Map (SOM)** for clustering.
- 5 Simulate a **Hopfield Neural Network** for associative memory.
- 6 Implement **Fuzzy Set operations**: union, intersection, complement.
- 7 Design a **Fuzzy Inference System (FIS)** for a temperature control system.
- 8 Develop a **Mamdani fuzzy logic controller** for fan speed control using MATLAB or SciKit-Fuzzy.
- 9 Implement a **Genetic Algorithm (GA)** to solve a simple optimization problem (e.g., TSP or function minimization).
- 10 Implement **selection, crossover, and mutation** operations in a GA manually.



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EAI3572	Cloud Computing & Edge AI LAB	L 0	T 0	P 4	2 credits
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List of Experiments:

- 1 Setup and simulate a **Virtual Machine (VM)** using a cloud provider (AWS/GCP/Azure)
- 2 **Create and deploy a simple website using Platform-as-a-Service (PaaS)** on Heroku or AWS Elastic Beanstalk.
- 3 **Implement a simple RESTful API** using Flask and host it on the cloud (e.g., AWS EC2).
- 4 Use **Google Colab** to train a machine learning model and export the model.
- 5 **Build and containerize an AI application using Docker** and run it locally or on the cloud.
- 6 **Train and convert a deep learning model to TensorFlow Lite format** for edge deployment.

7. Deploy a TensorFlow Lite model on an edge device like Raspberry Pi or Android phone.
8. Use AWS SageMaker or Google AI Platform to train and deploy a ML model.
9. Measure inference time and latency of the model on cloud or edge.
10. Create a cloud storage bucket (e.g., AWS S3) and store the data using PySpark.

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ECS3572	Database Management System Lab	L 0	T 0	P 4	2 credits
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List of Programs to be Implemented:

- 1.Data Definition, Table Creation, Constraints,
2. Insert, Select Commands, Update & Delete Commands.
3. Nested Queries & Join Queries
4. Views
- 5.High level programming language extensions (Control structures, Procedures and Functions).
6. Front end tools
7. Forms
- 8.Triggers
- 9.Menu Design
- 10.Reports.
- 11.Database Design and implementation (Mini Project).

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Text books and References:

1. "Research Methodology: A Step-by-Step Guide for Beginners" – Ranjit Kumar
2. "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" – John W. Creswell
3. "The Craft of Research" – Wayne C. Booth, Gregory G. Colomb, & Joseph M. Williams
4. "Research Methods for Engineers" – David V. Thiel (or similar discipline-specific texts)
5. "Academic Writing and Publishing: A Practical Guide" – James Booth (for guidance on research report writing and publication)

COURSE OUTCOMES:

CO1	Articulate a well-defined research problem and construct relevant hypotheses in the context of AI.
CO2	Critically evaluate academic literature and synthesize information to support research design.
CO3	Design and implement a sound research methodology tailored to technological and AI-based investigations.
CO4	Analyze collected data using appropriate statistical and qualitative techniques.
CO5	Effectively communicate research results through written reports and oral presentations.

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EAI3602	Internet of Things	L 2	T 0	P 0	2 credits
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Course Objectives:

CO1	To understand the basic concepts and architecture of the Internet of Things.
CO2	To explore various IoT communication protocols and network architectures.
CO3	To develop skills for building IoT applications using sensors, microcontrollers, and cloud platforms.
CO4	To examine IoT security issues and best practices.
CO5	To analyze real-world IoT applications and case studies in different domains.

Unit-I

Introduction to IoT: Definition and evolution of IoT, Characteristics and applications of IoT, IoT architecture: Physical, network, and application layers, Components: Sensors, actuators, embedded systems, and gateways, IoT enabling technologies: RFID, NFC, Bluetooth, Zigbee, GPS, Wi-Fi.

Unit-II

IoT Networking & Communication Protocols: Networking fundamentals for IoT, Protocols: MQTT, CoAP, AMQP, HTTP, and WebSocket, Wireless communication technologies: Wi-Fi, LoRaWAN, NB-IoT, 6LoWPAN and IPv6, Cloud and edge computing concepts for IoT.

Unit-III

IoT Device & Platform Integration: Microcontrollers and boards: Arduino, Raspberry Pi, ESP8266/ESP32, Interfacing sensors and actuators, Data acquisition and control using GPIO, Introduction to IoT platforms: ThingSpeak, Blynk, Google Firebase, AWS IoT, Azure IoT, Data logging, dashboard creation, and remote control

Unit-IV

Data Analytics & Cloud in IoT: IoT data characteristics and lifecycle, Stream and batch processing, Introduction to cloud services for IoT: AWS, Azure, Google Cloud, Data visualization using cloud dashboards, Case study: Smart home or smart agriculture

Unit-V

IoT Security & Applications: Security threats and challenges in IoT, Cryptographic techniques for secure communication, Privacy and ethical concerns, Real-world IoT applications: Healthcare, smart cities, industry 4.0, Recent trends: Edge AI, 5G integration, digital twins

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Text books and References:

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-on Approach*, Universities Press, 2015.
2. Raj Kamal, *Internet of Things: Architecture and Design*, McGraw-Hill Education, 2017.
3. Olivier Hersent, David Boswarthick, and Omar Elloumi, *The Internet of Things: Key Applications and Protocols*, Wiley, 2012.
4. Adrian McEwen and Hakim Cassimally, *Designing the Internet of Things*, Wiley, 2014.
5. Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, CRC Press, 2017.
6. Boris Adryan, Dominik Obermaier, and Paul Fremantle, *The Technical Foundations of IoT*, Artech House, 2017.

COURSE OUTCOMES:

CO1	Understand the architecture and components of IoT systems.
CO2	Explain various IoT communication technologies and protocols.
CO3	Develop basic IoT applications using embedded systems and sensors.
CO4	Analyze IoT data and utilize cloud integration for IoT services.
CO5	Identify security, privacy, and ethical issues in IoT systems.

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EAI3603	Introduction to Robotic Process Automation Tools	L 2	T 0	P 0	2 credits
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Course Objectives:

CO1	To introduce the fundamentals of Robotic Process Automation and its business impact.
CO2	To explore the architecture and working of popular RPA tools such as UiPath, Blue Prism, and Automation Anywhere.
CO3	To enable students to design, develop, and deploy automation workflows.
CO4	To demonstrate the integration of RPA with other enterprise systems.
CO5	To analyze real-world use cases and best practices in RPA deployment.

Unit-I

Introduction to RPA: What is RPA?, History and evolution of automation, Benefits, myths, and limitations, RPA vs Traditional automation, Business processes suitable for RPA, Market-leading RPA tools overview: UiPath, Blue Prism, Automation Anywhere.

Unit-II

RPA Tool Architecture and Features: RPA tool components: Studio, Orchestrator, Robot (Bot), Types of bots: Attended, Unattended, Workflow design basics, Recorder and selectors, Exception handling and debugging

Unit-III

Developing Bots Using RPA Tools: Installation and setup of RPA platform (e.g., UiPath), Variables, data types, and control flow activities, Automating desktop and web applications, Working with Excel and files, UI automation, data scraping, and screen scraping

Unit-IV

Advanced RPA Concepts: Email automation (Outlook, Gmail), Database and API integration, Orchestrator functionalities: Queues, assets, scheduling, REFramework (Robotic Enterprise Framework) basics, Security, compliance, and auditing in RPA

Unit-V

RPA Use Cases and Industry Applications: Case studies: Banking, HR, healthcare, manufacturing, Best practices in RPA implementation, ROI and process selection criteria, Challenges in scaling RPA, Future of RPA: Hyperautomation, AI + RPA integration

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Text books and References:

1. Alok Mani Tripathi, *Learning Robotic Process Automation*, Packt Publishing, 2018.
2. Tom Taulli, *The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems*, Apress, 2020.
3. Mary C. Lacity and Leslie P. Willcocks, *Robotic Process Automation and Risk Mitigation: The Definitive Guide*, SB Publishing, 2017.
4. UiPath Official Documentation – <https://docs.uipath.com/>
5. Automation Anywhere Learning Portal – <https://university.automationanywhere.com/>
6. Blue Prism University – <https://portal.blueprism.com/university>

COURSE OUTCOMES:

CO1	Understand the concept, benefits, and challenges of Robotic Process Automation.
CO2	Describe the features and architecture of leading RPA tools.
CO3	Design and implement simple automation workflows using RPA platforms.
CO4	Integrate RPA bots with external applications like Excel, email, and web services.
CO5	Analyze business processes suitable for automation and propose RPA solutions.

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EAI3605	Compiler Design	L 2	T 0	P 0	3 credits
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CO1	To understand the basic concepts and phases of a compiler.
CO2	To learn lexical analysis and token generation techniques.
CO3	To understand syntax analysis and parsing methods (top-down and bottom-up).
CO4	To study semantic analysis and intermediate code generation.
CO5	To learn code optimization techniques for improving program efficiency.

Unit-I

Introduction to Compiler: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

Unit-II

Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.

Unit-III

Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax-directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.

Unit-IV

Symbol Tables: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

Unit-V

Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.

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Text Books and References – Compiler Design

Text Books:

1. Compilers: Principles, Techniques, and Tools – Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman
2. Compiler Design – Allen I. Holub
3. Modern Compiler Implementation in C – Andrew W. Appel

COURSE OUTCOMES:

CO1	Understand the basic structure and different phases of a compiler.
CO2	Apply lexical analysis techniques to identify tokens from source programs.
CO3	Analyze syntax using top-down and bottom-up parsing methods.
CO4	Demonstrate semantic analysis and intermediate code generation.
CO5	Apply code optimization and target code generation techniques for efficient program execution.



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EAI3671	Internet of Things Lab	L 0	T 0	P 4	2 credits
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List of Experiments:

1. Blink an LED using Arduino or NodeMCU – Introduction to GPIO programming.
2. Interface a Temperature Sensor (DHT11/LM35) and display readings on serial monitor or LCD.
3. Control an LED or appliance using a smartphone via Blynk or Google Firebase.
4. Send sensor data to cloud platform (ThingSpeak) using NodeMCU (ESP8266).
5. Interface a PIR sensor to detect motion and trigger an alert (buzzer or message).
6. Create a web server on ESP8266/NodeMCU to monitor sensor data via Wi-Fi.
7. Soil moisture-based smart irrigation system using a sensor and relay module.

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8. Email/SMS alert system using IoT (e.g., when temperature crosses threshold).
9. IoT-based home automation system to control fan/light via web or app.
10. Mini Project: Develop a real-world IoT prototype (e.g., smart parking, air quality monitor, weather station, etc.).



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EAI3672	Introduction to Robotic Process Automation Tools Lab	L 0	T 0	P 4	2 credits
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List of Experiments:

1. Introduction to RPA Environment: Install and explore UiPath Studio / Automation Anywhere / Blue Prism.
- 2 Create a "Hello World" Bot using message box and log activities.
- 3 Automate Notepad or Calculator: Launch an app, perform typing or calculations.
- 4 Read and write data from Excel using an RPA bot (e.g., sum of columns, copying data).
- 5 Web Data Extraction: Extract table data from a website using Data Scraping.
- 6 Email Automation: Read unread emails from Outlook or Gmail and store subject in Excel.
- 7 Decision-making bot: Use IF, SWITCH, and loop activities to automate logic-based tasks.
- 8 Automate file and folder operations: Create, move, rename, delete files and folders.
- 9 Fill a web form automatically using input data from Excel.
- 10 Mini Project: Build a real-world automation task (e.g., invoice processing, leave request automation, attendance bot, etc.).

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EAI4701	Fuzzy Logic & Application	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	Understand the fundamentals of fuzzy logic and its comparison with classical logic.
CO2	Learn the mathematical foundations of fuzzy sets, fuzzy relations, and membership functions.
CO3	Explore fuzzy inference systems (FIS) and their applications in decision-making.
CO4	Study the design and implementation of fuzzy control systems.
CO5	Understand the fundamentals of fuzzy logic and its comparison with classical logic.

Unit-I

Introduction to Fuzzy Logic: Crisp vs Fuzzy sets, Classical logic vs Fuzzy logic, Applications and advantages of fuzzy logic, Types of uncertainty and imprecision, Linguistic variables and fuzzy control

Unit-II

Fuzzy Sets and Operations: Basic definitions and properties of fuzzy sets, Fuzzy membership functions (triangular, trapezoidal, Gaussian), Operations on fuzzy sets: union, intersection, complement, Fuzzy relations and composition, α -cuts and fuzzy numbers

Unit-III

Fuzzy Rules and Reasoning: Fuzzy propositions and logical connectives, Fuzzy implication and fuzzy inference rules, Mamdani and Sugeno models, Rule base and knowledge representation, Aggregation, defuzzification techniques (centroid, bisector, mean of maxima)

Unit-IV

Fuzzy Systems and Control: Structure of a fuzzy inference system (FIS), Fuzzy controllers: types and design, Tuning of fuzzy controllers, Applications in industrial and embedded systems, Case study: fuzzy temperature controller

Unit-V

Applications and Hybrid Models: Fuzzy logic in decision making and pattern recognition, Integration with neural networks and genetic algorithms (Neuro-Fuzzy systems), Applications in robotics, image processing, healthcare, and finance, Fuzzy clustering and data mining applications, Case studies on intelligent systems using fuzzy logic

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Text books and References:

1. Fuzzy logic with Engineering applications by Timothy J Ross
2. fuzzy Sets and Fuzzy Logic: Theory and Application by George J Klir, BoYuan
3. Neural Networks, Fuzzy Logic and Genetic Algorithms : Synthesis and Applications by GA Vijayalakshmi Pai

COURSE OUTCOMES:

CO1	Construct fuzzy sets, membership functions, and fuzzy rules.
CO2	Develop fuzzy inference systems (Mamdani and Sugeno models) for various applications.
CO3	Design and implement fuzzy control systems for automation and intelligent decision-making.
CO4	Apply fuzzy logic techniques to real-world problems in AI, machine learning, and industrial systems.
CO5	Integrate fuzzy logic with neural networks and genetic algorithms for advanced computational intelligence.

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EAI4702	R Programming	L 3	T 0	P 0	3 credits
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Course Objectives

CO1	Introduce the basics of R programming, including syntax, data types, and structures.
CO2	Understand control structures, functions, and apply them to problem-solving.
CO3	Learn data visualization techniques using R libraries.
CO4	Develop an understanding of statistical computing and data manipulation in R.
CO5	Explore machine learning basics and practical applications in R.

Unit-I

Introduction to R: Basic syntax, variables, and data types, Operators and expressions, Data structures: Vectors, Lists, Matrices, Arrays, Factors, and Data Frames, Data input/output: Reading/writing CSV, Excel, and databases.

Unit-II

Control Structures & Functions: Conditional statements: if-else, switch, Loops: for, while, repeat, User-defined functions, apply family functions (apply, lapply, sapply, tapply), Debugging and exception handling

Unit-III

Data Manipulation & Statistical Analysis: Data preprocessing: Cleaning and transformation, dplyr and tidyr for data manipulation, Descriptive statistics: Mean, Median, Variance, Standard Deviation, Hypothesis testing: t-test, chi-square test, ANOVA, Regression analysis: Linear and logistic regression

Unit-IV

Data Visualization in R: Base R plotting functions, ggplot2 for advanced visualization, Creating histograms, boxplots, scatter plots, and bar charts, Time series visualization

Unit-V

Machine Learning Basics in R: Introduction to machine learning with R, Supervised vs. Unsupervised learning, Clustering (K-means, Hierarchical), Classification (Decision Trees, Random Forests), Model evaluation and performance metrics

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Textbooks and References

1. Hadley Wickham, "R for Data Science", O'Reilly
2. Jared Lander, "R for Everyone", Addison-Wesley
3. Peter Dalgaard, "Introductory Statistics with R", Springer
4. Norman Matloff, "The Art of R Programming", No Starch Press

Course Outcomes

CO1	Ability to write R programs and understand basic syntax.
CO2	Implement control structures and custom functions.
CO3	Perform data manipulation and statistical analysis in R.
CO4	Develop interactive visualizations using ggplot2.
CO5	Apply machine learning techniques to real-world problems.

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FAJCT03	Deep Learning	L	T	P	3 credits
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Course Objectives

CO1	Introduce the fundamentals of deep learning and neural networks.
CO2	Understand optimization techniques and back propagation.
CO3	Learn about different deep learning architectures like CNNs, RNNs, and Transformers.
CO4	Explore practical applications using deep learning frameworks like TensorFlow and PyTorch.
CO5	Analyze and evaluate deep learning models for real-world problems.

Unit-I

Introduction to Deep Learning: Basics of Artificial Neural Networks (ANN), Activation functions: Sigmoid, ReLU, Tanh, Softmax, Feedforward networks and backpropagation, Gradient descent and optimization algorithms (SGD, Adam, RMSProp).

Unit-II

Convolutional Neural Networks (CNNs): Basics of convolution, padding, and pooling layers, CNN architecture: AlexNet, VGGNet, ResNet, Object detection: YOLO, Faster R-CNN, Image classification and transfer learning.

Unit-III

Recurrent Neural Networks (RNNs) & Transformers: Introduction to sequential modeling, Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU), Attention mechanism, Transformers and BERT for NLP.

Unit-IV

Generative Models & Advanced Topics: Auto encoders (AEs) and Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs), Reinforcement Learning basics, Deep Q-Networks (DQN) and Policy Gradient Methods.

Unit-V

Deep Learning Applications & Deployment: Deep learning for Computer Vision and Natural Language Processing (NLP), Speech recognition and time-series forecasting, Model deployment: TensorFlow Serving, ONNX, Flask/FastAPI for DL models, Ethical considerations and bias in AI.

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Textbooks and References

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", MIT Press
2. François Chollet, "Deep Learning with Python", Manning
3. Aurelien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly
4. Sebastian Raschka, "Python Machine Learning", Packt

Course Outcomes:

CO1	Understand the fundamentals of neural networks and deep learning models.
CO2	Implement CNNs for image classification and object detection.
CO3	Build and train RNNs, LSTMs, and Transformers for sequence modeling.
CO4	Develop generative models like GANs and VAEs.
CO5	Deploy deep learning models for real-world applications.

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EAI4771	R Programming Lab	L	T	P	2 credits
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List of Experiments:

1. **Basic R Syntax:** Write a program to demonstrate data types, variables, operators, and built-in functions.
2. **Control Structures:** Implement conditional statements and loops to find prime numbers, factorial, etc.
3. **Vectors, Lists, and Matrices:** Perform operations on vectors, lists, and create/modify matrices.
4. **Data Frames and File Handling:** Import/export .csv files and manipulate data frames (filtering, sorting, and merging).
5. **Descriptive Statistics:** Calculate mean, median, variance, standard deviation, correlation, and create summary statistics.
6. **Data Visualization with ggplot2:** Create bar charts, histograms, box plots, and scatter plots.
7. **Apply functions:** Use `apply()`, `lapply()`, `sapply()`, and `tapply()` functions on structured data.
8. **Exploratory Data Analysis (EDA):** Perform EDA on a built-in dataset like `mtcars`, `iris`, or `airquality`.
9. **Linear Regression:** Build a simple linear regression model and interpret the results.
10. **Mini Project:** Analyze a real-world dataset (e.g., COVID-19 data, sales data, etc.) and generate insights with visualizations.

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EA14S01	Entrepreneurship & AI Startups	L 3	T 0	P 0	3 credits
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Course Objectives

CO1	Understand the fundamentals of entrepreneurship and startup ecosystems.
CO2	Explore AI-driven business models and emerging trends.
CO3	Learn how to develop AI products and services for startups.
CO4	Gain insights into funding, marketing, and scaling AI startups.
CO5	Understand the ethical and regulatory challenges in AI entrepreneurship.

Unit-I

Introduction to Entrepreneurship & Startups: Definition and characteristics of entrepreneurs. Types of startups: Lifestyle, Scalable, Social, AI-driven startups, Stages of a startup: Ideation, Validation, Growth, Scaling, Lean Startup methodology & Minimum Viable Product (MVP). Case studies of successful AI startups

Unit-II

AI Business Models & Market Trends: Introduction to AI-driven business models, AI applications in various industries (Healthcare, Finance, Retail, etc.), Identifying AI opportunities and problem-solving approaches, Data-driven decision-making in AI startups, AI-powered automation and its impact on business efficiency

Unit-III

Building AI Products & Services: Basics of AI technologies: Machine Learning, Deep Learning, NLP, Data collection, processing, and model development, AI product lifecycle: From concept to deployment, Open-source AI tools and frameworks (TensorFlow, PyTorch, Hugging Face, etc.), Case studies on AI-driven product development.

Unit-IV

Startup Growth, Funding & Marketing Strategies: Business planning and pitch deck creation, Funding sources: Bootstrapping, Angel Investors, Venture Capital, Crowd funding, Go-to-market strategy for AI startups, Growth hacking and digital marketing for AI products, Scaling AI startups: Challenges and best practices

Unit-V

Ethics, Regulations & Future of AI Startups: Ethical considerations in AI (Bias, Privacy, Transparency), Regulatory frameworks for AI startups (GDPR, AI Act, etc.), The role of AI governance and responsible AI, Future trends: AI in Web3, Metaverse, and Edge Computing, AI and job creation: Opportunities and challenges

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Textbooks and References

1. Eric Ries, "The Lean Startup", Crown Business
2. Peter Thiel, "Zero to One", Crown Business
3. Andrew Ng, "AI Transformation Playbook"
4. Martin Ford, "Rule of the Robots", Basic Books
5. John D. Kelleher, "Deep Learning", MIT Press

Course Outcomes

CO1	Understand the basics of entrepreneurship and AI-driven startup ecosystems
CO2	Identify AI-driven business opportunities and develop innovative solutions.
CO3	Build and deploy AI-powered products and services.
CO4	Develop business strategies, secure funding, and market AI startups.
CO5	Navigate ethical and regulatory challenges in AI entrepreneurship.

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EAI4803	Robotic Operating Systems & Robot Simulation	L 2	T 0	P 0	2 credits
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Course Objectives

CO1	Understand the fundamentals of Robotic Operating System (ROS) and its architecture.
CO2	Learn the basics of robot simulation using Gazebo and Rviz.
CO3	Develop robotic applications with ROS using Python and C++.
CO4	Implement sensor integration and motion planning for autonomous robots.
CO5	Gain hands-on experience with real-world robotic platforms and simulators.

Unit-I

Introduction to ROS & Robotics Fundamentals: Overview of Robotics and ROS, ROS architecture: Nodes, Topics, Messages, Services, and Actions, Installation and setup of ROS (ROS Noetic, ROS2), Understanding ROS packages and catkin workspace, Basics of Linux and Shell scripting for ROS.

Unit-II

Robot Simulation & Visualization: Introduction to Gazebo and Rviz for robot simulation, creating a simple robot model using URDF (Unified Robot Description Format), Controlling a robot in simulation using ROS topics and services, Visualizing robot sensor data in Rviz, Simulating robotic arms and wheeled robots

Unit-III

ROS Programming & Communication: Writing ROS nodes in Python and C++, ROS publisher-subscriber model, ROS service-client communication and actions, Parameter server and launch files, Debugging and logging in ROS

Unit-IV

Motion Planning & Sensor Integration: Introduction to robot kinematics and dynamics, Sensor integration: LIDAR, IMU, Camera, and GPS, SLAM (Simultaneous Localization and Mapping) using ROS, Path planning with MoveIt! and Navigation Stack, Implementing autonomous navigation in simulation

Unit-V

Advanced Topics & Real-World Applications: Deep Learning and AI integration with ROS, Using ROS for drone and humanoid robot simulations, ROS with real hardware: TurtleBot, UR5, and other robots, Multi-robot coordination and swarm robotics in ROS, Future trends in robotics and ROS2 advancements.

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Textbooks and References

1. Morgan Quigley, Brian Gerkey, and William D. Smart, *Programming Robots with ROS*, O'Reilly
2. Aaron Martinez and Enrique Fernández, *Learning ROS for Robotics Programming*, Packt
3. Anis Koubaa, *Robot Operating System (ROS) for Absolute Beginners*, Springer
4. Lentin Joseph, *Mastering ROS for Robotics Programming*, Packt
5. Jason M. O'Kane, *A Gentle Introduction to ROS*

Course Outcomes:

CO1	Understand ROS architecture and its application in robotics.
CO2	Simulate and visualize robots using Gazebo and Rviz.
CO3	Develop ROS-based robotic applications using Python and C++.
CO4	Implement motion planning and sensor-based autonomous navigation.
CO5	Work with real-world robotic platforms and AI-driven robotics solutions.

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EAI4804	Artificial Intelligence & Expert System	L 3	T 0	P 0	3 credits
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CO1	To understand the basic concepts and foundations of Artificial Intelligence.
CO2	To learn problem-solving methods and search techniques used in AI.
CO3	To study knowledge representation and reasoning methods.
CO4	To understand the architecture and working of expert systems.

Unit-I

Introduction to Artificial Intelligence, history and scope of AI, intelligent agents, applications, and AI problem-solving techniques. State space representation, production systems, control strategies, and introduction to expert systems with their components and architecture.

Unit-II

Uninformed search techniques such as breadth-first search, depth-first search, depth-limited search, and iterative deepening search. Informed search strategies including best-first search, A* algorithm, heuristic functions, and problem reduction methods.

Unit-III

Knowledge representation techniques including predicate logic, propositional logic, semantic networks, and frames. Inference mechanisms, reasoning methods, rule-based systems, and introduction to knowledge-based systems.

Unit-IV

Introduction to expert systems, architecture of expert systems, knowledge acquisition, and inference engine. Development of expert systems, rule-based systems, applications of expert systems, and limitations of expert systems.

Unit-V

Introduction to machine learning, learning methods, supervised and unsupervised learning techniques. Neural networks, natural language processing, applications of AI, and future trends in Artificial Intelligence.



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Text Books and References – Artificial Intelligence & Expert System

Text Books:

1. Artificial Intelligence: A Modern Approach – Stuart Russell and Peter Norvig
2. Artificial Intelligence – Elaine Rich and Kevin Knight
3. Introduction to Artificial Intelligence and Expert Systems – Dan W. Patterson

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Reference Books:

1. Expert Systems: Principles and Programming – Joseph C. Giarratano and Gary D. Riley
2. Artificial Intelligence: Structures and Strategies for Complex Problem Solving – George F. Luger
3. Principles of Artificial Intelligence – Nils J. Nilsson

COURSE OUTCOMES:

CO1	Understand the fundamental concepts, techniques, and applications of Artificial Intelligence.
CO2	Apply problem-solving and search algorithms to solve AI-based problems.
CO3	Analyze knowledge representation methods and reasoning techniques.
CO4	Understand the architecture and working of expert systems and inference mechanisms.
CO5	Develop simple AI and expert system models for real-world applications.

ELECTIVES:

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EAI3504	Information Security	L 3	T 1	P 0	3 credits
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Course Objectives

CO1	Understand the fundamentals of information security and its key principles.
CO2	Learn about cryptographic techniques for securing data and communications.
CO3	Identify various security threats, vulnerabilities, and risk management strategies.
CO4	Explore network security, intrusion detection, and ethical hacking techniques.
CO5	Understand legal, ethical, and regulatory aspects of information security.

Unit-I

Introduction to Information Security: Fundamentals of Information Security, Security Goals: Confidentiality, Integrity, Availability (CIA Triad), Security Threats and Vulnerabilities, Risk Assessment and Management, Security Policies and Best Practices

Unit-II

Cryptography & Secure Communication: Basics of Cryptography: Symmetric vs. Asymmetric Encryption, Classical Encryption Techniques: Caesar Cipher, Vigenère Cipher, Modern Encryption Algorithms: AES, DES, RSA, ECC, Hashing Algorithms: SHA, MD5, Digital Signatures and Certificates

Unit-III

Network Security & Threats: Firewalls and Intrusion Detection Systems (IDS), Virtual

Private Networks (VPNs) and Secure Sockets Layer (SSL), Denial-of-Service (DoS) and Distributed DoS (DDoS) attacks, Phishing, Spoofing, and Man-in-the-Middle (MitM) attacks, Wireless Network Security

Unit-IV

System Security & Ethical Hacking: Malware Types: Viruses, Worms, Trojans, Ransomware, Security in Operating Systems and Web Applications, Penetration Testing and Ethical Hacking, Social Engineering Attacks and Countermeasures, Cloud Security and Zero Trust Architecture

Unit-V

Legal, Ethical, and Regulatory Aspects: Cyber Laws and IT Act 2000, General Data Protection Regulation (GDPR) and HIPAA, Ethical Issues in Cybersecurity, Digital Forensics and Incident Response, Security Frameworks: NIST, ISO 27001, PCI-DSS



Textbooks and References

1. William Stallings, *Cryptography and Network Security: Principles and Practice*, Pearson
2. Charles P. Pfleeger & Shari Lawrence Pfleeger, *Security in Computing*, Prentice Hall
3. Michael T. Goodrich & Roberto Tamassia, *Introduction to Computer Security*, Pearson
4. Behrouz A. Forouzan, *Cryptography & Network Security*, McGraw Hill
5. Kevin Mitnick, *The Art of Deception*, Wiley

Course Outcomes:

CO1	Understand security principles, threats, and risk management.
CO2	Apply cryptographic techniques for securing information.
CO3	Analyze network security threats and implement protective measures.
CO4	Explore ethical hacking and cybersecurity practices.
CO5	Understand legal and ethical frameworks governing cybersecurity.

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EAI3506	Database Security	L 3	T 1	P 0	3 credits
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Course Objectives

CO1	Understand database security concepts, threats, and vulnerabilities.
CO2	Learn access control models and database authentication mechanisms.
CO3	Explore encryption techniques for securing database data.
CO4	Implement auditing, monitoring, and intrusion detection in databases.
CO5	Understand compliance, legal aspects, and best practices in database security.

Unit-I

Introduction to Database Security: Fundamentals of Database Security, Threats and Attacks on Databases (SQL Injection, Insider Attacks), Database Security Models and Architectures, Role-Based Access Control (RBAC) vs. Discretionary Access Control (DAC), Multi-level Security in Databases

Unit-II

Authentication & Access Control: User Authentication Mechanisms, Role-Based and Mandatory Access Control (MAC), Privileges, Views, and Stored Procedures for Security, SQL Injection Attacks: Detection and Prevention, Database Security in Cloud Environments

Unit-III

Encryption & Data Protection: Data-at-Rest vs. Data-in-Transit Security, Column-Level and Row-Level Encryption, Transparent Data Encryption (TDE), Hashing and Salting for Password Security, Public Key Infrastructure (PKI) and Key Management

Unit-IV

Database Auditing & Intrusion Detection: Database Auditing Techniques and Log Analysis, Intrusion Detection and Prevention in Databases, Database Activity Monitoring (DAM), Security Policies for Data Integrity and Consistency, Secure Database Transactions

Unit-V

Compliance, Legal & Ethical Aspects: General Data Protection Regulation (GDPR) and HIPAA Compliance, Database Security Standards: ISO 27001, PCI-DSS, Privacy and Ethical Considerations in Data Management, Forensic Analysis of Database Breaches, Case Studies on Real-World Database Attacks.

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Textbooks and References

1. Alfred Basta & Melissa Zgola, *Database Security*, Cengage Learning
2. Ron Ben Natan, *Implementing Database Security and Auditing*, Elsevier
3. Hassan A. Afyouni, *Database Security and Auditing*, Cengage Learning
4. Michael Gertz & Sushil Jajodia, *Handbook of Database Security*, Springer
5. Kevin Mitnick, *The Art of Invisibility*, Little, Brown & Co.

Course Outcomes:

CO1	Identify security threats and vulnerabilities in databases.
CO2	Implement access control and authentication mechanisms
CO3	Apply encryption techniques to protect sensitive data.
CO4	Monitor and audit databases to detect intrusions.
CO5	Understand legal and compliance aspects of database security.

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EAI3507	Business Intelligence	L 3	T 1	P 0	3 credits
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Course Objectives:

CO1	Understand the fundamentals of Business Intelligence (BI) and its role in decision-making.
CO2	Learn data warehousing, ETL processes, and OLAP technologies
CO3	Explore BI tools, data visualization, and dashboard design.
CO4	Analyze predictive analytics and machine learning applications in BI.
CO5	Understand BI implementation, challenges, and future trends.

Unit-I

Introduction to Business Intelligence: Definition and Importance of Business Intelligence, BI vs. Data Analytics vs. Data Science, Components of a BI System, BI Lifecycle and Architecture, Case Studies on BI Applications in Industries.

Unit-II

Data Warehousing & ETL: Introduction to Data Warehousing, Extract, Transform, Load (ETL) Process, Data Warehouse Architecture: Star & Snowflake Schema, Online Analytical Processing (OLAP) and Data Marts, Data Lake vs. Data Warehouse

Unit-III

BI Tools & Data Visualization: Introduction to BI Tools: Power BI, Tableau, Looker, QlikView, Data Preprocessing and Cleaning for BI, Interactive Dashboards and Reporting, Data Storytelling and KPI Metrics, Real-Time BI and Streaming Analytics

Unit-IV

Predictive Analytics & Machine Learning in BI: Introduction to Predictive Analytics, Machine Learning Techniques in BI (Regression, Classification, Clustering), Sentiment Analysis and Text Mining for Business Insights, Big Data Analytics with BI: Hadoop, Spark, NoSQL, Case Studies on AI-driven BI Solutions

Unit-V

BI Implementation, Security & Future Trends: BI Strategy and Implementation Challenges, Data Governance and Security in BI, Ethical Considerations in Business Intelligence, Future Trends: Augmented BI, AI-driven Decision Making, Industry 4.0 and BI in Digital Transformation.

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Textbooks and References

1. R. N. Prasad & Seema Acharya, *Fundamentals of Business Analytics*, Wiley
2. Efraim Turban, *Business Intelligence: A Managerial Approach*, Pearson
3. Cindi Howson, *Successful Business Intelligence*, McGraw Hill
4. Larissa T. Moss, *Business Intelligence Roadmap*, Addison-Wesley
5. P. N. Tan, *Introduction to Data Mining*, Pearson

Course Outcomes:

CO1	Understand the role of BI in business decision-making.
CO2	Develop data warehouse models and implement ETL processes.
CO3	Use BI tools for data analysis and visualization.
CO4	Apply predictive analytics and machine learning techniques in BI.
CO5	Address security, governance, and future trends in BI.

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EAI3508	Smart Industry Connectivity	L 3	T 1	P 0	3 credits
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Course Objectives

CO1	Understand the concept of Industry 4.0 and smart industrial connectivity.
CO2	Learn about Industrial Internet of Things (IIoT) and communication protocols.
CO3	Explore cloud computing, edge computing, and cybersecurity in smart industries.
CO4	Analyze data integration, interoperability, and smart factory automation.
CO5	Understand future trends, challenges, and real-world applications of smart industry connectivity.

Unit-I

Introduction to Smart Industry & Industry 4.0: Evolution from Industry 1.0 to Industry 4.0, Key Technologies in Industry 4.0, Industrial Automation and Digital Transformation, Cyber-Physical Systems (CPS) and Smart Factories, Case Studies on Smart Manufacturing

Unit-II

Industrial Internet of Things (IIoT) & Communication Protocols: Fundamentals of IIoT and M2M (Machine-to-Machine) Communication, IIoT Architecture and Components, Industrial Communication Protocols: MQTT, OPC UA, Modbus, Profibus, Wireless Connectivity: 5G, LPWAN, LoRaWAN, Zigbee, NB-IoT, Integration of IIoT with SCADA and PLC Systems

Unit-III

Cloud & Edge Computing in Smart Industries: Role of Cloud Computing in Smart Manufacturing, Edge Computing and Fog Computing for Low-Latency Applications, Industrial Data Storage and Processing on the Cloud, Hybrid Cloud Solutions for Smart Industry, Real-Time Data Analytics for Industrial Operations

Unit-IV

Cybersecurity & Data Integration in Smart Industry: Industrial Cybersecurity Threats and Risk Management, Secure IIoT Architectures and Encryption Techniques, Identity and Access Management (IAM) for Smart Factories, Data Interoperability and Digital Twins, Blockchain for Secure Industrial Transactions

Unit-V

Future Trends & Case Studies: Artificial Intelligence (AI) and Machine Learning in Smart Industry, Predictive Maintenance and Digital Twin Technology, Robotics and Autonomous Systems in Manufacturing, Smart Supply Chain and Logistics Connectivity, Smart Energy Management and Sustainability in Industry 5.0.

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Textbooks and References

1. Alasdair Gilchrist, *Industry 4.0: The Industrial Internet of Things*, Apress
2. Rajkumar Buyya, *Fog and Edge Computing: Principles and Paradigms*, Wiley
3. John Soldatos, *Industrial IoT: Technologies and Applications*, Artech House
4. Wolfgang Wahlster, *Digital Industrial Platforms for Smart Factories*, Springer
5. Dirk Slama, *Enterprise IoT: Strategies and Best Practices for Connected Products and Services*, O'Reilly

Course Outcomes:

CO1	Understand Industry 4.0 concepts and smart industrial connectivity.
CO2	Implement IIoT-based communication and automation systems.
CO3	Integrate cloud and edge computing solutions in industrial environments.
CO4	Ensure cyber security and secure data communication in smart factories.
CO5	Analyze future trends, AI-driven automation, and real-world case studies in smart industries.

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EAI3509	Data Visualization	L 3	T 1	P 0	3 credits
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Course Objectives:

CO1	Understand the fundamentals of data visualization and its importance in decision-making.
CO2	Learn various data visualization techniques and tools.
CO3	Explore different types of charts, graphs, and dashboards for effective communication.
CO4	Apply best practices for designing interactive and visually appealing visualizations.
CO5	Understand advanced visualization techniques and real-world applications.

Unit-I

Introduction to Data Visualization: Importance of Data Visualization in Decision-Making, Principles of Effective Visualization (Clarity, Accuracy, Simplicity), Data Types and Their Representation (Categorical, Numerical, Temporal, Geospatial), Data Preprocessing for Visualization, Case Studies on Effective Data Visualization

Unit-II

Visualization Techniques & Tools: Types of Data Visualizations: Line Graphs, Bar Charts, Scatter Plots, Pie Charts, Heatmaps, Treemaps, Box Plots, and Histograms, Tools for Data Visualization: Tableau, Power BI, Matplotlib, Seaborn, D3.js, Storytelling with Data: Enhancing Narratives through Visuals, Real-Time Data Visualization

Unit-III

Interactive & Dashboard Design: Designing Interactive Visualizations, Dashboards and Business Intelligence Reporting, Filters, Drill-Downs, and Dynamic Visuals, Dashboard Development in Tableau and Power BI, Case Studies on Dashboard Applications in Different Domains

Unit-IV

Advanced Data Visualization & Big Data: Geospatial Visualization with Maps (Choropleth, Heatmaps, GIS), Network Visualization (Graphs and Social Network Analysis), Visualizing Time-Series and Streaming Data, Big Data Visualization: Handling Large Datasets, Augmented and Virtual Reality in Data Visualization

Unit-V

Best Practices & Real-World Applications: Color Theory and Perception in Visualization, Data Ethics and Avoiding Misleading Visualizations, Performance Optimization in Large-Scale Visualizations, Case Studies in Finance, Healthcare, Marketing, and Smart Cities, Future Trends in Data Visualization.

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Textbooks and References

1. Stephen Few, *Now You See It: Simple Visualization Techniques for Quantitative Analysis*, Analytics Press
2. Cole Nussbaumer Knaflitz, *Storytelling with Data*, Wiley
3. Ben Fry, *Visualizing Data: Exploring and Explaining Data with the Processing Environment*, O'Reilly
4. Nathan Yau, *Data Points: Visualization That Means Something*, Wiley
5. Andy Kirk, *Data Visualization: A Handbook for Data Driven Design*, Sage

Course Outcomes:

CO1	Understand the fundamentals of data visualization and its role in analytics.
CO2	Use various visualization techniques and tools for effective data representation.
CO3	Design interactive dashboards for real-time business insights.
CO4	Apply advanced visualization techniques for big data and geospatial analysis.
CO5	Implement best practices in data visualization and storytelling.

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EAI3604	Blockchain Technology	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	To understand the fundamental concepts and structure of blockchain systems.
CO2	To explore cryptographic foundations essential for blockchain.
CO3	To analyze blockchain consensus mechanisms and distributed ledgers.
CO4	To study smart contracts and decentralized applications (DApps).
CO5	To examine real-world blockchain use cases across different domains.

Unit-I

Introduction to Blockchain: History and evolution of blockchain, Blockchain structure: blocks, chains, nodes, Centralized vs. decentralized systems, Types of block chains: public, private, consortium, Key characteristics and applications

Unit-II

Cryptography and Blockchain Security: Hash functions and Merkle trees, Digital signatures (ECDSA), Public and private keys, Cryptographic puzzles, Wallets and addresses, Blockchain attacks: 51% attack, Sybil attack

Unit-III

Consensus Mechanisms: Need for consensus, Proof of Work (POW), Proof of Stake (PoS), Delegated PoS, Practical Byzantine Fault Tolerance (PBFT), Comparison of consensus algorithms, Mining and incentives

Unit-IV

Smart Contracts and Ethereum: Introduction to smart contracts, Ethereum architecture and Virtual Machine (EVM), Solidity basics: structure, variables, functions, Deploying and interacting with smart contracts, Gas and transaction fees, Use cases: ICOs, DAOs, token standards (ERC-20)

Unit-V

Blockchain Applications and Future Trends: Applications in finance, healthcare, logistics, voting, identity management, Blockchain-as-a-Service (BaaS), Interoperability and scalability issues, Hyperledger and enterprise block chains, Integration with AI and IoT, Regulatory and legal aspects of blockchain

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Textbooks and References

1. **Imran Bashir**, *Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications*, Packt, 3rd Edition, 2020.
2. **Narayanan et al.**, *Bitcoin and Cryptocurrency Technologies*, Princeton University Press, 2016.
3. **Arvind Narayanan**, *Introduction to Blockchain Technology*, Princeton University Lecture Notes.
4. **Andreas M. Antonopoulos**, *Mastering Bitcoin*, O'Reilly Media, 2nd Edition, 2017.
5. Ethereum & Solidity Documentation – <https://ethereum.org/>

Course Outcomes:

CO1	Explain the architecture, components, and characteristics of blockchain technology.
CO2	Understand the role of cryptographic primitives in securing blockchain.
CO3	Evaluate consensus algorithms and their impact on network performance and security.
CO4	Design and implement smart contracts on platforms like Ethereum.
CO5	Analyze practical applications of blockchain in various industries such as finance, supply chain, and healthcare.

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EAI3606		L	T	P	3 credits
	Cyber Security and AI	3	0	0	

Course Objectives:

CO1	To understand the fundamentals of cyber security and the evolving threat landscape.
CO2	To learn AI techniques such as machine learning for detecting and preventing cyber threats.
CO3	To explore the integration of AI in enhancing cyber security measures like intrusion detection, malware analysis, and risk assessment.
CO4	To evaluate ethical, legal, and social implications of AI in cyber security.
CO5	To study real-world applications and future trends in AI-driven cyber security solutions.

Unit-I

Introduction to Cyber Security: Fundamentals of cyber security, Types of threats: malware, phishing, ransomware, DDoS, Cybersecurity frameworks and models, Authentication, authorization, and access control, Basics of cryptography and network security.

Unit-II

Basics of Artificial Intelligence: Overview of AI, ML, and Deep Learning, Supervised and unsupervised learning, Classification, clustering, and regression, Introduction to AI tools and libraries (e.g., Scikit-learn, TensorFlow), Relevance of AI in cyber security.

Unit-III

AI for Threat Detection and Response: AI in malware detection and classification, Intrusion detection systems (IDS) using ML, Behavioral analysis and anomaly detection, Email and web security with NLP-based models, Case studies: AI-powered cybersecurity tools

Unit-IV

Advanced Applications of AI in Cybersecurity: Deep learning for cybersecurity, Neural networks for attack prediction, AI in risk management and fraud detection, Security Information and Event Management (SIEM) with AI, Limitations and evasion techniques against AI models

Unit-V

Ethics, Challenges, and Future of AI in Cybersecurity: Bias and adversarial attacks in AI, Privacy, explainability, and transparency, Ethical hacking and AI governance, Legal frameworks and compliance, Future directions in AI and cyber defense

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Textbooks and References

1. Sunit Belapure and Nina Godbole, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India, 2011.
2. Chirag Shah, *A Hands-On Introduction to Machine Learning in Cybersecurity*, Springer, 2022.
3. Mark Stamp, *Information Security: Principles and Practice*, Wiley, 2nd Edition, 2011.
4. Leslie F. Sikos, *AI in Cybersecurity*, Springer, 2020.
5. Russell and Norvig, *Artificial Intelligence: A Modern Approach*, Pearson, 3rd Edition, 2010.

Course Outcomes:

CO1	Explain the principles of cyber security and common attack vectors.
CO2	Apply machine learning and AI techniques to solve cyber security problems.
CO3	Analyze threats and build intelligent models for detection and mitigation.
CO4	Evaluate the role of AI in securing digital systems and networks.
CO5	Examine emerging trends, challenges, and ethical considerations in AI-based cyber security systems.

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EAI3607		L	T	P	3 credits
	Management Information System	3	0	0	

Course Objectives:

CO1	To understand the role of information systems in business decision-making and management.
CO2	To explore the types and components of management information systems.
CO3	To analyze how MIS supports strategic planning, operations, and control.
CO4	To study the impact of emerging technologies on MIS.
CO5	To understand the ethical, legal, and security issues related to information systems.

Unit-I

Introduction to Management Information Systems: Definition and importance of MIS, Types of information systems (TPS, MIS, DSS, ESS), Components of MIS (hardware, software, data, procedures, people), MIS in functional areas: marketing, finance, HR, and production, Evolution of MIS in business

Unit-II

Information Systems in Business Processes: Business processes and information flow, Decision-making process and MIS support, Strategic use of information systems, Enterprise Resource Planning (ERP) systems, Supply Chain Management (SCM) and Customer Relationship Management (CRM)

Unit-III

Decision Support Systems and Business Intelligence: Decision Support Systems (DSS), Business Intelligence (BI) tools and applications, Data warehousing and data mining, Executive Information Systems (EIS), Case studies in business analytics

Unit-IV

Emerging Technologies in MIS: Cloud computing and virtualization, Big Data and Internet of Things (IoT), Artificial Intelligence and machine learning in MIS, Blockchain and its implications for MIS, Mobile and web-based information systems

Unit-V

Security, Ethical, and Social Issues in MIS: Information system security threats and countermeasures, Cybersecurity fundamentals, Ethical and legal aspects in MIS, Data privacy and intellectual property, Social impact of information systems

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Textbooks and References

1. **Kenneth C. Laudon and Jane P. Laudon**, *Management Information Systems: Managing the Digital Firm*, Pearson, 15th Edition.
2. **James A. O'Brien and George M. Marakas**, *Management Information Systems*, McGraw-Hill, 10th Edition
3. **Waman S. Jawadekar**, *Management Information Systems: Text and Cases*, McGraw-Hill, 5th Edition.
4. **Ralph Stair and George Reynolds**, *Principles of Information Systems*, Cengage Learning, 12th Edition.
5. **Ramesh Behl**, *Information Systems for Managers*, McGraw-Hill Education, 2012.

Course Outcomes:

CO1	Understand the basic concepts, structure, and role of MIS in organizations.
CO2	Analyze different types of information systems and how they support business functions.
CO3	Apply MIS tools for decision-making and problem-solving.
CO4	Evaluate the impact of modern technologies such as AI, big data, and cloud computing on MIS.
CO5	Examine issues related to information security, privacy, and ethical use of information systems.

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EAI3608	Signal & Image Processing	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	To understand the fundamentals of digital signal and image processing.
CO2	To learn various signal transformation and filtering techniques.
CO3	To explore image representation, enhancement, and restoration methods.
CO4	To study feature extraction and image compression techniques.
CO5	To apply signal and image processing concepts to real-world applications.

Unit-I

Introduction to Signal Processing: Basics of signals and systems, Continuous vs. discrete signals, Linear Time-Invariant (LTI) systems, Convolution, correlation, Fourier series and Fourier transform, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT)

Unit-II

Digital Filtering: Sampling and quantization, FIR and IIR filters, Filter design techniques, Z-transform and system function, Applications in audio and biomedical signals

Unit-III

Fundamentals of Image Processing: Image representation and types, Digital image acquisition and storage, Image sampling and quantization, Histogram processing and contrast enhancement, Smoothing and sharpening filters (mean, median, Gaussian, Laplacian)

Unit-IV

Image Transformation and Analysis: Discrete Cosine Transform (DCT), DFT, and Wavelet Transform, Image segmentation: edge detection, thresholding, region-based methods, Morphological operations: dilation, erosion, opening, closing, Feature extraction: texture, shape, color descriptors, Principal Component Analysis (PCA) in image processing

Unit-V

Image Compression and Applications: Lossless and lossy compression methods, Run-length encoding, Huffman coding, JPEG and JPEG2000 standards, Applications: medical imaging, remote sensing, surveillance, Overview of AI integration in image processing

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Textbooks and References

1. **Rafael C. Gonzalez and Richard E. Woods**, *Digital Image Processing*, Pearson Education, 4th Edition.
2. **Alan V. Oppenheim and Ronald W. Schaffer**, *Discrete-Time Signal Processing*, Pearson Education, 3rd Edition.
3. **Sanjit K. Mitra**, *Digital Signal Processing: A Computer-Based Approach*, McGraw-Hill, 4th Edition.
4. **Jayaraman, Esakkirajan, and Veerakumar**, *Digital Image Processing*, McGraw-Hill Education, 2nd Edition.
5. **Anil K. Jain**, *Fundamentals of Digital Image Processing*, Pearson Education, 1st Edition.

Course Outcomes:

CO1	Understand the basic concepts of digital signals and image processing systems.
CO2	Apply time and frequency domain techniques to analyze signals and images.
CO3	Perform image enhancement, filtering, and restoration in spatial and frequency domains.
CO4	Implement image segmentation and feature extraction techniques.
CO5	Evaluate image compression methods and apply signal/image processing to practical problems.

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EAI3609		L T P	3 credits
	Meta Learning	3 0 0	

Course Objectives:

CO1	To introduce the foundational concepts of Meta Learning and its motivation.
CO2	To explore various approaches to learning-to-learn using few-shot, one-shot, and zero-shot learning paradigms.
CO3	To understand the architecture and optimization techniques used in meta-learning frameworks.
CO4	To apply meta-learning algorithms for solving practical problems in AI and machine learning.
CO5	To examine recent advancements and challenges in meta-learning research.

Unit-I

Introduction to Meta Learning: Definition and motivation, Traditional learning vs. Meta Learning, Types of learning problems: few-shot, one-shot, zero-shot, Applications of Meta Learning in NLP, vision, and robotics, Case studies in real-world scenarios

Unit-II

Meta Learning Approaches: Model-based meta learning, Metric-based meta learning, Optimization-based meta learning, Comparison of approaches, Inductive bias and generalization in meta learning

Unit-III

Optimization and Algorithms: Gradient-based meta learning: MAML (Model-Agnostic Meta-Learning), Reptile, First-order MAML, Black-box optimization techniques, Meta-regularization and meta-objectives, Learning-to-optimize methods.

Unit-IV

Few-shot and One-shot Learning: Prototypical Networks, Matching Networks, Siamese Networks, Relation Networks, Cross-domain few-shot learning and transfer learning, Benchmark datasets: Omniglot, Mini-ImageNet, Tiered-ImageNet.

Unit-V

Research Trends and Applications: Meta learning in reinforcement learning and federated learning, Meta learning for hyperparameter tuning, Neural architecture search with meta learning, Challenges: scalability, interpretability, bias, Research directions and open problems

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Textbooks and References

1. Sebastian Thrun and Loren Pratt, *Learning to Learn*, Springer, 1998.
2. Andrei A. Rusu et al., *Meta-Learning with Latent Embedding Optimization*, Conference papers (arXiv)
3. Chelsea Finn et al., *Model-Agnostic Meta-Learning for Fast Adaptation of Deep Networks*, ICML 2017
4. Hugo Larochelle, *Meta Learning Tutorial*, NeurIPS 2019.
5. Joan Bruna et al., *Meta-Learning in Neural Networks: A Survey*, arXiv preprint.
6. Online resources:

- <https://metalearning.nl>
- <https://arxiv.org/list/cs.LG/recent>

Course Outcomes:

CO1	Understand the fundamental concepts and need for Meta Learning in AI.
CO2	Analyze various meta-learning algorithms and their applications.
CO3	Implement few-shot and one-shot learning methods using meta-learning techniques.
CO4	Evaluate different optimization strategies and model architectures used in Meta Learning.
CO5	Explore and interpret cutting-edge research and use cases in Meta Learning.

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EAI4704	Orientation program in Entrepreneurship	L	T	P	3 credits
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Course Objectives:

CO1	To introduce students to the fundamentals of entrepreneurship and the entrepreneurial mindset.
CO2	To understand the process of identifying, evaluating, and developing business ideas.
CO3	To explore the legal, financial, and operational aspects of starting a business.
CO4	To develop communication, leadership, and problem-solving skills relevant to entrepreneurship.
CO5	To inspire students to consider entrepreneurship as a career option and understand the ecosystem that supports it.

Unit-I

Introduction to Entrepreneurship: Definition and characteristics of entrepreneurs, Types of entrepreneurs and entrepreneurship (social, tech, women, green), Role of entrepreneurship in economic development, Entrepreneurial mindset and motivation, Case studies of successful entrepreneurs

Unit-II

Business Idea Generation and Opportunity Evaluation: Sources of business ideas, Creativity and innovation in entrepreneurship, Idea validation and feasibility analysis, Identifying target markets and customer segments, SWOT analysis

Unit-III

Business Planning and Management: Elements of a business plan, Business models and value proposition design, Marketing strategies for startups, Basics of operations and supply chain management, Organizational structure and legal forms of business.

Unit-IV

Financial and Legal Aspects: Basics of entrepreneurial finance and funding options, Bootstrapping, angel investment, venture capital, Break-even analysis, cash flow, and budgeting, Business registration, licenses, and IP rights, Government schemes and startup policies (e.g., Startup India).

Unit-V

Entrepreneurial Support System and Pitching: Role of incubation centers, accelerators, and mentoring, Start-up ecosystem in India, Preparing and delivering business pitches, Communication and leadership skills for entrepreneurs, Entrepreneurial ethics and social responsibility

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Textbooks and References

1. Vasant Desai, *Dynamics of Entrepreneurial Development and Management*, Himalaya Publishing House.
2. S.S. Khanka, *Entrepreneurial Development*, S. Chand & Company Ltd.
3. David H. Holt, *Entrepreneurship: New Venture Creation*, Prentice Hall of India.
4. Thomas Zimmerer & Norman Scarborough, *Essentials of Entrepreneurship and Small*
5. Government e-resources:

- [Startup India Portal](#)
- [MSME Schemes](#)

Course Outcomes:

CO1	Understand the concept and importance of entrepreneurship in economic development.
CO2	Identify and evaluate viable business ideas and market opportunities.
CO3	Analyze the components of a business plan including finance, marketing, and operations.
CO4	Demonstrate entrepreneurial traits such as innovation, risk-taking, and leadership.
CO5	Gain awareness of government schemes, incubation centers, and funding options for startups.

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EAI4706	Meta Verse	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	To understand the fundamental concepts and technologies behind the Metaverse.
CO2	To explore how virtual and augmented reality, blockchain, and AI converge in the Metaverse.
CO3	To examine entrepreneurial opportunities and business models within the Metaverse ecosystem.
CO4	To analyze challenges related to privacy, ethics, and digital ownership.
CO5	To equip students with the ability to conceptualize ventures leveraging Metaverse platforms.

Unit-I

Introduction to the Metaverse: Definition and evolution of the Metaverse, Core technologies: AR, VR, XR, blockchain, NFTs, AI, Key platforms: Decentraland, The Sandbox, Meta Horizon, Roblox, Differences between Web 2.0 and Web 3.0, Stakeholders and global trends

Unit-II

Entrepreneurial Landscape in the Metaverse: Metaverse as a business frontier, Virtual real estate and marketplaces, NFT-based digital goods and services, Direct-to-avatar (D2A) business model, Case studies: Metaverse startups and innovations

Unit-III

Metaverse Experience Design and Development: User experience (UX) in immersive environments, Avatars and identity creation, Tools for content creation: Unity, Unreal Engine, Blender, Virtual collaboration and community-building, Design thinking in Metaverse product development

Unit-IV

Legal, Ethical, and Economic Implications: Digital ownership and copyright in virtual worlds, Data privacy, security, and cyber-ethics, Smart contracts and decentralized governance, Economic models: tokenomics, cryptocurrencies, in-world currencies, Global regulations and compliance

Unit-V

Future Trends and Startup Opportunities: AI-driven avatars and personalization, Virtual events, learning, and remote workspaces, Funding for Metaverse startups: VCs, DAOs, accelerators, Building a Metaverse MVP (Minimum Viable Product), Pitching and scaling a Metaverse-based venture.

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Textbooks and References

1. **Matthew Ball**, *The Metaverse: And How It Will Revolutionize Everything*, Liveright Publishing.
2. **Jon Radoff**, *Building the Metaverse*, MediaTech Ventures (Online series and blog-based compilation).
3. **Klaus Schwab**, *Shaping the Future of the Fourth Industrial Revolution*, World Economic Forum
4. **Tony Parisi**, *The Seven Rules of the Metaverse*, Unity Technologies.
5. **Online platforms & whitepapers:**

<https://www.meta.com>

<https://decentraland.org>

<https://blockchain-council.org>

Research papers from IEEE, ACM, and arXiv on Metaverse & XR technologies

Course Outcomes:

CO1	Understand the core concepts and technological stack of the Metaverse.
CO2	Identify business and entrepreneurial opportunities in the Metaverse landscape.
CO3	Design innovative products, services, or experiences for virtual environments.
CO4	Evaluate legal, social, and ethical implications of operating within the Metaverse.
CO5	Apply strategic thinking and digital tools to develop Metaverse-based startup ideas.

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EAI4707	AI Ethics and Governance	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	To understand the ethical implications of AI in society and entrepreneurial ventures.
CO2	To explore governance frameworks and regulatory mechanisms for responsible AI.
CO3	To analyze fairness, accountability, transparency, and data privacy in AI systems.
CO4	To examine how startups and enterprises can integrate ethical AI in their business models.
CO5	To empower entrepreneurs to build trustable and socially responsible AI solutions.

Unit-I

Introduction to AI Ethics: Importance of ethics in AI, Moral and philosophical foundations: utilitarianism, deontology, virtue ethics, Ethical issues: surveillance, bias, discrimination, job displacement, Role of ethics in product development and entrepreneurship, Case studies: real-world AI failures and ethical dilemmas

Unit-II

Fairness, Accountability, and Transparency (FAT) in AI: Understanding bias in datasets and algorithms, Fairness in decision-making systems, Explainable AI (XAI) and interpretability, Algorithmic accountability and human oversight, Startups applying FAT principles in AI tools

Unit-III

Data Privacy and Consent: Importance of privacy in AI systems, Informed consent and data ownership, GDPR, India's DPDP Act, and global regulations, Ethical data sourcing for startups, Compliance strategies for entrepreneurs

Unit-IV

Governance and Regulation of AI: National and international AI governance frameworks, Role of governments, tech companies, and civil society, AI policies and ethical guidelines by OECD, EU, IEEE, Risk management and audit of AI systems, Corporate governance for AI startups

Unit-V

Ethical AI in Entrepreneurial Innovation: Designing ethically aligned AI products and services, Responsible innovation and social entrepreneurship, ESG (Environmental, Social, and Governance) in AI ventures, Tools and frameworks: AI ethics canvas, AI for good, Future trends and challenges for ethical entrepreneurship in AI

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Textbooks and References

1. Mark Cocckelbergh, *AI Ethics*, The MIT Press, 2020.
2. Virginia Dignum, *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way*, Springer, 2019.
3. Wendell Wallach & Colin Allen, *Moral Machines: Teaching Robots Right from Wrong*, Oxford University Press.
4. Cathy O'Neil, *Weapons of Math Destruction*, Penguin Books.
5. UNESCO, OECD, EU AI Guidelines – Official whitepapers and reports
6. Online resources:
 - o AI Ethics Guidelines Global Inventory – AlgorithmWatch
 - o AI for Good – ITU

Course Outcomes:

CO1	To understand the ethical implications of AI in society and entrepreneurial ventures.
CO2	To explore governance frameworks and regulatory mechanisms for responsible AI.
CO3	To analyze fairness, accountability, transparency, and data privacy in AI systems.
CO4	To examine how startups and enterprises can integrate ethical AI in their business models.
CO5	To empower entrepreneurs to build trustable and socially responsible AI solutions.

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EAI4708	Unmanned Aerial Vehicles	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	To understand the fundamental concepts, types, and components of UAVs.
CO2	To explore design, control, and navigation systems of UAVs.
CO3	To identify applications and entrepreneurial opportunities using UAV technologies.
CO4	To examine regulatory, safety, and ethical concerns related to UAV deployment.
CO5	To enable students to conceptualize drone-based startup ideas across various industries.

Unit-I

Fundamentals of UAVs: Introduction to UAVs and drones, Classifications: fixed-wing, rotary-wing, hybrid, Components: airframe, propulsion, sensors, payloads, Drone subsystems: GPS, IMU, telemetry, UAVs vs. manned aerial vehicles

Unit-II

Design and Control Systems: Basics of aerodynamics for drones, Flight control and stabilization, Navigation and positioning systems, Ground control systems and telemetry, Open-source flight controllers (ArduPilot, PX4)

Unit-III

Applications and Entrepreneurial Opportunities: UAVs in agriculture, delivery, surveillance, inspection, media, Drone-based startups and business models, Market research and opportunity mapping, Case studies: Zipline, DJI, Skydio, Indian drone startups, MVP development for UAV-based ventures

Unit-IV

Legal, Ethical, and Regulatory Aspects: DGCA (India), FAA (USA) regulations, Airspace classifications and drone permissions, Drone safety protocols and risk management, Privacy and data protection in UAV usage, Environmental and social implications

Unit-V

UAV Entrepreneurship and Innovation: Building UAV-based solutions for real-world problems, Value proposition and customer discovery, Funding sources and drone tech incubators, Product lifecycle, prototyping, and scaling, Pitching a UAV business idea

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Textbooks and References

1. Kimon P. Valavanis & George J. Vachtsevanos, *Handbook of Unmanned Aerial Vehicles*, Springer.
2. Paul G. Fahlstrom & Thomas J. Gleason, *Introduction to UAV Systems*, Wiley.
3. Ella Atkins et al., *Autonomous Control of Unmanned Aerial Vehicles*, Springer.
4. DGCA Drone Regulations – <https://digitalsky.dgca.gov.in>
5. Chris Anderson, *Makers: The New Industrial Revolution* (For entrepreneurial mindset and UAV innovation)

Course Outcomes:

CO1	Understand the architecture, components, and classifications of UAVs.
CO2	Analyze flight dynamics, communication systems, and control mechanisms of drones.
CO3	Explore entrepreneurial use-cases in agriculture, logistics, surveillance, and more.
CO4	Comprehend the regulatory, legal, and ethical issues in UAV deployment.
CO5	Develop a UAV-based business proposal or product prototype aligned with market needs.

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EAI4709	Formal Language & Automata Theory	L 3	T 0	P 0	3 credits
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Course Objectives:

CO1	To understand the mathematical foundation of computation through formal languages and automata.
CO2	To explore finite automata, context-free grammars, and Turing machines for solving computational problems.
CO3	To analyze language recognition, parsing, and compiler design fundamentals.
CO4	To apply formal models to practical domains like software development, NLP, AI, and cyber security.
CO5	To encourage entrepreneurial applications in domains such as language processing, automaton-based bots, and low-code tools.

Unit-I

Regular Languages and Finite Automata: Introduction to formal languages, Deterministic Finite Automata (DFA) and Non-Deterministic FA (NFA), Regular expressions and their equivalence with FA, NFA with ϵ -transitions, Applications in lexical analysis, pattern recognition.

Unit-II

Properties of Regular Languages: Pumping Lemma for regular languages, Minimization of DFAs, Closure properties of regular languages, Decision algorithms, Real-world application: Token recognizers in compilers and text-processing startups

Unit-III

Context-Free Grammars (CFG) and Pushdown Automata (PDA): CFG and derivation trees, Ambiguity in grammars, Simplification and Normal Forms (Chomsky, Greibach), Pushdown Automata and language acceptance, Use in entrepreneurship: Parsing engines, chatbot grammar, and speech-to-text tools

Unit-IV

Turing Machines and Computability: Basic Turing Machine model, Variants and equivalence, Recursive and recursively enumerable languages, Undecidability: Halting problem, Application in logic-based AI systems and algorithmic automation.

Unit-V

Applications and Startup Use-Cases: Chomsky Hierarchy and computational limits, Introduction to compiler components: lexical analyzer, parser, Entrepreneurship in code analysis, compiler-as-a-service tools, NLP, regular language-based filters, and decision bots, Open-source parser tools: ANTLR, Lex/Yacc, and startup tools using them.

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Textbooks and References

1. John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, *Introduction to Automata Theory, Languages, and Computation*, Pearson Education.
2. Peter Linz, *An Introduction to Formal Languages and Automata*, Jones & Bartlett Learning.
3. Daniel I. A. Cohen, *Introduction to Computer Theory*, Wiley
4. Michael Sipser, *Introduction to the Theory of Computation*, Cengage Learning.
5. MIT OpenCourseWare – Theory of Computation
6. Stanford NLP and Compiler Design MOOCs (for entrepreneurial applications)

Course Outcomes:

CO1	Understand and construct finite automata and regular expressions for pattern matching.
CO2	Design context-free grammars and pushdown automata for language parsing.
CO3	Evaluate the power and limitations of various abstract machines including Turing machines.
CO4	Analyze computational problems using the Chomsky hierarchy and decidability.
CO5	Apply formal language theory in developing software tools, compilers, and entrepreneurial products in NLP, code automation, and cyber security.

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EAI4802	Quantum Computing	L 2	T 0	P 0	2 credits
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Course Objectives:

CO1	To introduce the principles and mathematics of quantum mechanics essential for quantum computing.
CO2	To understand quantum logic gates and quantum circuits.
CO3	To explore quantum algorithms and their applications in solving computational problems.
CO4	To provide knowledge of quantum entanglement, teleportation, and quantum error correction.
CO5	To familiarize students with current tools, frameworks, and trends in quantum computing technologies.

Unit-I

Fundamentals of Quantum Mechanics: Classical vs. quantum computation, Qubits and quantum states, Dirac notation and quantum state vectors, Superposition and measurement, Postulates of quantum mechanics, Bloch sphere representation

Unit-II

Quantum Gates and Circuits: Quantum logic gates: X, Y, Z, H, S, T, and Identity, Multi-qubit gates: CNOT, Toffoli, SWAP, Quantum circuit construction and representation, Matrix representation of quantum gates, Quantum parallelism and no-cloning theorem

Unit-III

Quantum Algorithms – I: Quantum algorithm basics, Deutsch and Deutsch-Jozsa algorithm, Grover's Search Algorithm, Quantum speedup and complexity

Unit-IV

Quantum Algorithms – II: Introduction to Shor's factoring algorithm, Quantum Fourier Transform (QFT), Simon's Algorithm, Applications of quantum algorithms in cryptography and database search

Unit-V

Advanced Topics and Quantum Programming: Entanglement and Bell states, Quantum teleportation and superdense coding, Quantum error correction and decoherence, Introduction to quantum programming platforms: IBM Qiskit, Google Cirq, Hands-on quantum program simulation (e.g., Qiskit Notebooks)

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Textbooks and References

1. **"Quantum Computation and Quantum Information"** by *Michael A. Nielsen and Isaac L. Chuang* Publisher: Cambridge University Press: *The most widely used textbook in quantum computing.*
2. **"Quantum Computing: An Applied Approach"** by *Jack D. Hidary* Publisher: Springer: *More practical and programming-focused.*
3. **"Quantum Mechanics: The Theoretical Minimum"** by *Leonard Susskind and Art Friedman* Publisher: Basic Books: *Best for physics background refreshers.*
4. **"Quantum Computing Explained"** by *David McMahon* Publisher: Wiley: *Beginner-friendly with examples and code.*
5. **"Dancing with Qubits: How quantum computing works and how it can change the world"** by *Robert S. Sutor* Publisher: Packt: *Good for real-world implications and tools like Qiskit.*

Course Outcomes:

CO1	Explain the foundational principles of quantum mechanics and how they differ from classical computing.
CO2	Construct and simulate quantum circuits using quantum gates.
CO3	Analyze and implement basic quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
CO4	Discuss the role of entanglement, superposition, and measurement in quantum computation.
CO5	Use quantum programming frameworks (e.g., Qiskit, Cirq) to create and test quantum programs.

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EAI4805	AI in Bioinformatics	L 2	T 0	P 0	2 credits
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Course Objectives:

CO1	To introduce the basic concepts of bioinformatics and its role in life sciences.
CO2	To understand how artificial intelligence (AI) techniques can be applied to solve biological data problems.
CO3	To equip students with machine learning and deep learning tools for sequence and structure analysis.
CO4	To explore AI-based solutions for genomic, proteomic, and systems biology data.
CO5	To provide hands-on experience in applying AI to real-world bioinformatics problems using tools and datasets.

Unit-I

Introduction to Bioinformatics and AI: Overview of bioinformatics: scope, applications, Biological data types: genomic, proteomic, transcriptomic, Introduction to Artificial Intelligence and Machine Learning, Role of AI in bioinformatics, Biological databases: GenBank, PDB, UniProt, NCBI

Unit-II

Sequence Analysis Using AI: DNA, RNA, and protein sequences, Sequence alignment (pairwise and multiple), Feature extraction from sequences, Classification techniques: SVM, Decision Trees, k-NN, Applications: gene prediction, disease gene identification

Unit-III

Clustering and Pattern Mining in Bioinformatics: Clustering methods: k-means, hierarchical, DBSCAN, Pattern recognition in biological sequences, Motif and domain identification, Expression data analysis using clustering, Case study: microarray data and clustering gene expression

Unit-IV

Deep Learning for Genomics and Proteomics: Basics of neural networks and deep learning, CNNs and RNNs for sequence data, Deep learning in protein structure prediction, Drug discovery and target identification using deep learning, Case study: AlphaFold and protein folding

Unit-V

Tools, Frameworks, and Applications: BioPython, scikit-learn, TensorFlow/Keras in bioinformatics, Data preprocessing and pipeline creation, AI in personalized medicine and systems biology, Ethical considerations in AI-based bioinformatics, Project/mini project on real-life dataset (e.g., cancer genomics, COVID-19 analysis)

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Textbooks and References

1. **"Bioinformatics: Sequence and Genome Analysis"** by *David W. Mount*
Publisher: Cold Spring Harbor Laboratory Press: *Great for foundational bioinformatics understanding.*
2. **"Artificial Intelligence and Machine Learning for Bioinformatics"** by *Mark Schreiber*
Publisher: Springer: *Focused specifically on the intersection of AI and bioinformatics.*
3. **"Machine Learning in Bioinformatics"** by *Yanqing Zhang and Jagath C. Rajapakse*
Publisher: Wiley: *Focuses on various ML methods used in bioinformatics.*
4. **"Bioinformatics Algorithms: An Active Learning Approach"** by *Phillip Compeau and Pavel Pevzner*: Publisher: Active Learning Publishers: *Highly engaging, problem-solving approach.*

3. Course Outcomes:

CO1	Understand and explain fundamental bioinformatics problems and data types.
CO2	Apply AI techniques such as classification, clustering, and pattern recognition in bioinformatics.
CO3	Analyze DNA, RNA, and protein sequences using machine learning approaches.
CO4	Utilize deep learning models for genomics, drug discovery, and disease prediction.
CO5	Work with bioinformatics datasets using AI tools like Python, scikit-learn, Biopython, and TensorFlow.

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EAI4806	Big Data Analytics	L 2	T 0	P 0	2 credits
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Course Objectives:

CO1	To provide a comprehensive understanding of big data characteristics, architecture, and challenges.
CO2	To explore data processing frameworks such as Hadoop, MapReduce, and Spark.
CO3	To apply data analytics techniques for handling structured and unstructured data.
CO4	To equip students with skills in big data tools, platforms, and real-time analytics.
CO5	To develop the ability to extract insights from large-scale datasets using machine learning and statistical techniques.

Unit-I

Introduction to Big Data: What is Big Data? Characteristics and types, Challenges of big data processing, Big Data vs. traditional data, Big Data applications in various domains (healthcare, retail, finance, etc.), Introduction to data science and data analytics lifecycle

Unit-II

Hadoop Ecosystem: Hadoop architecture and HDFS (Hadoop Distributed File System), MapReduce programming model: concepts and workflow, InputFormat, OutputFormat, Combiner, Partitioner, Hadoop ecosystem components: Pig, Hive, HBase, Sqoop, Flume, YARN and its role in resource management

Unit-III

Apache Spark and Real-Time Analytics: Introduction to Apache Spark and RDDs, Spark architecture and components, Spark SQL and DataFrames, Spark Streaming and structured streaming, Integration with Kafka and Flume for real-time data processing

Unit-IV

Data Storage and NoSQL Databases: Introduction to NoSQL databases, Types of NoSQL databases: Key-value, Document, Column-family, Graph, HBase architecture and operations, MongoDB: structure, queries, and indexing, Cassandra: architecture and data modeling

Unit-V

Big Data Analytics and Machine Learning: Data preprocessing and feature engineering in big data, Scalable ML with MLlib (Spark's machine learning library), Classification, clustering, regression models on big data, Big Data visualization tools (Tableau, Power BI, Apache Superset), Case studies and mini project on big data analytics

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Textbooks and References

1. "Big Data: Principles and Best Practices of Scalable Real-Time Data Systems" by Nathan Marz and James Warren: Publisher: Manning Publications
2. "Hadoop: The Definitive Guide" by Tom White Publisher: O'Reilly Media
3. "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services Publisher: Wiley
4. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Pramod J. Sadalage and Martin Fowler: Publisher: Addison-Wesley

Course Outcomes:

CO1	Define and explain the concepts, architecture, and challenges of big data systems.
CO2	Use Hadoop and MapReduce frameworks for distributed storage and processing.
CO3	Apply Spark-based in-memory processing for real-time big data analytics.
CO4	Analyze structured and unstructured data using appropriate tools and models.
CO5	Build and deploy big data solutions using industry-relevant technologies.

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EA14807	Evolutionary Algorithms	L 2	T 0	P 0	2 credits
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Course Objectives:

CO1	To introduce the fundamentals of optimization and evolutionary computing techniques.
CO2	To study various evolutionary algorithms like Genetic Algorithms, Evolution Strategies, and Genetic Programming.
CO3	To apply population-based search techniques to real-world optimization problems.
CO4	To analyze convergence behavior and performance of evolutionary methods.
CO5	To expose students to advanced topics such as multi-objective optimization and hybrid algorithms.

Unit-I

Introduction to Evolutionary Computation: Optimization: classical vs. evolutionary approaches. Basic principles of natural evolution, Search spaces, fitness landscapes, Components of evolutionary algorithms, Types: Genetic Algorithms (GA), Evolution Strategies (ES), Genetic Programming (GP), Differential Evolution (DE)

Unit-II

Genetic Algorithms: Chromosome representation and encoding, Selection methods: roulette wheel, tournament, rank, Crossover and mutation operators, Elitism and generational models, Applications of GA in combinatorial and continuous problems

Unit-III

Advanced Evolutionary Techniques: Evolution Strategies ($\mu + \lambda$) and (μ, λ), Genetic Programming: representation, initialization, operators, Differential Evolution: strategies and mutation mechanisms, Constraint handling techniques, Memetic algorithms and hybrid evolutionary methods

Unit-IV

Performance Evaluation and Benchmarking: Measures of performance: convergence, diversity, stability, Statistical comparison of algorithms, Benchmark functions: Sphere, Rastrigin, Rosenbrock, etc., Parameter tuning and control, Scalability and complexity

Unit-V

Multi-Objective and Real-World Applications: Multi-objective optimization: Pareto optimality, NSGA-II, SPEA2, and MOEA/D algorithms, Applications in engineering, scheduling, robotics, bioinformatics, Real-life case studies using MATLAB/Python/DEAP, Research trends and current advancements

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Textbooks and References

1. "An Introduction to Genetic Algorithms" by *Melanie Mitchell*
Publisher: MIT Press
2. "Introduction to Evolutionary Computing" by *A. E. Eiben and J. E. Smith*
Publisher: Springer
3. "Practical Genetic Algorithms" by *Randy L. Haupt and Sue Ellen Haupt*
Publisher: Wiley
4. "Evolutionary Computation: A Unified Approach" by *Kenneth A. De Jong*
Publisher: MIT Press

Course Outcomes:

CO1	Understand the theoretical foundations and classifications of evolutionary algorithms.
CO2	Design and implement Genetic Algorithms for single and multi-objective problems.
CO3	Apply Evolution Strategies, Genetic Programming, and other bio-inspired techniques.
CO4	Analyze and compare performance of evolutionary algorithms using benchmark problems.
CO5	Implement hybrid and adaptive evolutionary approaches for real-world applications.

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EAI4808	Computer Vision	L 2	T 0	P 0	2 credits
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Course Objectives:

CO1	To understand the fundamentals and mathematical foundations of computer vision.
CO2	To explore image processing techniques and feature extraction methods.
CO3	To apply machine learning and deep learning techniques in visual recognition.
CO4	To design systems capable of scene understanding, object detection, and tracking.
CO5	To develop hands-on skills using computer vision libraries like OpenCV, PyTorch, or TensorFlow.

Unit-I

Fundamentals of Computer Vision and Image Formation: Overview and applications of computer vision, Human and computer vision comparison, Image formation and camera models, Pinhole camera, perspective projection, Color spaces and transformations

Unit-II

Image Processing and Feature Detection: Image filtering: convolution, Gaussian blur, sharpening, Edge detection: Sobel, Prewitt, Canny, Thresholding and histogram equalization, Corner and blob detection: Harris corner, SIFT, SURF, ORB, Feature matching: RANSAC, FLANN

Unit-III

Segmentation and Object Recognition: Image segmentation: region-based, clustering (k-means), watershed, Morphological operations, Template matching and HOG (Histogram of Oriented Gradients), Object detection using Haar cascades and HOG+SVM, Scene understanding and background subtraction

Unit-IV

Motion Analysis and 3D Vision: Optical flow: Horn-Schunck, Lucas-Kanade, Video tracking: Kalman filter, Mean-shift, CAMShift, Structure from motion (SfM), Stereo vision and depth estimation, 3D reconstruction basics

Unit-V

Deep Learning in Computer Vision: Introduction to convolutional neural networks (CNNs), Architectures: LeNet, AlexNet, VGG, ResNet, Object detection: YOLO, SSD, Faster R-CNN, Image captioning and visual question answering, Transfer learning with pretrained models (e.g., MobileNet, ResNet)

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Textbooks and References

1. "Computer Vision: Algorithms and Applications" by *Richard Szeliski*
Publisher: Springer (*Highly recommended, also freely available online*)
2. "Learning OpenCV 4: Computer Vision with Python" by *Adrian Kaehler and Gary Bradski* Publisher: O'Reilly Media: (*Hands-on approach using OpenCV in Python*)
3. "Multiple View Geometry in Computer Vision" by *Richard Hartley and Andrew Zisserman* Publisher: Cambridge University Press: (*Great for 3D vision and geometry*)
4. "Deep Learning for Computer Vision" by *Rajalingappaa Shanmugamani*
Publisher: Packt: (*Focused on CNNs, transfer learning, and detection*)

Course Outcomes:

CO1	Explain the core concepts and mathematical models underlying computer vision systems.
CO2	Apply image filtering, transformation, and feature extraction techniques.
CO3	Implement object recognition, segmentation, and tracking algorithms.
CO4	Utilize deep learning architectures like CNNs for computer vision tasks.
CO5	Build practical computer vision applications using OpenCV and neural networks.

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