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

Study & Evaluation Scheme
Of

Bachelor of Technology

B. TECH. (CS)

[Applicable w.e.f. Academic Session 2024-25]

Approved by Academic Council

FUTURE UNIVERSITY

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

SUMMARY

Programme	**Bachelor of Technology**

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

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.***

FUTURE UNIVERSITY

Faculty of Engineering and Technology (Code: 05)
Department of Engineering and Technology
Bachelor of Technology in Computer Science and Engineering

Credit Framework for the B. Tech. (CS) -NEP-2020

Sem.	Major (Core)	Minor Stream	Multidisciplinary	Ability Enhancement Course	Skill Enhancement Course	Value Added Courses Common for All UG	Summer Internship	Research Project/ Dissertation	Total Credit
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	6	2	2	2				22
4	14	3		2					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	15	3			2				20
6	13	4						3	20
Students who want to undertake 3-year UG Programme will be awarded UG Degree in the relevant Discipline/ Subject Upon securing 120 credits									
7	11	3						6	20
8	9	4						12	25
Students will be awarded UG Degree (Honours) with Research in the relevant Discipline/ Subject provided they secure 160 credits (As per NEP guidelines)									

Total = 170 Credit

	Future University							
	B. Tech. in Computer Science (Undergraduate Regular)							
	Course Structure/ Degree Award Checklist 2024-2028							
Program Name:	**B. Tech. (CS)**				**Program Code:**	**07**		
	Total Credit of Program: 170				**Branch Code:**	**05**		
		Theory	**Week**		**Evalu**	**To**	**C**	

							ation Scheme		tal	redit
SN	**Course Category**	Code	**Course Title**	**L**	**T**	**P**	**CA**	**EE**		
Semester –I										
1	Multidisciplinary Course	BAS101	Engineering Mathematics-1	3	0	0	30	70	100	3
2	Minor Course	BAS103	Advanced Engineering Physics	2	1	0	30	70	100	3
3	Major Core Courses	BAS105/BEC101	Essentials of Electrical Engineering / Essentials of Electronics Engineering	3	0	0	30	70	100	3
4	Major Core Courses	BCS101/BME101	Principles of Problem-Solving Using Advance C / Elements of Mechanical	3	0	0	30	70	100	3
5	Value added course	BCS103	Recent Advances In Technology	2	0	0	30	70	100	2
6	Minor Course	BCS109	MOOC	Self-Paced Learning					100	3
Practical										
7	Minor Course	BAS171	Advanced Engineering Physics LAB	0	0	2	50	50	100	1
8	Major Core Courses	BCS173/BME173	Programming using advanced C LAB / EME Lab	0	0	2	50	50	100	1
9	Major Core Courses	BEE175/BEC175	Essentials of Electrical Engineering LAB / Essentials of Electronics Engineering LAB	0	0	2	50	50	100	1
10	Skill Enhancement Course	BME177/BME179	Workshop Practice Lab / Engineering Graphics Lab	0	0	4	50	50	100	2
11	Multidisciplinary Course	IKS101	IKS-1 (Indian Knowledge System-1)	1	0	0	50		50	1
		TOTAL		**14**	**1**	**10**	**400**	**550**	**1050**	**23**

			Theory	**Week**			**Evaluation Scheme**		**Total**	**Credit**
SN	**Course Category**	**Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**		
Semester –II										
1	Multidisciplinary Course	BAS102	Engineering Mathematics – II	3	0	0	30	70	100	3
2	Minor Course	BAS104	Environmental Science	2	0	0	3	70	10	2

							0		0	
3	Major Core Courses	BEC104/BEE 104	Essentials of Electronics Engineering / Essentials of Electrical Engineering	3	0	0	30	70	100	3
4	Major Core Courses	BME106/BCS 106	Elements of Mechanical Engg. / Principles of Problem Solving Using Advance C	3	1	0	30	70	100	4
5	Value added course	BCS108	Cyber Security	2	0	0	30	70	100	2
	Minor Course	BCS110	MOOC	Self-Paced Learning					100	3
Practical										
6	Major Core Courses	BME180/BCS 182	EME Lab/Programming using advanced C LAB	0	0	2	50	50	100	1
7	Major Core Courses	BEC184/BEE 186	Essentials of Electronics Engineering LAB / Essentials of Electrical Engineering	0	0	2	50	50	100	1
8	Skill Enhancement Course	BME188/BME190	Engineering Graphics Lab / Workshop Practice Lab	0	0	4	50	50	100	2
9	Skill Enhancement Course	LSM110	LSM - I (Life Skill & Mentoring I)	0	0	0				0
		TOTAL		**14**	**3**	**8**	**300**	**500**	**900**	**21**

			Theory	**Week**			**Evaluation Scheme**		**Total**	**Credit**
SN	**Course Category**	Code	**Course Title**	**L**	**T**	**P**	**CA**	**EE**		
Semester –III										
1	Multidisciplinary Course	BAS201	Discrete Mathematics	2	1	0	30	70	100	3
2	Minor Course	BAS203	Mathematics-III	3	0	0	30	70	100	3
3	Major Core Courses	BCS205	Data Structures	2	1	0	30	70	100	3
4	Minor Course	BCS207	MOOC	Self-Paced Learning					100	3
5	Major Core Courses	BEC209	Digital Electronics	2	1	0	30	70	100	3
7	Skill Enhancement	BCS213	AI for Everyone	2	1	0	30	70	100	3

	Course									
Practical										
1	Major Core Courses	BCS271	Data Structures Lab	0	0	4	50	50	100	2
2	Major Core Courses	BEC273	Digital Electronics Lab	0	0	4	50	50	100	2
		TOTAL		**13**	**2**	**8**	**280**	**520**	**900**	**22**

			Theory	**WEEK**			**Evaluation Scheme**			
SN	**Course Category**	**Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**	**Total**	**Credit**
		Semester-IV								
1	Major Core Courses	BCS202	OOP's Concept using Java	3	0	0	30	70	100	3
2	Major Core Courses	BCS204	Computer Organization & Architecture	3	0	0	30	70	100	3
3	Major Core Courses	BCS206	Operating Systems	2	0	0	30	70	100	2
5	Minor Course	BCS210	AI for Engineers	2	0	0	30	70	100	2
6	Minor Course	BCS2012	MOOC	Self-Paced Learning					100	3
Practical										
7	Major Core Courses	BCS280	OOP's Concept using Java Lab	0	0	4	50	50	100	2
8	Major Core Courses	BCS282	Computer Organization & Architecture Lab	0	0	4	50	50	100	2
9	Major Core Courses	BCS284	Operating System Lab	0	0	4	50	50	100	2
			TOTAL	**12**	**0**	**12**	**300**	**500**	**900**	**19**

			Theory	Week			Evaluation Scheme			
SN	**Course Category**	**Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**	**Total**	**Credit**
Semester –V										
1	Major Core Courses	BCS301	Design and Analysis of Algorithms	3	0	0	30	70	100	3
2	Major Core Courses	BCS303	Database Management System	3	0	0	30	70	100	3
3	Major Core Courses	BCS305	Compiler Design	2	0	0	30	70	100	2
4	Major Core Courses		Elective-1	3	0	0	30	70	100	3
5	Minor Course	BLA307	Professional Law and Ethics	2	0	0	30	70	100	2
6	Minor Course	BCS309	MOOC	Self-Pace Learning					100	1
Practical										
8	Major Core Courses	BCS371	Design and Analysis of Algorithms Lab	0	0	4	50	50	100	2
9	Major Core Courses	BCS373	Database Management System Lab	0	0	4	50	50	100	2
10	Skill Enhancement Course	BCS375	Internship	0	0	4	50	50	100	2
			TOTAL	**13**	**0**	**12**	**300**	**500**	**900**	**20**

			Theory	Week		Evaluation Scheme				
SN	**Course Category**	**Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**	**Total**	**Credit**
Semester-VI										
1	Major Core Courses	BCS302	Computer Networks	2	0	0	30	70	100	2
2	Major Core Courses		Elective II	3	0	0	30	70	100	3
3	Major Core Courses	BCS304	Cryptography	2	0	0	30	70	100	2
4	Minor Course		Open Elective-I	3	0	0	30	70	100	3
5	Major Core Courses	BCS306	Digital Image Processing	2	0	0	30	70	100	2
6	Minor Course	BCS308	MOOC	Self-Pace Learning					100	1
Practical										
8	Major Core Courses	BCS380	Computer Networks Lab	0	0	4	50	50	100	2
9	Major Core Courses	BCS382	Elective II Lab	0	0	4	50	50	100	2
10	Research Project/ Dissertation	BCS382	Mini Project	0	0	6	50	50	100	3
			TOTAL	**12**	**0**	**14**	**300**	**500**	**900**	**20**

			Theory	Week			Evaluation Scheme			
S No	**Course Category**	CODE	**Course Title**	**L**	**T**	**P**	**CA**	**EE**	**Total**	**Credit**
Semester –VII										
1	Major Core Courses		Elective- III	3	0	0	30	70	100	3
2	Major Core Courses		Elective- IV	3	0	0	30	70	100	3
3	Major Core Courses		Open Elective-II	3	0	0	30	70	100	3
4	Minor Courses	BCS401	Engineering Research Methodology	2	0	0	30	70	100	2
5	Minor Courses	BCS403	MOOC	Self-Pace Learning					100	1
Practical										
6	Research Project/ Dissertation	BCS471	Project-I	0	0	12	50	100	150	6
7	Major Core Courses		Elective- IV Lab	0	0	4	50	50	100	2
			TOTAL	**11**	**0**	**16**	**220**	**430**	**750**	**20**

			Theory	Week			Evaluation Scheme			
SN	**Course Category**	**Code**	**Course Title**	**L**	**T**	**P**	**CA**	**EE**	**Total**	**Credit**
Semester-VIII										
1	Major Core Courses	BCS402	Artificial Intelligence and Expert Systems	3	0	0	30	70	100	3
2	Major Core Courses		Elective-V	3	0	0	30	70	100	3
3	Minor Course		Elective- VI	3	0	0	30	70	100	3
4	Major Core Courses	BCS404	Data Compression	3	0	0	30	70	100	3
5	Minor Course	BCS406	MOOC	Self-Pace Learning					100	1
Practical										
6	Research Project/ Dissertation	BCS480	Project – II	0	0	24	100	300	400	12
			TOTAL	**12**	**0**	**24**	**220**	**580**	**900**	**25**

SN	Course Category
1	Major (Core)
2	Minor Stream
3	Multidisciplinary
4	Ability Enhancement Course
5	Skill Enhancement Course
6	Value Added Courses Common for All UG
7	Summer Internship
8	Research Project/ Dissertation

SN		B. Tech. CS ELECTIVE-I
1	BCS311	Fuzzy logic
2	BCS313	Soft Computing
3	BCS315	Discrete Mathematics
4	BCS317	Graph Theory
5	BCS319	System Programming
SN		**B. Tech. CS ELECTIVE-II**
1	BCS310	Software Testing
2	BCS312	Multimedia Systems
3	BCS314	Principles of Programming Language
4	BCS316	Web Development
5	BCS318	Linux Administration
SN		**B. Tech. CS ELECTIVE-III**
1	BSC405	Cyber Security
2	BCS407	Pattern Recognition
3	BCS409	Parallel Algorithm
4	BCS411	Introduction to Machine Learning
5	BCS413	Introduction to IOT
SN		**B. Tech. CS ELECTIVE-IV**
1	BCS415/BCS473	Embedded and Real Time Systems/Embedded and Real Time Systems Lab
2	BCS417/BCS475	Neural Networks/Neural Networks Lab
3	BCS419/BCS477	OS for Smart Devices (Android)/ OS for Smart Devices (Android) Lab
4	BCS421/BCS479	Client Server Computing/Client Server Computing Lab
5	BCS423/BCS481	Cloud Computing/Cloud Computing Lab
SN		**B. Tech. CS ELECTIVE-V**
1	BCS406	Distributed Databases
2	BCS408	Entrepreneurship & Technology Management
3	BCS410	Simulation and Modeling
4	BCS412	Block Chain
5	BCS414	Edge & Fog Computing

SN		B. Tech. CS ELECTIVE-VI
1	BCS416	Advanced Computer Networks
2	BCS418	Data Warehouse and Data Mining
3	BCS420	Computational Complexity
4	BCS422	DevOps
5	BCS424	Autonomous Systems & Robotics
SN		**CSE OPEN ELECTIVE-I**
1	BCS320	Total Quality Management
2	BCS322	Human Computer Interaction
3	MBA650	Entrepreneurship Development
4	BAS326	Non-Conventional Energy Resource
5	BAS328	Operational Research
SN		**CSE OPEN ELECTIVE-II**
1	BAS425	Soft Skills and Interpersonal Communications
2	MBA651	Human Resource Development and Organizational Behaviour
3	BCS429	Product Development
4	BAS427	Queuing Theory and Modelling
5	BCS427	E-Governance and Digital Transformation

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BAS101	ENGINEERING MATHEMATICS-I	L T P 3 0 0	3 credits

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.

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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BAS103	Advanced Engineering Physics	L T P 2 0 0	2 credits

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.

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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BEE105	ESSENTIALS OF ELECTRICAL ENGINEERING	L T P 3 0 0	3 credits

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:

1. Ritu Sahdev, *"Basic Electrical Engineering"*, Khanna Publishing House, 2018.
2. P.V. Prasad, S. Sivanagaraju, *"Electrical Engineering: Concepts and Applications"*, Cengage, 2018
3. D. P. Kothari and I. J. Nagrath, *"Basic Electrical Engineering"*, Tata McGraw Hill, 2010.
4. D. C. Kulshreshtha, *"Basic Electrical Engineering"*, McGraw Hill, 2009.

Reference Books:

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

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BEC101	ESSENTIALS OF ELECTRONICS ENGINEERING	L T P 3 0 0	3 credits

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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BCS101	PRINCIPLES OF PROBLEM SOLVING USING ADVANCED C	L T P 3 0 0	3 credits

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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BME101	**ELEMENTS OF MECHANICAL ENGINEERING**	**L T P** **3 0 0**	**3 credits**

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 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. Vijayarahgavan, 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

BCS103: RECENT ADVANCES IN TECHNOLOGY

Course Outcome (CO)	
CO1	Demonstrate the knowledge of the basic structure, components, features and Generations of computers.
CO2	Describe the concept of computer languages, language translators and construct Algorithms to solve problem using programming concepts.
CO3	Compare and contrast features, functioning & types of operating system and computer networks.
CO4	Demonstrate architecture, functioning & services of the Internet and basics of Multimedia.
CO5	Illustrate the emerging trends and technologies in the field of Information Technology.

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.

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

BAS171	ADVANCED ENGINEERING PHYSICS LAB	L T P 0 0 1	1 credits

:

(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 by Newton's ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To determine the specific rotation of cane sugar solution using polarimeter.
4. To determine the focal length of the combination of two lenses separated by a distance and verify the formula for the focal length of combination of lenses.
5. To measure attenuation in an optical fiber.
6. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
7. To verify Stefan's law by electric method.
8. To determine resistance per unit length and specific resistance of a given resistance using Carey Foster's Bridge.
9. To study the resonance condition of a series LCR circuit.
10. To determine the electrochemical equivalent (ECE) of copper.
11. To determine the energy band gap of a given semiconductor material.
12. To study Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.

BCS173	PROGRAMMING USING ADVANCED C LAB	L T P 0 0 1	1 credits

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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BME173	EME LAB	L T P 0 0 1	1 credits

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.

BEE175	ESSENTIALS OF ELECTRICAL ENGINEERING LAB	L T P 0 0 1	1 credits

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

BEC175	ESSENTIALS OF ELECTRONICS ENGINEERING LAB	L T P 0 0 1	1 credits

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

Part A:

1. Study of various types of Active & Passive Components based on their ratings.
2. Identification of various types of Printed Circuit Boards (PCB) and soldering techniques.
3. **PCB Lab:**
   a. Artwork & printing of a simple PCB
   b. Etching & drilling of PCB
4. Winding shop: Step down transformer winding of less than 5VA.
5. Soldering shop:
   - Soldering and desoldering of resistor in PCB
   - Soldering and desoldering of capacitor in PCB

Part B:

1. Study of Lab Equipment and Components:
   - CRO
   - Multimeter
   - Function Generator
   - Power supply
   - Active & Passive Components
   - Bread Board
2. **PN Junction Diode:**
   - Characteristics of PN junction diode
   - Static and dynamic resistance measurement from graph
3. **Applications of PN Junction diode:**
   - Half & full wave rectifier

- Measurement of Vrms,VdcV_{rms}, V_{dc}, and ripple factor

4. Characteristics of Zener diode:
   - V-I characteristics of zener diode
   - Graphical measurement of forward and reverse resistance
5. **Characteristic of BJT:** BJT in CE configuration
6. Study of **Operational Amplifier** as Adder and Subtractor
7. Verification of **Truth Table** of Various Logic Gates
8. Implementation of a given **Boolean function** using logic gates in both SOP and POS forms

Part C:

Part	Practical Component Description	Notes
Part A	PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB	This practical is not possible by virtual lab. It will be conducted only in physical mode.
Part B	Study of Lab Equipment & Components: CRO, Multimeter, Function Generator, etc.	NA. These test equipment can be demonstrated online from any lab of ECE department or physical mode is only option.

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IKS101	IKS-I (INDIAN KNOWLEDGE SYSTEM – I)	L 1	T 0	P 0	1 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*: Dincharya & 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.

BAS102	ENGINEERING MATHEMATICS-II	L T P 3 0 0	3 credits

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.

DETAILED SYLLABUS

Unit-I

Ordinary Differential Equation of Higher Order: Linear differential equation of nth 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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BAS104	ENVIRONMENTAL SCIENCE	L T P 2 0 0	2 credits

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.

BEC104	**ESSENTIALS OF ELECTRONICS ENGINEERING**	**L T P** **3 0 0**	**3 credits**

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

BEE104	ESSENTIALS OF ELECTRICAL ENGINEERING	L T P 3 0 0	3 credits

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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BME106	ELEMENTS OF MECHANICAL ENGINEERING	L T P 3 0 0	3 credits

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 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. Vijayarahgavan, 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

BCS106	PRINCIPLES OF PROBLEM SOLVING USING ADVANCED C	L T P 3 0 0	3 credits

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:

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

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BCS108	CYBER SECURITY	L T P 2 0 0	2 credits

Course Outcome (CO)	
CO1	Learn the foundations of Cyber security and threat landscape.
CO2	To equip with the technical knowledge and skills needed to protect and defend against cyber threats.
CO3	To develop skills to plan, implement, and monitor cyber security mechanisms.
CO4	To expose students to governance, regulatory, legal, economic, environmental, social and ethical contexts of cyber security.
CO5	To expose students to responsible use of online social media networks.

DETAILED SYLLABUS

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.

Textbooks and Reference Books:

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.

BME180	EME LAB	L T P 0 0 1	1 credits

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, ultra-sonic 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.

BCS182	PROGRAMMING USING ADVANCED C LAB	L T P 0 0 1	1 credits

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

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BEC184	ESSENTIALS OF ELECTRONICS ENGINEERING LAB	L T P 0 0 1	1 credits

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

Part A:

6. Study of various types of Active & Passive Components based on their ratings.
7. Identification of various types of Printed Circuit Boards (PCB) and soldering techniques.
8. **PCB Lab:**
   a. Artwork & printing of a simple PCB
   b. Etching & drilling of PCB
9. Winding shop: Step down transformer winding of less than 5VA.
10. Soldering shop:
    - Soldering and desoldering of resistor in PCB
    - Soldering and desoldering of capacitor in PCB

Part B:

9. Study of Lab Equipment and Components:
    - CRO
    - Multimeter
    - Function Generator

- Power supply
- Active & Passive Components
- Bread Board

10. **PN Junction Diode:**
    - Characteristics of PN junction diode
    - Static and dynamic resistance measurement from graph
11. **Applications of PN Junction diode:**
    - Half & full wave rectifier
    - Measurement of Vrms,VdcV_{rms}, V_{dc}, and ripple factor
12. Characteristics of Zener diode:
    - V-I characteristics of zener diode
    - Graphical measurement of forward and reverse resistance
13. **Characteristic of BJT:** BJT in CE configuration
14. Study of **Operational Amplifier** as Adder and Subtractor
15. Verification of **Truth Table** of Various Logic Gates
16. Implementation of a given **Boolean function** using logic gates in both SOP and POS forms

Part C:

Part	Practical Component Description	Notes
Part A	PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB	This practical is not possible by virtual lab. It will be conducted only in physical mode.
Part B	Study of Lab Equipment & Components: CRO, Multimeter, Function Generator, etc.	NA. These test equipment can be demonstrated online from any lab of ECE department or physical mode is only option.

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BEE186	ESSENTIALS OF ELECTRICAL ENGINEERING LAB	L T P 0 0 1	1 credits

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.

11. **Verification of Kirchoff's laws**
12. **Measurement of power and power factor in:**
    i. a single phase AC series inductive circuit
    ii. study improvement of power factor using capacitor
13. **Study of phenomenon of resonance** in RLC series circuit and obtain resonant frequency.
14. **Connection and measurement of power consumption** of a fluorescent lamp (tube light).
15. **Measurement of power in 3-phase circuit** by two-wattmeter method and determination of power factor for star as well as delta connected load.
16. **Determination of parameters** of AC single phase series RLC circuit
17. **Determination of:**
    i. Voltage ratio
    ii. Polarity
    iii. Efficiency by load test of a single phase Transformer
18. **Determination of efficiency** of a DC shunt motor by load test
19. **To study running and speed reversal** of a three-phase induction motor and record speed in both directions.
20. **Demonstration of cut-out sections of machines**:

- DC machine
- Three phase induction machine
- Single-phase induction machine
- Synchronous machine

LSM 110	Life Skills & Mentoring - I	L T P 0 0 0	0 credits

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 graphic reasoning, Scientific temperament and Logical thinking.

Unit-IV

Group and Team Dynamics: Introduction to Groups: Composition, formation, Cycle, thinking, Clarifying expectations, Problem Solving, Consensus, Dynamics techniques, Group vs Team, Team Dynamics, and Virtual Teams. Managing team performance and managing conflicts, Entrepreneurship.

Unit-V

Leadership: Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions, Growing as a leader, turnaround leadership, managing diverse stakeholders, crisis management. **Types of Leadership**, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.

Suggested Readings:

1. Girish Batra, *Experiments in Leadership*, Chennai: Notion Press, 2018
2. Mitesh Khatri, *Awaken the Leader in You*, Mumbai: Jaico Publishing House, 2013
3. Carnegie Dale, *Become an Effective Leader*, New Delhi: Amaryllis, 2012
4. Hall, C.S., Lindzey, G. & Campbell, J.B. *Theories of Personality*, John Wiley & Sons, 1998
5. A. Nagraj, 1998, *Jeevan Vidya Ek Parichay*, Divya Path Sansthan, Amarkantak
6. P. L. Dhar RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers
7. A. N. Tripathy, 2003, *Human Values*, New Age International Publishers

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BAS201	Discrete Mathematics	L T P 2 0 0	2 credits

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 and References:

1. **Discrete Mathematics and Its Applications"** – Kenneth H. Rosen, McGraw-Hill Education
2. **"Discrete Mathematical Structures"** – Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, Pearson Education
3. **Elements of Discrete Mathematics"** – C.L. Liu, D.P. Mohapatra, McGraw-Hill

COURSE OUTCOMES:

CO1	Apply the principles of logic and proof techniques in mathematical reasoning.
CO2	Use set theory, relations, and functions to model and solve problems.

CO3	Analyze and solve problems using combinatorics and recurrence relations.
CO4	Represent and manipulate discrete structures such as graphs and trees.
CO5	Apply graph theory concepts in solving network-related problems.

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BAS203	Mathematics-III	L T P 3 0 0	3 credits

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 idea s of probability and random variables and various discrete and continuous probability distributions and their properties.
CO5	The statistical methods of studying data samples, hypothesis testing and statistical quality control, control charts and their properties.

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 I: 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

Statistical Techniques II: Probability and Distribution: Introduction, Addition and multiplication law of probability, Conditional probability, Baye's theorem, Random variables (Discrete and Continuous Random variable) Probability mass function and Probability density function, Expectation and variance, Discrete and Continuous Probability distribution: Binomial, Poission and Normal distributions.

Unit-V

Statistical Techniques III: Sampling, Testing of Hypothesis and Statistical Quality Control: Introduction , Sampling Theory (Small and Large) , Hypothesis, Null hypothesis, Alternative hypothesis, Testing a Hypothesis, Level of significance, Confidence limits, Test of significance of difference of means, T-test, F-test and Chi-square test, One way Analysis of Variance (ANOVA).Statistical Quality Control (SQC) , Control Charts , Control Charts for variables ($\bar{X}$ and R Charts), Control Charts for Variables (p, np and C charts).

Text books and References:

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
2. S. Ross: A First Course in Probability, 6th Ed., Pearson Education India, 2002.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. .T.Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi.

COURSE OUTCOMES:

CO1	Remember the concept of partial differential equation and to solve partial differential equations .
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 probability to evaluate probability distributions
CO5	Apply the concept of hypothesis testing and statistical quality control to create control charts .

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BCS205	DATA STRUCTURES	L T P 2 1 0	3 credits

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, 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.

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 etal, "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.

BEC209	DIGITAL ELECTRONICS	L T P 2 1 0	3 credits

Course Objectives:

CO1	Understand the concepts of various components
CO2	Understand concepts that underpin the disciplines of analog and digital electronic logic circuits.
CO3	Understand various Number systems and Boolean algebra, the Boolean expression using Boolean algebra and design it using logic gates.
CO4	Understand Design and implementation of combinational circuits.
CO5	Understand Design and develop sequential circuits.

Unit-I

Digital system and binary numbers: Signed binary numbers, binary codes, cyclic codes, Error detecting and correcting codes, hamming codes. Floating point representation Gate-level minimization: The map method up to five variable, don't care conditions, POS simplification, NAND and NOR implementation,Quine McClusky method (Tabular method).

Unit-II

Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary addersubtractor, decimal adder, binary multiplier, magnitude comparator, decoders, encoders, multiplexers, Half adder, Full adder, Half subtractor, Full subtractor, Parallel binary adder & subtractor, Multiplexer (MUX) and Demultiplexer (DEMUX), Encoder and Decoder, Parity generator and checker, Comparator.

Unit-III

Synchronous Sequential logic: Sequential circuits, storage elements: latches, flip flops, analysis of clocked sequential circuits, state reduction and assignments, design procedure. Registers and counters: Shift registers, ripple counter, synchronous counter, other counters.

Unit-IV

Memory and programmable logic: RAM ROM, PLA, PAL.

Design at the register transfer level: ASMs, design example, design with multiplexers.

Asynchronous sequential logic: Analysis procedure, circuit with latches, design procedure, reduction of state and flow table, race Free State assignment, hazards

Unit-V

Logic Families & IC Technology: Introduction to TTL and CMOS logic families, Characteristics: Speed, Power, Noise margin, Fan-in, Fan-out, Interfacing between TTL and CMOS.

Text books and References:

1. M. Morris Mano and M. D. Ciletti, "Digital Design", 4th Edition, Pearson Education
2. Introduction to Digital Logic Design, JP Hayes, PHI.
3. The Art of Digital Design: An Introduction to Top-Down Design, Franklin P. Prosser, PHI

COURSE OUTCOMES:

CO1	Understand the concepts of various components to design stable analog circuits
CO2	Represent numbers and perform arithmetic operations
CO3	Minimize the Boolean expression using Boolean algebra and design it using logic gates.
CO4	Analyze and design combinational circuit.
CO5	Design and develop sequential circuits.

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BCS113/ BCS213	AI FOR EVERYONE	L T P 2 1 0	3 credits

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.

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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-onProject Options: AI for Image Classification: Train an AI model to recognize objectsCreate 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.**

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.

BCS271	Data Structures Lab	L T P 0 0 4	2 credits

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.
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

BEC273	Digital Electronics Lab	L T P 0 0 4	2 credits

LIST OF EXPERIMENTS:

1. Study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
2. Design & realize a given function using K-maps and verify its performance.
3. To verify the operation of multiplexer & Demultiplexer
4. To verify the operation of comparator.
5. To verify the truth tables of S-R, J-K, T & D type flip flops.
6. To verify the operation of bi-directional shift register.
7. To design & verify the operation of 3-bit synchronous counter.
8. To design and verify the operation of synchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.
9. To design and verify the operation of asynchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.
10. To design & realize a sequence generator for a given sequence using J-K flip-flops.

BCS202	OOP's Concept using Java	L T P 3 0 0	3 credits

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.

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	Design and implement Java classes and objects to solve real-world problems using OOP principles.
CO2	Apply inheritance, polymorphism, encapsulation, and abstraction to create modular and maintainable Java programs.
CO3	Develop Java applications that effectively use exception handling and error management.
CO4	Utilize Java libraries and frameworks to build efficient, reusable, and scalable software solutions.
CO5	Demonstrate the ability to implement advanced OOP concepts, such as generics and design patterns, in Java-based projects.

BCS204	Computer Organization & Architecture	L T P 3 0 0	3 credits

Course Objectives:

CO1	How Computer Systems work & the basic principles.
CO2	Instruction Level Architecture and Instruction Execution.
CO3	The current state of art in memory system design.
CO4	How I/O devices are accessed and its principles.
CO5	Concepts of advanced pipelining techniques.

Unit-I

Basic Functional units of Computers: Functional units, basic Operational concepts, Bus structures. Software, Performance, Multiprocessors, Multicomputer. Data Representation: Signed number representation, fixed and floating point Representations.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms. Error detection and correction codes.

Unit-II

Register Transfer Language and Micro Operations: RTL- Registers, Register transfers, Bus and memory transfers. Micro operations: Arithmetic, Logic, and Shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Computer Registers, Computer instructions, Instruction cycle. Instruction codes, Timing and Control, Types of Instructions: Memory Reference Instructions, Input – Output and Interrupt.

Unit-III

Central Processing Unit organization: General Register Organization, Stack organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, Program Control, CISC and RISC processors **Control unit design:** Design approaches, Control memory, Address sequencing, micro program example, design of CU, Micro Programmed Control.

Unit-IV

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

Unit-V

Input –Output Organization: Peripheral devices, Input-output subsystems, I/O device interface, I/O Processor, I/O transfers–Program controlled, Interrupt driven, and DMA, interrupts and exceptions. I/O device interfaces – SCII, USB

Pipelining and Vector Processing: Basic concepts, Instruction level Parallelism Throughput and Speedup, Pipeline hazards.

Text books and References:

1. Computer Systems Architecture- M.Moris Mano, IIIrd Edition, Pearson/PHI.
2. Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGraw Hill.
3. Computer Architecture and Organization", 3rd Edition by John P. Hayes.
4. "Computer Organization and Architecture: Designing for Performance",10th Edition by William Stallings, Pearson Education.

COURSE OUTCOMES:

CO1	Student will learn the concepts of computer organization for several engineering applications.
CO2	Student will develop the ability and confidence to use the fundamentals of computer organization as a tool in the engineering of digital systems.
CO3	An ability to identify, formulate, and solve hardware and software computer engineering problems using sound computer engineering principle.

CO4	To impart the knowledge on micro programming.
CO5	Comprehend the concepts of advanced pipelining techniques.

BCS206	**Operating Systems**	**L T P** **3 0 0**	**3 credits**

Course Objectives:

CO1	Learn concepts of operating systems.
CO2	Study of various mechanisms involved in memory management techniques.
CO3	Develop skills in hardware and software integration for embedded systems with resource constraints.
CO4	Gaining knowledge of deadlocks prevention and detection techniques
CO5	The purpose of this course is to understand the mechanisms of the Operating Systems like Process Management, Process Synchronization etc.

Unit-I

Operating System: History, Types: Batch System, Time Sharing System, Real Time System Multiprogramming, Distributed System; Functions; Services; System calls; System programs; Virtual machines.
Process Management: Concept, States, Control Block.

Unit-II

CPU Scheduling: Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling.

Unit-III

Process Synchronization: Critical Section, Race Condition, Synchronization Hardware, Semaphores, Classical Problems of Synchronization.
Deadlocks: Characterization, Avoidance, Detection & Recovery.

Unit-IV

Memory Management: Contiguous Allocation, External and Internal, Fragmentation, Paging &Segmentation.
Virtual Memory: Concept, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Unit-V

File Management: Directory Structure, Allocation Methods; Contiguous; Linked;Indexed: Free
Space Management: Disk: Structure, Scheduling Algorithms, Disk Management.Linux: Basics of Linux, Introduction to Linux - History, Architecture, , Basic commands in Linux, Files and File Structure

Text books and References:

1.Silbershatz, A. and Galvin, P.,*Operating System Concept*,Addison- Wesley.

2.Tannenbaum, O, *Operating System Concept*, Addison-Wesley.

3. **Flynn, M.,** *Understanding Operating System*, Thomson Press.

4. **D M Dhamdhere,** "Operating Systems : A Concept based Approach", 2nd Edition,

COURSE OUTCOMES:

CO1	Understand the structure and functions of OS.
CO2	Learn about Processes, Threads and Scheduling algorithms.
CO3	Understand the principles of concurrency and Deadlocks.
CO4	Applying the basics of operating system along with the types and main functionalities of the operating system.
CO5	Applying the file management policies and disk structure along with scheduling algorithm for applying it to solve the disk scheduling problems.

BCS 210	**AI for Engineers**	**L T P** **3 0 0**	**3 credits**

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.

COURSE OUTCOMES:

CO1	To understand the fundamentals of Artificial Intelligence.
CO2	To design smart system using different search strategies of Artificial Intelligence.
CO3	To analyze various basic probability notations, game theory.
CO4	Implement Artificial Intelligence solutions using logical reasoning.

CO5	To apply various algorithms for Artificial Intelligence application development.

BCS280	**OOP's Concept Using Java Lab**	**L T P** **0 0 4**	**2 credits**

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.Encapulation
   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 matrixes?
5. WAP to print the multiplication of two matrixes?
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)

BCS282	Computer Organization & Architecture Lab	L 00	T 4	P	2 credits

List of Practicals:

1. Implementation of Flip-Flops: SR, JK, D, T, Master Slave
2. Implementation of counters, up and Down Counters
3. Implementation of shift registers SISO, SIPO, PISO, PIPO
4. Implementation of Binary Adder.
5. Implementation of Binary Subtractor
6. Implementation of Seven Segment Display.

BCS284	Operating System Lab	L T P 0 0 4	2 credits

List of Programs

1. Write a program in C to implement FCFS cpu scheduling.
2. Write a program in C to implement SJF cpu scheduling.
3. Write a program in C to implement Round robin cpu scheduling.
4. Write a program in C to implement Priority cpu scheduling.
5. Write a program in C to implement FIFO page replacement algorithm.
6. Write a program in C to implement LRU page replacement algorithm.
7. Write a program in C to implement OPTIMAL page replacement algorithm.
8. Simulate Banker's Algorithm for Dead Lock Avoidance.
9. Simulate Banker's Algorithm for Dead Lock Prevention.
10. Write a program in C to simulate FCFS disk scheduling algorithms
11. Write a program in C to simulate SCAN disk scheduling algorithms
12. Write a program in C to simulate C-SCAN disk scheduling algorithms.

BCS301	Design and Analysis of Algorithms	L 3	T 0	P 0	3 credits

Course Objectives:

CO1	To demonstrate performance of algorithms with respect to time and space complexity.
CO2	To explain graph and tree traversals
CO3	To explain the concepts greedy method and dynamic programming. Applying for several applications like knapsack problem, job sequencing with deadlines, and optimal binary search tree, TSP and so on respectively.
CO4	To Illustrate the methods of backtracking and branch bound techniques to solve the problems like n-queens problem, graph colouring and TSP respectively.
CO5	To familiarize the concepts of deterministic and non-deterministic algorithms.

UNIT - I

Introduction : Algorithms, Analyzing Algorithms, Complexity of Algorithms, Growth of Functions, Performance Measurements, Sorting and Order Statistics - Shell Sort, Quick Sort, Merge Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time.

UNIT – II

Advanced Data Structures: Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List

UNIT - III

Divide and Conquer with Examples Such as Sorting, Matrix Multiplication, Convex Hull and Searching.
Greedy Methods with Examples Such as Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman Ford Algorithms.

UNIT - IV

Dynamic Programming with Examples Such as Knapsack. All Pair Shortest Paths – Warshal's and Floyd's Algorithms, Resource Allocation Problem. Backtracking, Branch and Bound with Examples Such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets.

UNIT – V

NP-Hard AND NP-complete problem: Basic concepts, non-deterministic algorithms, NP-hard and NP-complete classes, Cook's theorem. String Matching, Approximation Algorithms and Randomized Algorithm.

Text books and References:

1. Ellis Horowitz, Satraj Sahni, Rajasekharam (2007), Fundamentals of Computer Algorithms, 2nd edition, University Press, New Delhi.
2. R. C. T. Lee, S. S. Tseng, R.C. Chang and T. Tsai (2006), Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, India.
3. Allen Weiss (2009), Data structures and Algorithm Analysis in C++, 2nd edition, Pearson education, New Delhi.
4. Aho, Ullman, Hopcroft (2009), Design and Analysis of algorithms, 2nd edition, Pearson education, New Delhi

COURSE OUTCOMES:

CO1	Define various Time and Space complexities of various algorithms
CO2	Understand Tree Traversal method and Greedy Algorithms
CO3	Apply Dynamic Programming concept to solve various problems
CO4	Apply Backtracking, Branch and Bound concept to solve various problems

CO5	Analyze different performance analysis methods for non-deterministic algorithms

BCS303	**DATA BASE MANAGEMENT SYS-TEM**	**L T P** **3 0 0**	**3 credits**

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.

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.

Text books and References:

5. Korth, H.F.,Silbertz, A., Database Concepts, McGraw Hill.

6. 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.

BCS305	Compiler Design	L T P 2 0 0	2 credits

Course Objectives:

CO1	To understand the various phases in the design of a compiler.
CO2	To understand the design of top-down and bottom-up parsers.
CO3	To understand syntax directed translation schemes.
CO4	To introduce LEX and YACC tools.
CO5	To learn to develop algorithms to generate code for a target machine.

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.

Text books and References:

1 .Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education

2 .K. Muneeswaran,Compiler Design,First Edition,Oxford University Press

3. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, McGraw-Hill,2003.

4 .Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.

5. V Raghvan, "Principles of Compiler Design", McGraw-Hill,

6. Kenneth Louden," Compiler Construction", Cengage Learning.

7. Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson Education

COURSE OUTCOMES:

CO1	Define knowledge of different phases and passes of the compiler and also able to use the compiler tools like LEX, YACC, etc. Students will also be able to design different types of compiler tools to meet the requirements of the realistic constraints of compilers.
CO2	Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.
CO3	Apply the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.
CO4	Acquire knowledge about run time data structure like symbol table organization and different
CO5	Analyze the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.

BLA307	Professional Law and Ethics	L T P 2 0 0	2 credits

Course Objectives:

CO1	Students will understand the importance of Values and Ethics in their Personal lives and professional careers
CO2	To understand the design of top-down and bottom-up parsers.
CO3	To understand syntax directed translation schemes.
CO4	To learn profession ethics
CO5	To learn about IPR.

Unit-I

Professional Practice – Respective roles of various stakeholders: Government(constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards);Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)

Unit-II

Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of- the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

Unit-III

General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions &Specifications; Critical /" Red Flag"conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations.

Unit-IV

Time extensions & Force Majeure: Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public-Private Partnerships; International Commercial Terms;

Unit-V

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996;UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Text books and References:

1 . B.S. Patil, Legal Aspects of Building and Engineering Contracts,1974.

2. The National Building Code, BIS,2017

3. Dutt (1994), Indian Contract Act, Eastern Law House

4. Anson W.R. (1979), Law of Contract, Oxford University Press.

5. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration

6. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co

COURSE OUTCOMES:

CO1	Define the basic purpose of profession, professional ethics and various moral and social issues.
CO2	Understand of professional rights and responsibilities of a Engineer, safety and risk benefit analysis of a Engineer
CO3	Apply knowledge of various roles of Engineer In applying ethical principles at.
CO4	Understand Professional Ethical values and contemporary issues
CO5	Analyse excelling in competitive and challenging environment to contribute to industrial growth.

BCS371	Design and Analysis of Algorithms Lab	L T P 0 0 4	2 credits

List of Programs to be implemented:

1. Program for Quick Sort
2. Program for Merge Sort
3. Program for Heap sort

4 Program for Insertion sort

5 Program for counting sort

6. Program for Radix sort

7 Program for Knapsack Problem

8 Program for prims algorithm

9 Program for Kruskals Algorithm

10 Program for k-th element to find minimum and maximum

11. Program for Warshal's Algorithm

12. Program for Dijkstra's Algorithm

BCS373	Database Management System Lab	L T P 0 0 4	2 credits

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).

BCS302	COMPUTER NETWORKS	L T P 2 0 0	2 credits

Course Objectives:

CO1	Build an understanding of the fundamental concepts of computer networking.
CO2	Familiarize the student with the basic taxonomy and terminology of the computer networking area.

CO3	Introduce the student to advanced networking concepts, preparing the student for entry Advanced Courses in computer networking.
CO4	Allow the student to gain expertise in some specific areas of networking such as the design and Maintenance of individual networks.
CO5	To understand about electronic mail, FTP, WWW, HTTP, Multimedia and Network security.

Unit-I

Introduction: Introduction to networks, Internet, Protocols and Standards, The OSI model, Layers in OSI Model, TCP/IP Suite, Addressing, Analog & Digital Signals
Physical Layer: Physical Layer Introduction, Digital Transmission, multiplexing, Transmission media, Circuit switched networks, Datagram networks, Virtual circuit networks, Switch& telephone network

Unit-II

Data link layer: Introduction, Block coding, Cyclic codes, checksum, Framing, Flow and error control, Noiseless & Noisy channels, HDLC, Point to point protocols
Media Access Sub Layer: Random Access, Controlled access, channelization, IEEE Standards.

Unit-III

Ethernet, Fast Ethernet, Giga bit Ethernet, wireless LANS, Connecting LANs, Backbone networks,Virtual LANs, Wireless WANs, SONET, frame relay, ATM.

Unit-IV

Network Layer: Logical addressing, internetworking, tunneling, address mapping, ICMP, IGMP,Forwarding, Unicast routing protocols, multicast routing protocols.

Unit-V

Transport Layer: Process to process delivery, TCP and UDP protocols, SCTP, Data traffic, congestion, Congestion Control, QoS, integrated services, Differentiated services, QoS in Switched networks.
Application Layer: Domain name space, DNS in internet, Electronic Mail, FTP, WWW, HTTP,SNMP, Multi Media, Network Security.

Text books and References:

1. Data Communications and Networking- Behrouz A Forouzan Fourth Edition TMH,2006.
2. Computer Networks- Andrew S Tanenbaum, 4th Edition, Pearson Education
3. An Engineering approach to computer Networks- S. Keshav, 2nd Edition, Pearson Education

4. Computer and communication Networks- Nader F Mir, Pearson Education
5. Data and Computer Communications, G.S. Hura and M. Singhal, CRC Press, Taylor and Francis Group.
6. Data Communications and Computer Networks, P.C. Gupta, PHI

COURSE OUTCOMES:

CO1	Define good understanding of the OSI Reference Model and in particular have a good knowledge of Layers 1-3.
CO2	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies
CO3	Understand and identify deficiencies in existing protocols, and then go onto formulate new and better protocols
CO4	Apply an understanding of the issues surrounding Mobile and WirelessNetworks.
CO5	Evaluate a working knowledge of datagram and internet socket programming.

BCS304	**Cryptography**	**L T P** **2 0 0**	**2 credits**

Course Objectives:

CO1	Explain the importance and application of each of confidentiality, integrity, authentication and availability.
CO2	Understand various cryptographic algorithms and basic categories of threats to computers

	and networks.
CO3	Describe the enhancements made to IPv4 by IPSec.
CO4	Understand Intrusions, intrusion detection, Web security and Firewalls.

Unit-I

Introduction of Cryptography: Introduction To security: Attacks, Services and Mechanisms, Conventional Encryption: Conventional Encryption Model, Steganography, Block Cipher Principles, DES Standard, DES Strength, Differential and Linear Cryptanalysis, Block Cipher Modes of Operations. Double DES, Triples DES, Blowfish, International Data Encryption Algorithm, Placement of Encryption Function, Key Distribution, Random Number Generation and Traffic confidentiality

Unit-II

Number Theory and Public Key Encryption: Fermat's and Euler's Theorem, Primality Testing, Chinese Remainder Theorem, Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm.

Unit-III

Key Management: Key Management scenario in secret key and public key cryptography, Diffie Hellman Key Exchange algorithm, OAKLEY and ISAKMP key management protocol, Elliptic Curve Cryptography

Unit-IV

Hash Functions: Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Function Birthday Attacks, Security of Hash Function and MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures, Digital Signature Standard (DSS).

Unit-V

Network and System Security: Authentication Applications: Kerberos, X.509, Electronic Mail Security, Pretty Good Privacy (PGP),S/Mine Security: Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction (SET), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.

Text books and References:

1. Cyber security Essentials, Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, Sybex, October 2018
2. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press
3. Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, B.B. Gupta, D.P. Agrawal, Haoxiang Wang, CRC Press, 2018

COURSE OUTCOMES:

CO1	Define and Identify the various attacks and its issues.
CO2	Understand the usage of cryptographic algorithms for avoiding basic level threats.
CO3	Analyse the issues involved in Integrity, Authentication and Key Management techniques.
CO4	The importance of user authentication and Kerberos concepts.
CO5	Acquire the knowledge of network and system security domain.

BCS306	Digital Image Processing	L T P 2 0 0	2 credits

Course Objectives:

CO1	To learn the advanced concepts of image processing and its implementation.
CO2	Enhance the visual quality of given grey/color image using well known transformations and filters.
CO3	Distinguish between lossy and lossless image compression prototypes.
CO4	Demonstrate the use of MATLAB to create correlative image processing applications

Unit-I

Introduction and Fundamentals Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization. Image Enhancement i Frequency Domain Fourier Transform and the Frequency Domain.

Unit-II

Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering i Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Lowpass Filters; Sharpening Frequency Domain Filters – Gaussian High pass Filters; Homomorphic Filtering.

Unit-III

Image Enhancement in Spatial Domain Introduction; Basic Gray Level Functions – Piecewise-Linea Transformation Functions: Contrast Stretching; Histogram Specification.

Unit-IV

Histogram Equalization; Local Enhancement: Enhancement using Arithmetic/Logic Operations – Imag Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter Sharpening – The Laplacian.

Unit-V

Image Restoration A Model of Restoration Process: Noise Models, Restoration in the presence of Noise only Spatial Filtering – Mean Filters: Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Media Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering – Bandpass Filters; Minimum Mean-square Error Restoration.

Text books and References:

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.
2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons, NY.
3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall, Upper Saddle River, NJ. E

COURSE OUTCOMES:

CO1	Define and acquire the knowledge of soft computing and hard computing
CO2	Understand to develop skill in soft computing methodology
CO3	To acquire the knowledge of the fuzzy Neural network and Genetic Language.
CO4	To analyze and optimized the problem of real-life applications
CO5	Acquire and able to explain Max and Min filters

BCS380	Computer Networks Lab	L T P 0 0 4	2 credits

List of Programs to be Implemented:

1. Study of different network devices in detail.
2. Study of different types of network cables and practically implement
3. The cross-wired cable and straight through cable using clamping tool.
4. Study of basic network command and Network configuration commands
5. Study of network IP.
6. Implement the concept of VLAN using Network Simulator.
7. Implement the concept of static routing.

8. Implement the concept of dynamic routing (RIP, OSPF, BGP).

9. Packet capture and header analysis by wire-shark (TCP,UDP,IP)

10. Configure a network topology using packet tracer software.

BCS401	Engineering Research Methodology	L T P 2 0 0	2 credits

Course Objectives:

CO1	To understand the fundamental concepts of research methodology and its significance in engineering.
CO2	To familiarize students with various research designs, data collection techniques, and sampling methods..
CO3	To equip students with statistical tools and data analysis techniques required for research.

CO4	To develop skills in technical writing, research ethics, and intellectual property rights, to enable students to prepare research proposals, reports, and publications.
CO5	To introduce emerging trends and technological advancements in research methodology.

Unit-I

Introduction to Research : Definition and Objectives of Research, Types of Research: Basic, Applied, Quantitative, Qualitative, Research Process and its Importance in Engineering, Characteristics of Good Research, Research Ethics and Integrity.

Unit-II

Research Problem Identification: Defining the Research Problem, Literature Review: Sources, Techniques, and Critical Analysis, Research Gap Identification, Formulating Research Objectives and Hypotheses.

Unit-III

Research Design & Methodology: Research Design: Experimental, Descriptive, Case Study, Survey, Data Collection Methods: Primary & Secondary Sources, Sampling Techniques: Probability & Non-Probability Sampling, Measurement and Scaling Techniques

Unit-IV

Data Analysis and Interpretation: Statistical Techniques: Descriptive and Inferential Statistics, Regression, Correlation, and Hypothesis Testing, Introduction to Software Tools (SPSS, R, MATLAB, Python etc.), Experimental Design and Simulation in Research, Data Validation and Interpretation Techniques, **Technical Writing and Research Ethics:** Research Paper Structure and Writing Techniques, Referencing Styles: APA, IEEE, MLA, and Chicago, Plagiarism: Types, Detection, and Avoidance

Unit-V

Intellectual Property Rights (IPR) and Patents: Research Funding Agencies and Grant Proposal Writing, Ethics in Engineering Research, Research Proposal Preparation, Writing Thesis/Dissertation and Technical Reports, Presentation Skills: Oral and Poster Presentations, Emerging Trends in Research Methodology, Role of Artificial Intelligence & Machine Learning in Research, Big Data and Cloud Computing in Research, Research Collaboration and Funding Opportunities

Text books and References:

7. **C.R. Kothari & Gaurav Garg** – *Research Methodology: Methods and Techniques*, New Age International Publishers, 4th Edition, 2019.
8. **Panneerselvam R.** – *Research Methodology*, PHI Learning, 2nd Edition, 2014."Focuses on both qualitative and quantitative research methods".

9. **John W. Creswell & J. David Creswell** – *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, SAGE Publications, 5th Edition, 2018.A detailed guide on different research approaches and methodologies.
10. **Kumar R.** – *Research Methodology: A Beginner's Guide*, Pearson Education, 4th Edition, 2019.Ideal for students new to research methods and techniques.
11. **Donald R. Cooper & Pamela S. Schindler** – *Business Research Methods*, McGraw Hill, 12th Edition, 2018.Explains research concepts with real-world case studies.

COURSE OUTCOMES:

CO1	Define fundamental research principles, methodologies, and processes in engineering research.
CO2	Apply statistical techniques and data analysis tools for meaningful interpretation of research data.
CO3	Demonstrate proficiency in technical writing, referencing styles, and ethical research practices.
CO4	Analyze and prepare well-structured research proposals, thesis reports, and scholarly publications..
CO5	Utilize modern research tools, artificial intelligence, and big data techniques to enhance research quality.
CO5	Understand the role of theory in the application of conceptual frameworks in the research process.

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BCS402	**Artificial Intelligence and Expert Systems**	**L T P** **3 0 0**	**3 credits**

Course Objectives:

CO1	Introduce the foundational concepts and history of AI..
CO2	Explore problem-solving techniques and algorithm design.
CO3	Examine various logic systems and their applications in AI. Understand the architecture and functioning of expert systems.
CO4	Introduce planning problems and state-space search techniques..
CO5	Introduce various learning paradigms, including supervised, unsupervised, and reinforcement learning..

Unit-I

Introduction to Artificial Intelligence: Foundations of AI: Understanding the history, definitions, and applications of AI, **Problem-Solving Techniques**: Exploring various methods to approach and solve complex problems, **Algorithm Design**: Studying the characteristics and development of efficient algorithms.

Unit-II

Knowledge Representation and Reasoning: Logic Systems: Delving into propositional and predicate logic, including clause form and unification algorithms, Expert Systems: Examining the architecture and examples of rule-based and non-monotonic expert systems, Natural Language Processing (NLP): Introducing basic tasks and challenges in NLP.

Unit-III

Planning and Decision Making: Planning Problems: Understanding state-space search and partial-order planning, Planning Graphs: Utilizing propositional logic in planning and analyzing various approaches, Hierarchical and Conditional Planning: Exploring advanced planning techniques, including multi-agent planning.

Unit-IV

Machine Learning:Learning Paradigms: Introduction to supervised, unsupervised, and reinforcement learning, Algorithm Implementation: Applying machine learning algorithms to real-world problems, Deep Learning: Understanding neural networks and their applications in AI.

Unit-V

Advanced Topics in AI: Robotic Process Automation: Studying the automation of repetitive tasks using AI, Augmented Reality (AR) and Virtual Reality (VR) Simulation: Exploring the integration of AI in AR/VR technologies, Big Data Analytics: Analysing large datasets to extract meaningful insights using AI tools.

Text books and References:

1. "Artificial Intelligence: A Modern Approach" by Stuart J. Russell and Peter Norvig
2. "Artificial Intelligence" by Elaine Rich and Kevin Knight
3. "Introduction to AI and Expert Systems" by Dan W. Patterson
4. Pattern Recognition and Machine Learning" by Christopher M. Bishop
5. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto

COURSE OUTCOMES:

CO1	Understand the evolution and applications of AI. Apply problem-solving methods to complex scenarios.
CO2	Apply propositional and predicate logic to AI problems.
CO3	Formulate and solve planning problems using appropriate methods.
CO4	Analyze the role of AI in automating complex tasks through Robotic Process Automation Develop applications that combine AI with AR and VR technologies.
CO5	Understand the integration of AI in these advanced technologies.

BCS404	Data Compression	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To introduce the fundamental concepts of data compression and its importance.
CO2	To understand lossless and lossy compression techniques.
CO3	To explore various data compression algorithms used in text, image, audio, and video compression.
CO4	To study entropy coding, dictionary-based methods, and wavelet-based compression.
CO5	To analyze real-world applications of data compression in storage and communication systems.

Unit Ⅰ

Introduction to Data Compression: Overview of Data Compression, Need for Compression, Types of Compression (Lossless vs. Lossy), Measures of Compression (Compression Ratio, Redundancy), Run-Length Encoding (RLE), Statistical Modeling for Compression.

Unit Ⅱ

Entropy Encoding and Dictionary-Based Methods: Shannon-Fano Algorithm, Huffman Coding, Arithmetic Coding, Dictionary-Based Compression (LZ77, LZ78, LZW), Burrows-Wheeler Transform (BWT).

Unit Ⅲ

Lossy Compression Techniques: Transform Coding (Discrete Cosine Transform, Discrete Wavelet Transform), Quantization Methods, Vector Quantization, Predictive Coding (Delta Modulation, Adaptive Predictive Coding).

Unit Ⅳ

Image, Audio, and Video Compression: JPEG and JPEG2000 Image Compression, GIF and PNG Compression, MP3 and AAC Audio Compression, MPEG Video Compression (MPEG-1, MPEG-2, MPEG-4, H.264), Introduction to HEVC (H.265).

Unit V

Applications and Future Trends in Data Compression: Data Compression in File Storage, Cloud Computing, Video Streaming, and Networking, Compression in Big Data and IoT, Emerging Trends in Data Compression.

Text books and References:

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kaufmann.
2. David Salomon, “Data Compression: The Complete Reference”, Springer.
3. Mark Nelson, “The Data Compression Book”, M&T Books.
4. Toby Berger, “Rate Distortion Theory”, Wiley.

Course Outcomes:

CO1	Understand the fundamentals of data compression and redundancy reduction.
CO2	Apply lossless and lossy compression techniques for different types of data.

CO3	Analyze entropy coding, dictionary-based, and transform-based compression methods.
CO4	Explain image, audio, and video compression standards.
CO5	Explore real-world applications of data compression in networking, multimedia, and storage.

Electives:

BCS311	Fuzzy Logic	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts of fuzzy logic and its applications.
CO2	Understand the mathematical foundations of fuzzy sets and fuzzy relations.
CO3	Explore fuzzy inference systems and fuzzy rule-based systems.
CO4	Apply fuzzy logic techniques in real-world scenarios, including decision-making and control systems.
CO5	Analyze and compare fuzzy systems with traditional binary logic systems.

Unit Ⅰ

Introduction to Fuzzy Logic: Classical Sets vs. Fuzzy Sets: Definitions and Differences, Properties of Fuzzy Sets: Membership Functions, Basic Operations, Fuzzy Complements, Fuzzy Intersections, and Fuzzy Unions, Fuzzy Relations: Cartesian Product, Composition, and Properties, Applications of Fuzzy Logic in Engineering and AI.

Unit Ⅱ

Fuzzy Systems and Membership Functions: Membership Functions: Types and Characteristics, Linguistic Variables and Hedges, Fuzzy Logic Operators and Aggregation, Fuzzification and Defuzzification Techniques, Fuzzy Decision Making and Approximate Reasoning

Unit Ⅲ

Fuzzy Inference Systems: Introduction to Fuzzy Inference Systems (FIS), Mamdani and Sugeno Fuzzy Models, Rule-Based Fuzzy Systems, Fuzzy IF-THEN Rules and Rule Aggregation, Case Studies and Applications in Control Systems

Unit Ⅳ

Fuzzy Control Systems: Fuzzy Controllers: Design and Implementation, Adaptive Fuzzy Systems, Stability and Performance Analysis of Fuzzy Controllers, Applications in Industrial Automation, Robotics, and Pattern Recognition

Unit Ⅴ

Advanced Topics and Applications: Hybrid Fuzzy Systems: Neuro-Fuzzy and Genetic Fuzzy Approaches, Fuzzy Clustering and Pattern Recognition, Fuzzy Optimization Techniques, Case Studies in Decision-Making and Expert Systems

Textbooks & References:

1. J. J. Buckley & E. Eslami, "An Introduction to Fuzzy Logic and Fuzzy Sets," Springer.
2. George J. Klir & Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications," Prentice Hall.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," Wiley.
4. Lotfi A. Zadeh, "Fuzzy Sets and Applications," Wiley.
5. H. J. Zimmermann, "Fuzzy Set Theory and Its Applications," Springer.

Course Outcomes:

CO1	Understand the theoretical foundations of fuzzy logic and fuzzy sets.
CO2	Implement fuzzy set operations and analyze their properties.
CO3	Design and apply fuzzy inference systems for various applications.
CO4	Develop fuzzy controllers for decision-making and control processes..
CO5	Evaluate the advantages and limitations of fuzzy logic compared to conventional systems.

BCS313	Soft Computing	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts of soft computing and its applications.
CO2	**CO2**: Understand the mathematical foundations of fuzzy logic, neural networks, and genetic algorithms.
CO3	Explore various soft computing techniques for problem-solving.
CO4	Apply soft computing techniques in real-world scenarios, including optimization and decision-making.
CO5	Analyze and compare soft computing approaches with traditional computational techniques.

Unit Ⅰ

Introduction to Soft Computing: Definition and Importance of Soft Computing, Comparison of Soft Computing and Hard Computing, Components of Soft Computing: Fuzzy Logic, Neural Networks, and Genetic Algorithms, Applications of Soft Computing in Engineering and AI

Unit Ⅱ

Fuzzy Logic and Fuzzy Systems: Classical Sets vs. Fuzzy Sets: Definitions and Differences, Properties of Fuzzy Sets: Membership Functions, Basic Operations, Fuzzy Logic Operators and Aggregation, Fuzzification and Defuzzification Techniques, Fuzzy Decision Making and Approximate Reasoning

Unit Ⅲ

Artificial Neural Networks (ANN): Introduction to Neural Networks, Biological Neurons vs. Artificial Neurons, Learning Techniques: Supervised, Unsupervised, and Reinforcement Learning, Backpropagation Algorithm, Applications of Neural Networks in Pattern Recognition and Data Analysis

Unit Ⅳ

Genetic Algorithms and Evolutionary Computing: Fundamentals of Genetic Algorithms, Genetic Operators: Selection, Crossover, and Mutation, Convergence of Genetic Algorithms, Hybrid Soft Computing Techniques: Neuro-Fuzzy and Genetic-Fuzzy Approaches, Applications in Optimization Problems

Unit Ⅴ

Advanced Topics and Applications: Swarm Intelligence and Evolutionary Strategies, Hybrid Soft Computing Techniques, Case Studies in Machine Learning and Control Systems, Real-world Applications in Decision-Making, Robotics, and Data Mining

Textbooks & Refernces:

1. J. S. R. Jang, C. T. Sun & E. Mizutani, "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence," Pearson.
2. S. N. Sivanandam & S. N. Deepa, "Principles of Soft Computing," Wiley.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," Wiley.
4. S. Rajasekaran & G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications," PHI Learning.
5. D. E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning," Addison-Wesley.

Course Outcomes:

CO1	Understand the theoretical foundations of soft computing techniques.
CO2	Implement fuzzy set operations, neural networks, and genetic algorithms
CO3	Design and apply soft computing methods for various applications.
CO4	Develop hybrid soft computing models for optimization and control
CO5	Evaluate the advantages and limitations of soft computing compared to traditional approaches.

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BCS315	**Discrete Mathematics**	**L-T-P** **3-0-0**	**Credits: 3**

Course Objectives:

CO1	Introduce the fundamental concepts of discrete mathematics and its applications.
CO2	Understand the mathematical foundations of logic, set theory, relations, and functions.
CO3	Explore graph theory, combinatorics, and recurrence relations.
CO4	Apply discrete mathematical techniques in problem-solving and algorithm design.
CO5	Analyze and compare various discrete mathematical structures in computing.

Unit Ⅰ

Set Theory and Logic: Fundamentals of Sets, Subsets, Operations, and Propertie, Propositional Logic: Statements, Logical Connectives, Truth Tables, Predicate Logic: Quantifiers, Rules of Inference, Mathematical Induction and Proof Techniques

Unit Ⅱ

Relations and Functions: Relations: Properties, Equivalence Relations, Partial Orders, Functions: Types, Composition, Inverse Function, Pigeonhole Principle and Inclusion-Exclusion Principle, Generating Functions and Recurrence Relations

Unit Ⅲ

Combinatorics and Counting Techniques: Basics of Counting: Permutations and Combinations, Binomial Theorem and Pascal's Triangle, Principle of Inclusion-Exclusion, Recurrence Relations: Solving Linear Recurrence Relations

Unit Ⅳ

Graph Theory: Basic Definitions and Terminologies in Graph Theory, Types of Graphs: Simple, Directed, Weighted, Graph Traversal Algorithms: BFS and DFS, Shortest Path Algorithms: Dijkstra's and Floyd-Warshall Algorithm, Eulerian and Hamiltonian Graphs

Unit Ⅴ

Algebraic Structures and Applications: Groups, Monoids, and Semigroups, Rings, Fields, and Lattices, Boolean Algebra and Logic Gates, Applications in Computer Science and Cryptography.

Textbooks & Refernces:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications," McGraw Hill.
2. C. L. Liu & D. P. Mohapatra, "Elements of Discrete Mathematics," McGraw Hill.
3. Richard Johnsonbaugh, "Discrete Mathematics," Pearson Education.
4. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science," PHI.

5. J. P. Tremblay & R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science," McGraw Hill.

Course Outcomes:

CO1	Understand the theoretical foundations of discrete mathematics.
CO2	Implement set operations, logic principles, and proof techniques.
CO3	Apply combinatorial and counting techniques in problem-solving.
CO4	Develop and analyze graph-based models for computing applications.
CO5	Evaluate and utilize algebraic structures in computing and cryptography.

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BCS317	**Graph Theory**	**L-T-P** **3-0-0**	**Credits: 3**

Course Objectives:

CO1	Introduce the fundamental concepts of graph theory and its applications.
CO2	Understand the mathematical foundations of graphs, trees, and connectivity.
CO3	Explore graph algorithms and their computational complexities
CO4	Apply graph theory techniques in real-world problem-solving and network

	analysis
CO5	Analyze and compare different graph structures and their properties

Unit-I

Introduction to Graph Theory: Basic Definitions: Graphs, Subgraphs, Degrees, and Isomorphism, Types of Graphs: Simple, Multigraphs, Directed, Weighted, Graph Representation: Adjacency Matrix and Adjacency List, Incidence and Degree, Regular Graphs

Unit-II

Trees and Connectivity: Definition and Properties of Tree, Rooted and Binary Tree, Spanning Trees: Prim's and Kruskal's Algorithm, Connectivity: Vertex and Edge Connectivity, Network Flows and Max-Flow Min-Cut Theorem

Unit-III

Graph Traversal and Paths: Eulerian and Hamiltonian Graphs, Graph Traversal: Breadth-First Search (BFS) and Depth-First Search (DFS), Shortest Path Algorithms: Dijkstra's and Bellman-Ford Algorithm, Applications of Graph Traversal in AI and Networking

Unit-IV

Planarity and Coloring: Planar Graphs and Euler's Formula, Kuratowski's Theorem, Graph Coloring: Chromatic Number and Chromatic Polynomials, Applications of Graph Coloring in Scheduling and Resource Allocation

Unit-V

Advanced Topics and Applications: Matching and Covering in Graphs, Graph Isomorphism and Automorphisms, Spectral Graph Theory, Applications in Social Networks, Computer Science, and Bioinformatics.

Textbooks and References:

1. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science," PHI.
2. Douglas B. West, "Introduction to Graph Theory," Pearson Education.
3. Reinhard Diestel, "Graph Theory," Springer.
4. Harary F., "Graph Theory," Narosa Publishing.
5. John Clark & Derek Allan Holton, "A First Look at Graph Theory," World Scientific.

Course Outcomes:

CO1	Understand the theoretical foundations of graph theory.
CO2	Implement and analyze graph-based algorithms
CO3	Apply graph traversal and connectivity concepts in problem-solving.
CO4	Develop solutions for real-world applications using graph theory.
CO5	Evaluate and compare different graph structures and their computational properties.

BCS319	System Programming	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts of system programming and its role in computer science.
CO2	Understand the design and implementation of system software such as assemblers, linkers, and loaders.
CO3	Explore various system software tools, including compilers, interpreters, and operating systems.
CO4	Apply system programming techniques for process management, memory management, and file systems.
CO5	Analyze system software performance and optimization techniques.

Unit-I

Introduction to System Programming: Overview of System Software and Application Software, System Programming vs. Application Programming, Language Processors: Assemblers, Compilers, and Interpreters, Fundamentals of Machine and Assembly Language.

Unit-II

Assemblers and Loaders: Design of an Assembler: Single-Pass and Multi-Pass Assemblers, Macro Processors and Macro Expansion, Linkers and Loaders: Static and Dynamic Linking, Relocation and Symbol Resolution in Linking.

Unit-III

Compilers and Interpreters: Phases of Compilation: Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation and Code Optimization, Code Generation and Machine-Dependent Optimization, Interpreters vs. Compilers: Design and Applications.

Unit-IV

Operating System Components and Process Management: Introduction to Operating System Components, Process Management: Process Scheduling and Context Switching, Memory Management: Paging and Segmentation, File Systems and I/O Systems.

Unit-V

Advanced Topics and Applications: Device Drivers and System Calls, Virtual Machines and System Security, Performance Optimization of System Software, Case Studies: Unix/Linux System Programming, Windows System Programming.

Textbooks and References:

1. Leland L. Beck, "System Software: An Introduction to Systems Programming," Pearson Education.
2. John J. Donovan, "System Programming," McGraw Hill.
3. D. M. Dhamdhere, "Systems Programming and Operating Systems," Tata McGraw Hill.
4. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools," Pearson Education.
5. Andrew S. Tanenbaum, "Modern Operating Systems," Pearson Education.

Course Outcomes:

CO1	Understand the role and importance of system programming.
CO2	Develop assemblers, loaders, and linkers for system software development.
CO3	Implement compilers and interpreters for programming language translation.
CO4	Apply system programming techniques for process and memory management.
CO5	Analyze and optimize system software performance.

BCS310	Software Testing	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts of software testing and quality assurance
CO2	Understand various testing techniques, including functional and non-functional testing.
CO3	Explore test automation tools and strategies for efficient software validation.

CO4	Apply test management techniques to ensure software reliability and maintainability.
CO5	Analyze different software testing methodologies and their applications in real-world scenarios

Unit-I

Introduction to Software Testing: Basics of Software Testing and Quality Assurance, Software Development Life Cycle (SDLC) and Testing Life Cycle, Testing Principles, Types of Testing, and Testing Levels, Static and Dynamic Testing Techniques.

Unit-II

Functional and Structural Testing: Black Box Testing: Equivalence Partitioning, Boundary Value Analysis, White Box Testing: Statement, Branch, and Path Coverage, Unit Testing, Integration Testing, System Testing, Regression Testing and Smoke Testing

Unit-III

Test Automation and Tools: Test Automation vs. Manual Testing, Automation Testing Tools: Selenium, JUnit, TestNG, Writing Test Scripts and Test Case Design, Performance Testing and Load Testing with JMeter

Unit-IV

Test Management and Defect Tracking: Test Planning and Strategy Development, Defect Life Cycle and Bug Tracking Tools (JIRA, Bugzilla), Test Metrics and Reporting, Risk-Based Testing and Cost of Quality.

Unit-V

Advanced Topics and Industry Trends: Security Testing and Penetration Testing, Usability Testing and Accessibility Testing, Agile and DevOps Testing Methodologies, Case Studies on Real-World Software Testing Applications.

Textbooks and References:

1. Glenford J. Myers, "The Art of Software Testing," Wiley.
2. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach," CRC Press.
3. Aditya P. Mathur, "Foundations of Software Testing," Pearson Education.
4. Cem Kaner, Jack Falk, Hung Quoc Nguyen, "Testing Computer Software," Wiley.
5. Rex Black, "Managing the Testing Process," Wiley.

Course Outcomes:

CO1	Understand software testing principles and methodologies.
CO2	Develop functional and structural test cases for software validation.
CO3	Utilize automation tools to enhance testing efficiency
CO4	Implement defect tracking and test management techniques.
CO5	Analyze and apply modern testing methodologies in software development.

BCS312	Multimedia systems	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts of multimedia systems and their applications.
CO2	Understand different multimedia components, including text, images, audio, and video.
CO3	Explore multimedia storage, compression techniques, and retrieval methods.
CO4	Apply multimedia tools and techniques for content creation and editing.
CO5	Analyze the impact of multimedia in various domains such as education, entertainment, and business.

Unit-I

Introduction to Multimedia Systems: Definition and Components of Multimedia, Multimedia Applications and Evolution, Hardware and Software Requirements for Multimedia, Multimedia and Hypermedia Concepts.

Unit-II

Multimedia Components and Processing: Text and Image Processing: Formats, Editing, and Storage, Audio: Characteristics, File Formats, and Compression, Video: Formats, Frame Rates, Compression Techniques, Animation Techniques and Tools.

Unit-III

Multimedia Storage and Compression: Data Representation and Multimedia Databases, Image Compression: JPEG, PNG, GIF, Audio Compression: MP3, AAC, WAV, Video Compression: MPEG, H.264, AVI.

Unit-IV

Multimedia Networking and Applications: Multimedia over the Internet, Streaming Protocols and Content Delivery Networks, Virtual Reality and Augmented Reality, Multimedia in E-learning, Gaming, and Digital Marketing.

Unit-V

Advanced Multimedia Technologies: Artificial Intelligence in Multimedia Systems, Cloud-based Multimedia Applications, 3D Modeling and Rendering, Case Studies on Multimedia Applications in Industry.

Textbooks and References:

1. Ze-Nian Li and Mark S. Drew, "Fundamentals of Multimedia," Springer.
2. Ralf Steinmetz and Klara Nahrstedt, "Multimedia: Computing, Communications, and Applications," Pearson Education.
3. Tay Vaughan, "Multimedia: Making It Work," McGraw Hill.
4. Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols, and Standards," Pearson Education.
5. John F. Koegel Buford, "Multimedia Systems," ACM Press.

Course Outcomes:

CO1	Understand the principles and components of multimedia systems.
CO2	Process and manipulate multimedia elements effectively.
CO3	Implement compression and storage techniques for multimedia data.
CO4	Apply multimedia tools for real-world applications.
CO5	Analyze the latest trends and advancements in multimedia technologies.

BCS314	Principles of Programming Language	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts and paradigms of programming languages.
CO2	Understand syntax, semantics, and implementation techniques for different languages.
CO3	Explore various programming paradigms, including procedural, object-oriented, functional, and logic programming.
CO4	Analyze language features such as type systems, control flow, and memory management.
CO5	Compare and evaluate different programming languages based on their suitability for various applications

Unit-I

Introduction to Programming Languages: History and Evolution of Programming Languages, Language Classification: Procedural, Object-Oriented, Functional, Logic-based, Syntax and Semantics of Programming Languages, Programming Language Design Principles.

Unit-II

Data Types, Variables, and Expressions: Primitive, Composite, and Abstract Data Types, Type Checking and Type Inference, Variable Binding, Scope, and Lifetime, Expression Evaluation and Control Structures.

Unit-III

Control Flow and Subprograms: Conditional Statements and Loops, Subprograms: Functions, Procedures, and Recursion, Parameter Passing Techniques, Exception Handling and Error Recovery.

Unit-IV

Memory Management and Runtime Environment: Static vs. Dynamic Memory Allocation, Stack-based and Heap-based Memory Management, Garbage Collection Techniques, Runtime Environment and Execution Models.

Unit-V

Programming Paradigms and Case Studies: Procedural vs. Declarative Programming, Object-Oriented Programming Concepts, Functional and Logic Programming, Comparative Study of Languages (C, Java, Python, Lisp, Prolog, etc.)

Textbooks and References:

1. Robert W. Sebesta, "Concepts of Programming Languages," Pearson Education.
2. John C. Mitchell, "Concepts in Programming Languages," Cambridge University Press.
3. Benjamin C. Pierce, "Types and Programming Languages," MIT Press.
4. Ravi Sethi, "Programming Languages: Concepts and Constructs," Addison-Wesley.
5. Terrence W. Pratt, "Programming Languages: Design and Implementation," Pearson Education.

Course Outcomes:

CO1	Understand the principles, syntax, and semantics of programming languages.
CO2	Implement different programming paradigms in software development.
CO3	Analyze and compare various language constructs and features.
CO4	Develop efficient programs using appropriate language paradigms.
CO5	Evaluate and select suitable programming languages for different applications

BCS316	Web Development	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts and technologies of web development.
CO2	Understand front-end and back-end development methodologies.
CO3	Explore web development frameworks, tools, and best practices.
CO4	Implement responsive and interactive web applications.

CO5	Analyze security considerations and performance optimization techniques in web development.

Unit-I

Introduction to Web Development: Basics of the Internet and World Wide Web, Overview of Web Technologies (HTML, CSS, JavaScript), Web Standards and Accessibility, Client-Side vs. Server-Side Scripting.

Unit-II

Front-End Development: HTML: Elements, Forms, Tables, and Multimedia, CSS: Styling, Layouts, and Responsive Design (Flexbox, Grid), JavaScript Basics: DOM Manipulation, Events, ES6+ Features, Frameworks: Bootstrap, Tailwind CSS.

Unit-III

Back-End Development: Server-Side Programming: Introduction to Node.js, PHP, Python (Django/Flask), Databases: SQL vs. NoSQL, MySQL, MongoDB, RESTful APIs and Web Services, Authentication and Authorization (JWT, OAuth).

Unit-IV

Advanced Web Technologies: Single Page Applications (SPAs) with React/Vue.js, State Management: Redux, Vuex, WebSockets and Real-Time Communication, Progressive Web Apps (PWAs)

Unit-V

Web Security and Performance Optimization: Security Threats: XSS, CSRF, SQL Injection, Clickjacking, Web Performance Optimization Techniques (Lazy Loading, Minification, Caching), DevOps and Deployment Strategies (Docker, CI/CD), Cloud Hosting and Serverless Architecture (AWS, Firebase)

Textbooks and References:

1. Jon Duckett, "HTML & CSS: Design and Build Websites," Wiley.
2. Jon Duckett, "JavaScript and JQuery: Interactive Front-End Web Development," Wiley.
3. Ethan Brown, "Learning JavaScript Design Patterns," O'Reilly.
4. Kyle Simpson, "You Don't Know JS (book series)," O'Reilly.
5. Robin Nixon, "Learning PHP, MySQL & JavaScript," O'Reilly.

Course Outcomes:

CO1	Understand and apply web development technologies
CO2	Develop responsive and user-friendly web applications.
CO3	Work with databases and server-side programming for dynamic content.

CO4	Implement modern web frameworks and security measures.
CO5	Optimize and deploy scalable web applications.

BCS318	Linux Administration	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts of Linux operating system and administration.
CO2	Understand Linux installation, file system structure, and command-line interface.
CO3	Explore user management, process control, and system security in Linux.
CO4	Configure networking, services, and automation using shell scripting.
CO5	Analyze Linux system monitoring, troubleshooting, and performance tuning.

Unit-I

Introduction to Linux and Installation: History and Evolution of Linux, Linux Distributions and Installation Methods, File System Structure and Hierarchy, Basic Linux Commands and Shell Environment.

Unit-II

User and File Management: User and Group Administration, File Permissions and Ownership, Process Management and Job Scheduling, File Archiving and Backup Techniques

Unit-III

System Administration and Security: System Boot Process and Initialization (GRUB, systemd), Package Management (APT, YUM, RPM), Security Essentials: Firewalls, SELinux, iptables, Access Control and Encryption Techniques

Unit-IV

Networking and Services Configuration: Network Configuration and Troubleshooting, DNS, DHCP, and Web Server Setup (Apache, Nginx), FTP, SSH, and Remote AdministrationDatabase Server Configuration (MySQL/PostgreSQL).

Unit-V

Automation and Performance Tuning: Shell Scripting and Automation, System Monitoring and Performance Analysis (top, vmstat, iostat), Log Management and Troubleshooting (syslog, journalctl), Virtualization and Cloud Integration with Linux.

Textbooks and References:

1. Evi Nemeth, Garth Snyder, Trent R. Hein, "UNIX and Linux System Administration Handbook," Pearson.
2. William E. Shotts Jr., "The Linux Command Line: A Complete Introduction," No Starch Press.
3. Mark G. Sobell, "A Practical Guide to Linux Commands, Editors, and Shell Programming," Pearson.
4. Richard Blum, "Linux Command Line and Shell Scripting Bible," Wiley.
5. Christopher Negus, "Linux Bible," Wiley.

Course Outcomes:

CO1	Understand Linux system architecture, installation, and file system management.
CO2	Perform user and file management tasks efficiently.
CO3	Configure security mechanisms and system administration tools.
CO4	Manage Linux networking services and remote administration
CO5	Automate tasks and optimize system performance using advanced Linux tools

BSC405	Cyber Security	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce fundamental concepts of cyber security and threat management.
CO2	Understand cryptography, network security, and access control mechanisms
CO3	Explore ethical hacking, malware analysis, and penetration testing techniques.
CO4	Analyze security frameworks, policies, and legal aspects of cyber security.
CO5	Implement security measures for risk management and incident response.

Unit-I

Introduction to Cyber Security: Basics of Cyber Security and Its Importance, Threats, Vulnerabilities, and Attack Vectors, Security Policies and Governance Frameworks, Cyber Ethics and Legal Aspects.

Unit-II

Cryptography and Network Security: Principles of Cryptography: Symmetric vs. Asymmetric Encryption, Hash Functions and Digital Signatures, Network Security Protocols (SSL/TLS, IPsec), Firewalls, IDS, and IPS.

Unit-III

Ethical Hacking and Malware Analysis: Ethical Hacking Fundamentals and Penetration Testing, Phases of Ethical Hacking (Reconnaissance, Exploitation, Post-Exploitation), Malware Types and Attack Techniques (Viruses, Worms, Trojans, Ransomware), Reverse Engineering and Forensics

Unit-IV

Security Policies, Risk Management, and Compliance: Security Audits and Risk Assessment Techniques, Security Standards (ISO 27001, NIST, GDPR), Incident Response and Disaster Recovery Planning, Secure Coding Practices and Vulnerability Assessments.

Unit-V

Advanced Cyber Security Technologies: Cloud Security and Virtualization Threats, IoT Security and Industrial Control System Security, Blockchain for Cyber Security Applications, Artificial Intelligence in Cyber Threat Detection

Textbooks and References:

1. William Stallings, "Cryptography and Network Security: Principles and Practice," Pearson.
2. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security," Cengage Learning.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing," Pearson.
4. Kevin Mitnick, "The Art of Deception: Controlling the Human Element of Security," Wiley.
5. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms, and Source Code in C," Wiley.

Course Outcomes:

CO1	Understand cyber security fundamentals, risks, and legal implications.
CO2	Implement cryptographic and network security measures.
CO3	Apply ethical hacking techniques for vulnerability assessment.
CO4	Develop security policies and risk management strategies.
CO5	Utilize emerging technologies for cyber security threat mitigation.

BCS407	Pattern Recognition	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts of pattern recognition and machine learning.
CO2	Understand feature extraction, dimensionality reduction, and classification techniques.
CO3	Explore supervised and unsupervised learning approaches for pattern analysis.
CO4	Apply statistical and structural methods for pattern recognition problems.
CO5	Implement real-world applications of pattern recognition in various domains.

Unit-I

Introduction to Pattern Recognition: Basics of Pattern Recognition, Applications of Pattern Recognition in Various Domains, Statistical Decision Theory and Bayes Classifier, Introduction to Machine Learning Concepts.

Unit-II

Feature Extraction and Selection: Feature Extraction Techniques (PCA, LDA, ICA), Feature Selection and Dimensionality Reduction, Data Preprocessing and Normalization, Similarity Measures and Distance Metrics.

Unit-III

Classification and Clustering: Supervised Learning: k-NN, Decision Trees, SVM, Neural Networks, Unsupervised Learning: k-Means, Hierarchical Clustering, DBSCAN, Probabilistic Models: Hidden Markov Models (HMM), Gaussian Mixture Models (GMM), Performance Evaluation: Confusion Matrix, ROC Curve, Precision-Recall.

Unit-IV

Structural and Syntactic Pattern Recognition: Graph-Based Approaches to Pattern Recognition, String Matching and Parsing Techniques, Grammar-Based Methods for Pattern Recognition, Applications in Image Processing and Text Recognition

Unit-V

Advanced Topics and Applications: Deep Learning for Pattern Recognition (CNN, RNN, GANs), Real-Time Applications in Speech and Image Recognition, Biometric Systems and Security Applications, Pattern Recognition in Medical and Financial Data Analysis.

Textbooks and References:

1. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification," Wiley.
2. C. M. Bishop, "Pattern Recognition and Machine Learning," Springer.
3. Sergios Theodoridis, Konstantinos Koutroumbas, "Pattern Recognition," Academic Press.
4. Robert Schalkoff, "Pattern Recognition: Statistical, Structural, and Neural Approaches," Wiley.
5. S. Haykin, "Neural Networks and Learning Machines," Pearson.

Course Outcomes:

CO1	Understand the fundamental concepts of pattern recognition and its applications in various domains such as image processing, speech recognition, and biometrics.
CO2	Apply statistical and structural techniques to analyze and classify data patterns.
CO3	Implement feature extraction and dimensionality reduction techniques for effective data representation.
CO4	Develop and evaluate pattern recognition systems using tools like MATLAB or Python with real-world datasets.
CO5	Analyze the performance of classification and clustering algorithms using appropriate metrics.

BCS409	Parallel Algorithm	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Introduce the fundamental concepts of parallel computing and parallel algorithms.
CO2	Understand parallel architectures, models, and complexity analysis.
CO3	Explore parallel sorting, searching, and graph algorithms.
CO4	Implement parallel programming paradigms and synchronization techniques.
CO5	Analyze real-world applications and performance optimization strategies for parallel algorithms

Unit-I

Introduction to Parallel Computing: Fundamentals of Parallelism and Concurrency, Parallel Computer Models and Architectures, Performance Metrics: Speedup, Efficiency, Scalability, Flynn's Taxonomy (SISD, SIMD, MISD, MIMD)

Unit-II

Parallel Algorithm Design and Analysis: Work, Depth, and Parallel Complexity Models, Parallel Divide-and-Conquer Strategies, Scheduling and Load Balancing Techniques, Communication Costs and Overhead.

Unit-III

Parallel Sorting and Searching Algorithms: Parallel Merge Sort, Quick Sort, and Bitonic Sort, Parallel Searching: Parallel Binary Search, Hashing, PRAM Model and Sorting , Networks, Matrix Operations: Parallel Matrix Multiplication

Unit-IV

Parallel Graph Algorithms: Parallel Breadth-First Search (BFS) and Depth-First Search (DFS), Minimum Spanning Tree (MST) Algorithms (Prim's, Kruskal's), Shortest Path Algorithms (Dijkstra, Floyd-Warshall), Graph Partitioning and Connectivity Algorithms

Unit-V

Parallel Programming and Optimization: Shared Memory vs. Distributed Memory Models, OpenMP, MPI, and CUDA Programming, Synchronization and Deadlocks in Parallel Computing, Performance Optimization Techniques and Case Studies

Textbooks and References:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing," Pearson.
2. Michael J. Quinn, "Parallel Programming in C with MPI and OpenMP," McGraw Hill.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms," MIT Press.
4. Ian Foster, "Designing and Building Parallel Programs," Addison-Wesley.
5. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability," McGraw Hill.

Course Outcomes:

CO1	Understand the principles of parallel computing and algorithm design.
CO2	Analyze the efficiency and complexity of parallel algorithms.
CO3	Develop and implement parallel sorting, searching, and graph algorithms
CO4	Utilize parallel programming models and synchronization mechanisms.
CO5	Apply performance optimization techniques in real-world parallel computing applications.

BCS411	Introduction to Machine Learning	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Understand the fundamental concepts and applications of machine learning.
CO2	Explore various supervised and unsupervised learning techniques.
CO3	Learn feature selection, model evaluation, and performance metrics.
CO4	Implement machine learning algorithms using modern tools and libraries.
CO5	Analyze real-world case studies and applications of machine learning.

Unit-I

Introduction to Machine Learning: Basics of Machine Learning and AI, Types of Machine Learning: Supervised, Unsupervised, Reinforcement Learning, Applications of Machine Learning in Various Domains, Basics of Probability, Statistics, and Linear Algebra for ML

Unit-II

Supervised Learning:Regression Techniques: Linear Regression, Polynomial Regression, Classification Algorithms: Logistic Regression, Decision Trees, Random Forests, Support Vector Machines (SVM), Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, ROC Curve, Overfitting and Underfitting: Bias-Variance Tradeoff.

Unit-III

Unsupervised Learning: Clustering Algorithms: k-Means, Hierarchical Clustering, DBSCAN, Dimensionality Reduction Techniques: PCA, LDA, t-SNE, Association Rule Learning: Apriori, FP-Growth, Applications in Anomaly Detection and Customer Segmentation.

Unit-IV

Neural Networks and Deep Learning: Basics of Artificial Neural Networks (ANN), Activation Functions and Backpropagation, Introduction to Deep Learning and Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM).

Unit-V

Practical Applications and Case Studies: Implementing ML Models Using Python (Scikit-Learn, TensorFlow, Keras), Natural Language Processing (NLP) Applications, Image Processing and Computer Vision, Ethics and Challenges in Machine Learning

Textbooks and References:

1. Tom Mitchell, "Machine Learning," McGraw Hill.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning," Springer.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning," MIT Press.
4. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning," Springer.
5. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow," O'Reilly.

Course Outcomes:

CO1	Gain a strong foundation in machine learning concepts and techniques.
CO2	Apply supervised and unsupervised learning models to real-world problems.
CO3	Evaluate the performance of machine learning models.
CO4	Develop machine learning solutions using modern programming tools.
CO5	Understand ethical concerns and challenges in the field of machine learning.

BCS413	Introduction to IOT	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Understand the fundamental concepts and architecture of the Internet of Things (IoT).
CO2	Explore various IoT communication protocols and network technologies
CO3	Learn about IoT sensors, actuators, and embedded systems.
CO4	Implement IoT applications using cloud computing and data analytics.
CO5	Analyze security challenges and real-world applications of IoT.

Unit-I

Introduction to IoT: Overview of IoT and its Evolution, Characteristics and Benefits of IoT, IoT Architecture and Layers, Applications of IoT in Various Domains (Smart Cities, Healthcare, Agriculture, Industry 4.0)

Unit-II

IoT Communication and Networking: IoT Communication Models and Protocols, Wireless Technologies: Bluetooth, Zigbee, LoRa, 6LoWPAN, Cloud Computing and IoT, Edge and Fog Computing in IoT Systems.

Unit-III

Sensors, Actuators, and Embedded Systems: Types of IoT Sensors and Actuators, Microcontrollers and Microprocessors for IoT (Arduino, Raspberry Pi, ESP8266), Interfacing Sensors with IoT Devices, Power Management and Energy Efficiency in IoT.

Unit-IV

IoT Data Processing and Security: IoT Data Analytics and Machine Learning Applications, IoT Security Threats and Countermeasures, Authentication and Encryption in IoT Networks, Privacy and Ethical Concerns in IoT.

Unit-V

Practical Applications and Case Studies: IoT-Based Smart Home Automation, Industrial IoT (IIoT) Applications, Healthcare and Wearable IoT Technologies, Future Trends and Challenges in IoT.

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Textbooks and References:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach," Universities Press.
2. Raj Kamal, "Internet of Things: Architecture and Design Principles," McGraw Hill.
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things," Wiley.
4. Pethuru Raj, Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases," CRC Press.
5. Mohammad Ali Jabraeil Jamali, "Practical Internet of Things with Arduino and Raspberry Pi," Springer.

Course Outcomes:

CO1	Understand the core concepts and architecture of IoT.
CO2	Apply IoT communication protocols and networking techniques.
CO3	Develop IoT applications using sensors, actuators, and embedded systems.
CO4	Implement cloud-based IoT solutions with data analytics.

CO5	Evaluate security challenges and ethical considerations in IoT systems.

BCS415	Embedded and Real Time Systems	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Understand the fundamentals of embedded and real-time systems.
CO2	Explore the architecture and components of embedded systems.
CO3	Learn about real-time operating systems (RTOS) and scheduling techniques.
CO4	Develop embedded applications using hardware and software components.
CO5	Analyze performance, security, and power management in embedded systems.

Unit-I

Introduction to Embedded Systems: Overview of Embedded Systems, Characteristics and Design Constraints, Embedded System Architecture, Applications of Embedded Systems in Various Domains

Unit-II

Embedded Hardware and Software: Microcontrollers and Microprocessors, Memory and I/O Interfacing, Embedded System Development Tools, Programming Languages for Embedded Systems (C, Assembly).

Unit-III

Real-Time Systems and Scheduling: Fundamentals of Real-Time Systems, Hard vs. Soft Real-Time Systems, Task Scheduling Algorithms: Rate Monotonic Scheduling (RMS), Earliest Deadline First (EDF), Inter-Process Communication and Synchronization

Unit-IV

Real-Time Operating Systems (RTOS): Introduction to RTOS and Kernel Services, Process Management and Multithreading, RTOS Case Studies: FreeRTOS, VxWorks, RTEMS, Power Management and Energy Efficiency in Embedded Systems

Unit-V

Applications and Future Trends: Embedded Systems in IoT, Automotive, and Healthcare, Security Challenges in Embedded Systems, Case Studies and Practical Implementations, Emerging Trends: Edge Computing, AI in Embedded Systems.

Textbooks and References:

1. Raj Kamal, "Embedded Systems: Architecture, Programming, and Design," McGraw Hill.
2. Frank Vahid, Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction," Wiley.
3. Jonathan W. Valvano, "Embedded Systems: Introduction to ARM Cortex-M Microcontrollers," CreateSpace.
4. Jane W. S. Liu, "Real-Time Systems," Pearson.
5. Qing Li, "Real-Time Concepts for Embedded Systems," CMP Books.

Course Outcomes:

CO1	Understand the fundamentals of embedded and real-time systems.
CO2	Design and develop embedded hardware and software components
CO3	Implement real-time scheduling techniques and RTOS applications.
CO4	Optimize embedded systems for power, performance, and security.
CO5	Analyze real-world applications and future trends in embedded systems.

BCS417	Neural Networks	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Understand the fundamentals of neural networks and their applications.
CO2	Explore various types of artificial neural networks and learning algorithms.
CO3	Learn about training methodologies, optimization techniques, and error minimization.
CO4	Implement neural networks for pattern recognition and data classification.
CO5	Analyze real-world case studies and future trends in neural networks.

Unit-I

Introduction to Neural Networks: Biological Neurons and Artificial Neurons, Perceptron Model and Activation Functions, Supervised, Unsupervised, and Reinforcement Learning, Applications of Neural Networks in Various Domains.

Unit-II

Artificial Neural Network (ANN) Architectures: Single-Layer and Multi-Layer Perceptrons (MLP), Backpropagation Algorithm and Training Process, Radial Basis Function (RBF) Networks, Hopfield Networks and Boltzmann Machines.

Unit-III

Deep Learning and Advanced Neural Networks: Introduction to Deep Learning, Convolutional Neural Networks (CNN) for Image Processing, Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM), Generative Adversarial Networks (GANs) and Autoencoders

Unit-IV

Optimization and Performance Evaluation: Gradient Descent and its Variants, Overfitting and Regularization Techniques, Hyperparameter Tuning and Cross-Validation, Performance Metrics: Accuracy, Precision, Recall, F1-Score.

Unit-V

Applications and Future Trends: Neural Networks in Computer Vision, NLP, and Robotics, Neural Network-based Forecasting and Anomaly Detection, Ethical Considerations and Interpretability of Neural Networks, Future Directions: Neuromorphic Computing and Quantum Neural Networks.

Textbooks and References:

1. Simon Haykin, "Neural Networks and Learning Machines," Pearson.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning," Springer.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning," MIT Press.
4. David Kriesel, "A Brief Introduction to Neural Networks."
5. Satish Kumar, "Neural Networks: A Classroom Approach," McGraw Hill.

Course Outcomes:

CO1	Gain a strong foundation in neural network architectures and learning algorithms.
CO2	Implement artificial neural networks for classification and prediction tasks.
CO3	Optimize and fine-tune neural networks for better performance.
CO4	Develop deep learning models for real-world applications.
CO5	Understand ethical concerns and future advancements in neural networks.

BCS419	OS for Smart Devices(Android)	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Understand the fundamentals of mobile operating systems with a focus on Android.
CO2	Explore the architecture and components of the Android OS.
CO3	Learn about application development, UI design, and system services in Android.
CO4	Analyze security, performance, and optimization techniques in Android OS.
CO5	Implement real-world Android applications and explore emerging trends.

Unit-I

Introduction to Smart Device OS: Evolution of Mobile Operating Systems, Features and Challenges of Smart Device OS, Android vs. iOS vs. Other Mobile OS, Application Development Lifecycle in Android.

Unit-II

Android Architecture and Components: Android System Architecture, Linux Kernel and Android Runtime (ART), Application Framework and APIs, Activity, Services, Broadcast Receivers, and Content Providers

Unit-III

User Interface and Development Tools: UI Design and Material Design Principles, Layouts, Views, and Event Handling, Android Studio, Gradle, and ADB, Intents, Fragments, and Navigation Components

Unit-IV

System Services and Security: Location-based Services and Sensors, Data Storage: Shared Preferences, SQLite, and Cloud Integration, Android Security Model: Permissions, Encryption, and Sandboxing, App Optimization and Performance Tuning.

Unit-V

Advanced Topics and Future Trends: Internet of Things (IoT) and Android, AI and Machine Learning in Android Apps, Android Custom ROMs and Open-Source Development, Future Directions: 5G, Foldable Devices, and Edge Computing.

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Textbooks and References:

1. Mark Murphy, "The Busy Coder's Guide to Android Development."
2. Ian F. Darwin, "Android Cookbook: Problems and Solutions for Android Developers," O'Reilly Media.
3. Paul Deitel, Harvey Deitel, "Android How to Program," Pearson.
4. Reto Meier, "Professional Android Development," Wrox.
5. Jeff Friesen, "Android Programming for Beginners," Packt Publishing.

Course Outcomes:

CO1	Gain knowledge of mobile operating systems and their evolution.
CO2	Understand Android OS architecture and key components
CO3	Develop Android applications using modern tools and frameworks.
CO4	Implement security, data management, and performance optimization in Android.

CO5	Explore advanced topics and the future of Android OS in smart devices.

BCS421	**Clien**	**3-0-0**	**Credits: 3**

Course Objectives:

CO1	Understand the fundamentals of client-server architecture and distributed systems.
CO2	Explore the roles and responsibilities of clients and servers in a networked environment.
CO3	Develop basic client-server applications using sockets and remote procedure calls.
CO4	Evaluate the performance and scalability of client-server models.
CO5	Understand issues of concurrency, security, and data management in distributed computing.

Unit-I

Introduction to Client-Server Computing: Definition and basics of client-server computing, Evolution of computing models: mainframe, PC, distributed, and client-server, Components of client-server architecture, Comparison: client-server vs. peer-to-peer, Advantages and challenges of client-server architecture, Examples of client-server applications.

Unit-II

Networking Fundamentals and Protocols: Overview of computer networks, OSI and TCP/IP models, Protocols used in client-server communication: HTTP, FTP, SMTP, POP3, IMAP, IP addressing and DNS basics, Socket programming: concepts and types (TCP vs UDP), Basic client-server communication using sockets (with examples)

Unit-III

Client-Server Architectures: Types of architectures: 2-tier, 3-tier, N-tier, Role of clients and servers in each model, Thin client vs. thick client architecture, Middleware: definition, purpose, and types, Comparison of distributed architectures, Real-world examples (banking, online shopping, etc.)

Unit-IV

Interprocess Communication and Middleware Technologies: Interprocess Communication (IPC) concepts, Remote Procedure Call (RPC) and its implementation, Java RMI (Remote Method Invocation), CORBA (Common Object Request Broker Architecture), Message Oriented Middleware (MOM), Introduction to web services (SOAP, REST)

Unit-V

Server-Side Programming and Databases: Overview of server-side scripting languages (PHP, ASP.NET, Node.js), Building server-side applications, Web servers vs. application servers, Database connectivity: ODBC and JDBC, Basics of server-side database operations (CRUD), Introduction to connection pooling and security practices.

Textbooks and References:

1. **"Client/Server Computing"** by *Patrick Smith and Steve Guengerich,* Publisher: Prentice Hall, A foundational book covering client-server models, middleware, networking, and implementation technologies.
2. **"Distributed Systems: Principles and Paradigms"** by *Andrew S. Tanenbaum and Maarten van Steen*, Pearson, Great for understanding the broader context of distributed computing, which includes client-server models.
3. **"Web Technologies: A Computer Science Perspective"** by *Jeffrey C. Jackson*, Pearson Education, Includes detailed coverage of server-side scripting and web-based client-server systems.
4. **"Computer Networks"** by *Andrew S. Tanenbaum and David J. Wetherall*, Pearson, Essential for understanding networking protocols used in client-server systems.

Course Outcomes:

CO1	Explain the principles and components of client-server computing architectures.
CO2	Analyze and compare various client-server models and technologies (e.g., 2-tier, 3-tier, N-tier).
CO3	Develop basic client-server applications using socket programming in languages like Java, C++, or Python.
CO4	Apply communication protocols such as HTTP, TCP/IP, FTP, and SOAP in networked applications.
CO5	Apply communication protocols such as HTTP, TCP/IP, FTP, and SOAP in networked applications.

BCS423	Cloud Computing	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To provide students with the fundamentals and essentials of Cloud Computing.
CO2	To provide students a sound foundation of the Cloud computing so that they are able to identify the vendors and assess the risk involved in cloud migration.
CO3	To enable students be aware of the various governance issues in cloud and how to manage the same.
CO4	To provide a comprehensive understanding of the fundamental principles and architecture of cloud computing.
CO5	To enable students to explore various cloud service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid).

Unit-I

Fundamentals of Cloud Computing: Cloud Computing Basics – History of Cloud Computing, Characteristics of Cloud Computing, Need for Cloud computing, Advantages and Possible Disadvantages of cloud computing, Cloud Deployment Models – Public, Private, Hybrid, Community, Other deployment Models. Evolving Data Center into Private Cloud, Datacenter Components, Extracting Business value in Cloud Computing – Cloud Security, Cloud Scalability, Time to Market, Distribution over the Internet, Cloud Computing Case Studies.

Unit-II

Cloud Delivery Models: Introduction to Cloud Services, Infrastructure as a Service (IAAS) – Overview, Virtualization, Container, Pricing Models, Service Level Agreements, Migrating to the Cloud, IaaS Networking options, Virtual Private Cloud(VPC), IAAS Storage – File and Object storage, Data Protection, IaaS security, Benefits, Risks and Examples of IaaS. Platform as a Service (PAAS) – Overview, IAAS v/s PAAS, PAAS Examples, benefits and risks. Software as a Service (SAAS)

– Introducing SaaS, SaaS Examples – Office 365, Google G Suite, Salesforce.com , Evaluating SaaS – user and vendor perspective, Impact of SaaS, Benefits and risks of SaaS. Other Services on Cloud, Cloud Delivery Models Considerations

Unit-III

Cloud Platforms: Introducing Cloud Platforms, Evaluating cloud platforms, Cloud Platform technologies – Amazon Web Services, Microsoft Azure, Google Cloud Platform, Salesforce.com, and Impact of Cloud platforms. Private Cloud Platforms – Introducing Private clouds – Microsoft Azure stack, Open stack, AWS Greengrass, Impact of Private clouds
Cloud Migration: Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies

Unit-IV

Cloud Computing - Challenges, Risk and Mitigation: Cloud Storage, Application performance, Data Integration, Security. Ensuring Successful Cloud Adoption: Designing a Cloud Proof of Concept, Vendor roles and capabilities, moving to the Cloud. Impact of Cloud on IT Service Management.
Risks and Consequences of Cloud Computing – Legal Issues, Compliance Issues, Privacy and Security.

Unit-V

Managing the Cloud: Managing and Securing Cloud Services, Virtualization and the Cloud, Managing Desktops and devices on the cloud, SOA and Cloud computing, Managing the Cloud environment, Planning for the Cloud – Economic Cost Model and Leveraging the Cloud, Cloud computing resources, Cloud Dos and Don'ts.

Textbooks and References:

1. Kirk Hausman, Susan L. Cook, TelmoSampaio, "CLOUD ESSENTIALS CompTIA® Authorized Courseware for Exam CLO-001", John Wiley & Sons Inc., 2013
2. Judith Hurwitz , Robin Bloor , Marcia Kaufman , Fern Halper, "Cloud Computing for Dummies", Wiley Publishing Inc., 2010
3. Erl," Cloud Computing: Concepts, Technology & Architecture", Pearson Education, 2014
4. Srinivasan, "Cloud Computing: A Practical Approach for Learning and Implementation "Pearson Education, 2014

Course Outcomes:

CO1	Analyze the Cloud computing setup with its vulnerabilities and applications using different architecture
CO2	Analyze the risks involved in migrating the existing infrastructure to cloud.
CO3	Assess various cloud service providers and generate effective cloud infrastructure by optimizing the cost involved..
CO4	Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.
CO5	Explain the basic concepts, service models, and deployment models of cloud computing, and identify its applications and benefits in real-world scenarios.

BCS406	Distributed Databases	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	Enhanced the knowledge in the area of Distributed Database system.
CO2	Comprehend the Distributed query processing
CO3	The subject explores the ideas of Transaction management and concurrency control.
CO4	Know the parallel database system architecture.
CO5	To learn about Distributed Deadlock Detection

Unit-I

Transaction and schedules: Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concepts in Recoverable and Cascadeless schedules. Lock based protocols, time stamp based protocols, Multiple Granularity and MultiversionTechniques, Enforcing serializablity by Locks, Locking system with multiple lock modes, architecture for Locking scheduler

Unit-II

Distributed Transactions Management: Data Distribution, Fragmentation and ReplicationTechniques, Distributed Commit, Distributed Locking schemes, Long duration transactions,Moss Concurrency protocol. Issues of Recovery and atomicity in Distributed Databases

Unit-III

Traditional recovery techniques, Logbased recovery, Recovery with Concurrent Transactions, Recovery in Message passing systems, Checkpoints, Algorithms for recovery line, Concepts in Orphan and Inconsistent Messages.

Unit-IV

Distributed Query Processing: Multiway Joins, Semi joins, Cost based query optimization for distributed database, Updating replicated data, protocols for Distributed Deadlock Detection, Eager and Lazy Replication Techniques. **Distributed Transactions:**Definition and characteristics, ACID properties in distributed environments, Transaction processing monitors, Commit Protocols:Two-Phase Commit (2PC), Three-Phase Commit (3PC), Failures and recovery mechanisms in commit protocols.

Unit-V

Concurrency Control in Distributed Databases: Distributed concurrency control techniques, Locking mechanisms (centralized, primary site, distributed), Timestamp ordering, Multiversion concurrency control, Deadlock Management: Deadlock prevention, avoidance, and detection, Deadlock resolution techniques in distributed systems, Reliability and Fault Tolerance:

Reliability issues in distributed systems, Failure classification, Recovery methods and techniques (shadow paging, write-ahead logging)

Textbooks and References:

1. Silberschatz, orth and Sudershan, Database System Concept', McGraw Hill
2. Ramakrishna and Gehrke,' Database Management System, McGraw Hill
3. Garcia-Molina, Ullman,Widom,' Database System Implementation' Pearson Education
4. Ceei and Pelagatti,'Distributed Database', TMH
5. Singhal and Shivratri, 'Advance Concepts in Operating Systems' MC Graw Hill

Course Outcomes:

CO1	Aware of fundamentals of Distributed Database system
CO2	Use the different techniques of Distributed query processing.
CO3	Set the rules over management of transaction and concurrency control..
CO4	Familiar with parallel database system architecture.
CO5	Understand Distributed Deadlock Detection

BCS408	Entrepreneu	FUTURE UNIVERSITY Learn · Assimilate · Transcend	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To introduce students to the concepts of entrepreneurship and the entrepreneurial process.
CO2	To help students understand how to manage technology and innovation in business environments.
CO3	To develop students' ability to identify, evaluate, and implement business opportunities.
CO4	To provide knowledge about institutional support and financing for start-ups and innovation.
CO5	To develop managerial skills for handling risks, scaling, and sustaining technology-based enterprises.

Unit-I

Introduction to Entrepreneurship: Definition, characteristics, and types of entrepreneurs, Entrepreneurial mindset and motivation, Theories of entrepreneurship, Women entrepreneurs and rural entrepreneurship, Role of entrepreneurship in economic , development.

Unit-II

Entrepreneurial Process & Business Planning: Idea generation and opportunity evaluation, Feasibility study – technical, financial, market, legal, Business model canvas, Business plan development – components and structure, Risk analysis and market strategy

Unit-III

Technology and Innovation Management: Role of technology in entrepreneurship, Innovation types: product, process, incremental, disruptive, Technology life cycle, R&D management and technology transfer, Intellectual Property Rights (IPR) – patents, copyrights, trademarks

Unit-IV

Institutional Support & Funding Agencies: Entrepreneurship development institutions: MSME, NSIC, SIDBI, NIESBUD, DST, NABARD, Incubators, accelerators, and start-up ecosystems, Sources of funding: angel investors, venture capital, crowdfunding, government grants, Start-up India and Make in India initiatives

Unit-V

Managing Growth and Sustainability: Scaling strategies for start-ups, Strategic partnerships and collaborations, Leadership and team building in start-ups, Exit strategies: IPO, acquisition, mergers, Case studies of successful tech-based start-ups

Textbooks and References:

1. **Entrepreneurship Development"** by *S.S. Khanka*
   Publisher: S. Chand
2. **"Entrepreneurship"** by *Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd*
   Publisher: McGraw Hill
3. **"Innovation and Entrepreneurship"** by *Peter F. Drucker*
   Publisher: HarperBusiness
4. "T**echnology Management: Activities and Tools"** by *Dilek Cetindamar, Rob Phaal, David Probert*
   Publisher: Palgrave Macmillan
5. **"Managing Innovation"** by *Joe Tidd and John Bessant*
   Publisher: Wiley
6. **"Entrepreneurship: Successfully Launching New Ventures"** by *Bruce R. Barringer and R. Duane Ireland,* Publisher: Pearson Education

Course Outcomes:

CO1	Demonstrate an understanding of entrepreneurial mindset, innovation, and opportunity identification.
CO2	Develop business models and project plans for start-ups, especially in the tech domain.
CO3	Analyze various strategies for managing technology, R&D, and innovation.
CO4	Evaluate funding options and institutional support for entrepreneurs in India and globally.
CO5	Apply managerial techniques to lead, scale, and sustain entrepreneurial ventures.

BCS410	Simulation and Modeling	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To introduce the fundamental concepts of system modeling and simulation.
CO2	To understand the types of simulation and their applications.
CO3	To learn discrete-event simulation and Monte Carlo methods.
CO4	To model real-world systems using simulation tools.
CO5	To analyze simulation outputs and validate simulation models.

Unit-I

Introduction to Modeling and Simulation: Definition and types of models: physical, mathematical, static, dynamic, Importance and applications of simulation., Systems and system environment., Steps in a simulation study., Advantages and disadvantages of simulation.

Unit-II

System Modeling: Model classification: deterministic vs. stochastic, continuous vs. discrete, Concept of entities, attributes, and events, System modeling methodologies, Model building, verification, and validation, Case studies of real-world systems.

Unit-III

Discrete-Event Simulation: Discrete-event system simulation, Components of a simulation model., Event scheduling and time-advance mechanisms, Activity scanning, process interaction, Introduction to simulation languages (e.g., Arena, Simul8, GPSS).

Unit-IV

Random Numbers and Monte Carlo Simulation: Generation of random numbers and testing for randomness, Random variate generation: uniform, exponential, normal, Poisson, Monte Carlo simulation techniques, Applications of Monte Carlo methods, Input modeling: data collection and analysis.

Unit-V

Output Analysis and Model Validation: Types of simulation output data, Estimation of performance measures, Confidence intervals and hypothesis testing, Model calibration and validation techniques, Use of simulation software for performance analysis.

Textbooks and References:

1. Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, *Discrete-Event System Simulation*, Pearson Education.
2. Averill M. Law, *Simulation Modeling and Analysis*, McGraw-Hill Education.
3. Robert E. Shannon, *Systems Simulation: The Art and Science*, Prentice-Hall.
4. W. David Kelton, Randall P. Sadowski, *Simulation with Arena*, McGraw-Hill.
5. Gordon G.,, *System Simulation*, Prentice-Hall India.
6. Geoffrey Gordon, *Introduction to Simulation*, McGraw-Hill.

Course Outcomes:

CO1	Explain the importance and applications of simulation and modeling in real-world scenarios.
CO2	Develop mathematical models and simulate them using appropriate techniques
CO3	Apply discrete-event simulation techniques to model and analyze complex systems.
CO4	Use Monte Carlo simulation to estimate outcomes under uncertainty.
CO5	Evaluate and validate simulation models and interpret simulation results effectively.

BCS412	Block Chain	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To understand the fundamentals of blockchain and distributed ledger technology.
CO2	To explore the structure and functionality of blockchain systems including consensus mechanisms.
CO3	To analyze smart contracts and their applications in various domains.
CO4	To study cryptocurrency technologies like Bitcoin and Ethereum.
CO5	To examine real-world applications and security issues in blockchain-based systems.

Unit-I

Introduction to Blockchain: Definition and features of blockchain, Types of blockchain: Public, Private, Consortium, History of blockchain and Bitcoin, Benefits and limitations, Use cases overview

Unit-II

Blockchain Architecture and Consensus Mechanisms: Block structure and chain structure, Nodes, transactions, and mining, Proof-of-Work (PoW), Proof-of-Stake (PoS), Delegated PoS, Byzantine Fault Tolerance, RAFT, PBFT, Scalability and performance issues

Unit-III

Cryptocurrency and Bitcoin: Introduction to cryptocurrency, Bitcoin architecture, Bitcoin wallets and addresses, Bitcoin mining and security, Forks: Hard and Soft Forks

Unit-IV

Ethereum and Smart Contracts: Ethereum architecture and EVM, Introduction to Solidity programming, Writing, compiling, and deploying smart contracts, Gas fees and transactions, Decentralized Applications (DApps)

Unit-V

Blockchain Applications and Challenges: Blockchain in finance, supply chain, healthcare, voting, Interoperability between block chains, Legal and ethical aspects, Blockchain attacks and security concerns, Future trends and research directions

Textbooks and References:

1. **Arvind Narayanan et al.**, *Bitcoin and Cryptocurrency Technologies*, Princeton University Press, 2016.
2. **Andreas M. Antonopoulos**, *Mastering Bitcoin*, O'Reilly Media, 2017.
3. **Roger Wattenhofer**, *The Science of the Blockchain*, 2016.
4. **Imran Bashir**, *Mastering Blockchain*, Packt Publishing, 2020 (3rd Edition).

Course Outcomes:

CO1	Understand the principles and architecture of blockchain technology.
CO2	Analyze the various consensus mechanisms used in blockchain.
CO3	Develop and deploy smart contracts using Ethereum and Solidity.
CO4	Evaluate the applications of blockchain in different sectors like finance, healthcare, and supply chain.
CO5	Assess the security, privacy, and legal implications of blockchain systems.

BCS414	Edge & Fog Computing	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To understand the limitations of traditional cloud computing and the need for edge and fog computing
CO2	To explore the architecture, components, and applications of edge and fog computing.
CO3	To compare and contrast cloud, edge, and fog computing paradigms.
CO4	To study resource management, security, and privacy challenges in edge and fog environments.
CO5	To analyze real-time use cases and future trends in edge and fog computing.

Unit-I

Introduction to Edge and Fog Computing: Evolution from cloud to edge and fog, Need for low latency computing, Comparison: Cloud vs Edge vs Fog, Edge and fog computing in IoT, smart cities, healthcare.

Unit-II

Architecture and Design Principles: Edge and fog computing architecture, Components: Edge nodes, gateways, fog nodes, Communication protocols and network topology, Resource management and orchestration

Unit-III

Application Scenarios and Use Cases: Smart homes and buildings, Industrial IoT and smart manufacturing, Autonomous vehicles and transportation, Content delivery networks and video surveillance

Unit-IV

Security, Privacy, and Challenges: Security threats and vulnerabilities, Authentication and access control in edge/fog, Privacy preservation techniques, Trust models and data integrity.

Unit-V

Tools, Platforms, and Future Directions: Tools and frameworks: Cisco IOx, EdgeX Foundry, Azure IoT Edge, AWS Greengrass, Fog computing with OpenFog Reference Architecture, Edge AI and machine learning at the edge, Research trends and open challenges.

Textbooks and References:

1. **Rajkumar Buyya and Satish Narayana Srirama**, *Fog and Edge Computing: Principles and Paradigms*, Wiley, 2019.
2. **Meikang Qiu**, *Edge Computing: Models, Technologies and Applications*, Springer, 2020.
3. **Flavio Bonomi et al.**, *Fog Computing and Its Role in the Internet of Things*, MCC Workshop on Mobile Cloud Computing, 2012.
4. **Wei Zhang, *Edge Computing: A Primer*, SpringerBriefs in Computer Science, 2021.**

Course Outcomes:

CO1	Explain the fundamental concepts and evolution of edge and fog computing.
CO2	Describe the architecture and design principles of edge and fog computing systems.
CO3	Analyze real-world applications and case studies involving edge/fog computing.
CO4	Evaluate security, privacy, and resource management issues.
CO5	Apply edge and fog computing strategies to solve latency-sensitive IoT problems.

BCS416	Advanced Computer Networks	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To provide in-depth understanding of network protocols and layered architecture.
CO2	To study advanced concepts in routing, transport, and application layer protocols.
CO3	To explore emerging trends like SDN, MPLS, and data center networking.
CO4	To analyze network performance and quality of service (QoS) techniques.
CO5	To understand network security challenges and modern solutions.

Unit-I

Advanced Network Architecture and Protocols: Review of OSI and TCP/IP models, IPv6 and transition mechanisms, Socket programming and advanced IP addressing, Network simulation tools (e.g., NS2/NS3).

Unit-II

Routing and Traffic Engineering: Interior and Exterior Gateway Protocols: OSPF, BGP, Policy-based routing, Multiprotocol Label Switching (MPLS), Software Defined Networking, (SDN) architecture, Network virtualization.

Unit-III

Transport Layer Protocols and Congestion Control: TCP enhancements (TCP Reno, New Reno, Vegas), UDP and DCCP, Congestion control algorithms, Flow control, fairness, and reliability mechanisms, Real-time transport protocols (RTP/RTCP).

Unit-IV

Quality of Service (QoS) and Multimedia Networking: QoS models: IntServ, DiffServ, Traffic shaping and policing, Resource Reservation Protocol (RSVP), Multimedia transport and streaming protocols, Voice over IP (VoIP), SIP, H.323

.

Unit-V

Network Security and Emerging Technologies: Network attacks and mitigation: DoS, spoofing, sniffing, Firewalls, IDS/IPS, VPNs and tunneling protocols, IoT networking and challenges, Edge, fog, and 5G networking overview.

Textbooks and References:

1. **Larry L. Peterson and Bruce S. Davie**, *Computer Networks: A Systems Approach*, 5th Edition, Morgan Kaufmann, 2012.
2. **Behrouz A. Forouzan**, *Data Communications and Networking*, 5th Edition, McGraw-Hill, 2013.
3. **William Stallings**, *High-Speed Networks and Internets: Performance and Quality of Service*, 2nd Edition, Pearson, 2002.
4. **Andrew S. Tanenbaum and David J. Wetherall**, *Computer Networks*, 5th Edition, Pearson, 2011.

Course Outcomes:

CO1	Analyze and design complex network architectures and protocols.
CO2	Compare traditional and emerging routing techniques including MPLS and SDN.
CO3	Evaluate transport layer mechanisms and congestion control algorithms.
CO4	Apply techniques for traffic engineering and QoS in IP networks.
CO5	Identify and resolve security issues in computer networks.

BCS418	Data Warehouse and Data Mining	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To introduce the concepts of data warehousing and data mining techniques.
CO2	To design and implement a data warehouse for analytical processing.

CO3	To apply data mining algorithms for knowledge discovery from large datasets.
CO4	To evaluate various classifications, clustering, and association rule mining techniques.
CO5	To explore advanced topics like web mining, text mining, and big data analytics.

Unit-I

Introduction to Data Warehousing: Data warehouse architecture, OLTP vs OLAP, Multidimensional data model, Star, Snowflake, and Fact Constellation schemas, ETL process and data cleaning.

Unit-II

Data Warehouse Implementation: Data cube and OLAP operations, Indexing OLAP data, Efficient computation of data cubes, Materialization strategies, Data warehouse design and usage.

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Unit-III

Introduction to Data Mining: Data mining concepts and functionalities, Data preprocessing and data integration, Types of data mining: Descriptive vs Predictive, Knowledge discovery in databases (KDD), Issues and challenges in data mining.

Unit-IV

Association Rules and Classification: Association rule mining: Apriori algorithm, FP-Growth, Rule generation and evaluation metrics, Classification: Decision trees, Naïve Bayes, KNN, Evaluation methods: Confusion matrix, ROC curves.

Unit-V

Clustering and Advanced Topics: Clustering techniques: K-means, Hierarchical clustering, DBSCAN, Cluster evaluation methods, Introduction to Web mining, Text mining, and Big Data, Applications in business intelligence and fraud detection.

Textbooks and References:

1. **Jiawei Han, Micheline Kamber, and Jian Pei**, *Data Mining: Concepts and Techniques*, 3rd Edition, Morgan Kaufmann, 2011.
2. **Ralph Kimball and Margy Ross**, *The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling*, 3rd Edition, Wiley, 2013.
3. **Alex Berson and Stephen J. Smith**, *Data Warehousing, Data Mining, and OLAP*, McGraw-Hill, 1997.
4. **Pang-Ning Tan, Michael Steinbach, and Vipin Kumar**, *Introduction to Data Mining*, Pearson, 2019.

Course Outcomes:

CO1	Understand the architecture and components of data warehousing.
CO2	Design and implement data warehouse schemas using dimensional modeling.
CO3	Apply various data mining techniques like classification, clustering, and association.
CO4	Analyze patterns and relationships using data mining tools and algorithms.
CO5	Evaluate and interpret results for business intelligence and decision making.

BCS420	**Computational Complexity**	**L-T-P** **3-0-0**	**Credits: 3**

Course Objectives:

CO1	To introduce foundational models of computation and complexity classes.

CO2	To understand the concept of algorithmic efficiency and resource-bounded computation.
CO3	To explore complexity classes such as P, NP, NP-complete, and beyond.
CO4	To analyze space complexity, hierarchy theorems, and completeness.
CO5	To introduce advanced topics such as probabilistic computation and approximation algorithms.

Unit-I

Models of Computation and Time Complexity: Turing machines: deterministic and nondeterministic, Decision problems and languages, Time complexity and Big-O notation, Time-constructible functions, Complexity class P.

Unit- Class NP and Polynomial-Time Reductions**:** Definition of NP and nondeterministic computation, Polynomial-time verifiability and certificates, NP-completeness, Reductions and Cook-Levin theorem, NP-complete problems: SAT, CLIQUE, VERTEX COVER

.

Unit-III

Space Complexity and Hierarchy Theorems: Space complexity classes: L, NL, PSPACE, NPSPACE, Savitch's Theorem and NL = co-NL, Deterministic and nondeterministic space hierarchy theorems, PSPACE-completeness and QBF

Unit-IV

Advanced Complexity Classes: The Polynomial Hierarchy (PH), Randomized classes: RP, BPP, Interactive proofs: IP = PSPACE, Oracle machines and relativization, Time-space trade-offs

Unit-V

Approximation and Intractability: Approximation algorithms and performance ratios, APX and PTAS, PCP theorem (overview), Hardness of approximation, Complexity theory in cryptography and beyond.

Textbooks and References:

1. **Sanjeev Arora and Boaz Barak**, *Computational Complexity: A Modern Approach*, Cambridge University Press, 2009.
2. **Christos H. Papadimitriou**, *Computational Complexity*, Addison-Wesley, 1994.
3. **Michael Sipser**, *Introduction to the Theory of Computation*, 3rd Edition, Cengage Learning, 2012.
4. **Dexter Kozen**, *Theory of Computation*, Springer, 2006.

Course Outcomes:

CO1	Explain models of computation and classify problems based on complexity

CO2	Identify and analyze problems in P, NP, and NP-complete classes.
CO3	Apply polynomial-time reductions to prove NP-completeness.
CO4	Understand space complexity classes and the role of hierarchy theorems.
CO5	Explore probabilistic and parallel complexity, and limits of efficient computation.

BCS422	DevOps	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To understand the principles, practices, and tools of DevOps.
CO2	To explore continuous integration (CI), continuous delivery (CD), and automated deployment pipelines.
CO3	To learn configuration management, containerization, and orchestration tools.
CO4	To examine monitoring, logging, and incident response systems in DevOps.
CO5	To apply DevOps practices to improve software development lifecycle and business outcomes.

Unit-I

Introduction to DevOps: DevOps overview: History, goals, and benefits, DevOps vs traditional IT, Agile, Lean, and DevOps culture, Software Development Lifecycle (SDLC) and role of DevOps, DevOps pipeline overview.

Unit-II

Version Control and Continuous Integration: Source code management with Git and GitHub/GitLab, Branching strategies and merge workflows, CI tools: Jenkins, GitHub Actions, CI pipeline setup and integration testing, Build automation using Maven/Gradle.

.

Unit-III

Configuration Management and Deployment: Infrastructure as Code (IaC), Configuration tools: Ansible, Puppet, Chef, Environment provisioning, Continuous Deployment (CD), Artifact repositories: Nexus, JFrog Artifactory.

Unit-IV

Containerization and Orchestration: Introduction to Docker: images, containers, Dockerfile, Docker Compose and multi-container apps, Kubernetes: Pods, ReplicaSets, Deployments, Services, Helm charts and Kubernetes configuration management, Microservices and container orchestration.

Unit-V

Monitoring, Logging, and DevOps Security: Monitoring tools: Prometheus, Grafana, Nagios, Centralized logging: ELK Stack (Elasticsearch, Logstash, Kibana), Fluentd, Alerts and incident response, DevSecOps and secure CI/CD pipelines, Best practices and case studies in DevOps.

Textbooks and References:

1. **Len Bass, Ingo Weber, Liming Zhu**, *DevOps: A Software Architect's Perspective*, Addison-Wesley, 2015.
2. **Emily Freeman**, *DevOps for Dummies*, Wiley, 2019.
3. **Gene Kim, Jez Humble, Patrick Debois, John Willis**, *The DevOps Handbook*, IT Revolution Press, 2016.
4. **Jez Humble and David Farley**, *Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation*, Addison-Wesley, 2010.

Course Outcomes:

CO1	Explain the DevOps culture, principles, and the need for automation.
CO2	Implement continuous integration and continuous deployment pipelines.
CO3	Use tools like Git, Jenkins, Docker, Ansible, and Kubernetes in a DevOps workflow.
CO4	Monitor, log, and analyze performance of systems and applications.
CO5	Design scalable and automated DevOps pipelines for real-world projects.

BCS424	Autonomous Systems & Robotics	L-T-P 3-0-0	Credits: 3

CO1	To introduce the fundamentals of autonomous systems and intelligent robotics.
CO2	To understand kinematics, dynamics, and motion planning for mobile robots.
CO3	To explore sensing, perception, and localization techniques in robotics.
CO4	To study control architectures and decision-making strategies for autonomous behavior.
CO5	To gain insight into real-world applications and ethical implications of autonomous systems.

Course Objectives:

Unit-I

Introduction to Autonomous Systems and Robotics: Definition and characteristics of autonomous systems, History and evolution of robotics, Components of a robotic system: sensors, actuators, controllers, Types of robots: wheeled, legged, aerial, underwater, Applications in industry, healthcare, military, and service domains.

Unit-II

Robot Kinematics and Dynamics: Forward and inverse kinematics, Degrees of freedom (DoF), coordinate frames, and transformations, Robot dynamics and equations of motion, Mobile robot locomotion: differential drive, skid-steer, omni-wheels, Trajectory generation and path following

.

Unit-III

Sensing, Perception, and Localization: Robot sensors: LIDAR, sonar, GPS, cameras, IMU, Data fusion and sensor calibration, Environment mapping: occupancy grids, SLAM, Localization techniques: Kalman filter, Particle filter, Vision-based perception and object detection

Unit-IV

Planning and Decision Making: Motion planning: A*, D*, RRT, Behavior-based and deliberative architectures, Finite State Machines (FSM) and Hybrid control, Path planning vs trajectory planning, Real-time decision-making and reactive behaviors.

Unit-V

Autonomous System Design and Applications: Control architectures: centralized vs decentralized, ROS (Robot Operating System) framework, Multi-robot coordination and swarm robotics, Autonomous vehicles and drones, Ethics, safety, and human-robot interaction (HRI).

Textbooks and References:

1. **Siegwart, Roland; Nourbakhsh, Illah R.; Scaramuzza, Davide**, *Introduction to Autonomous Mobile Robots*, 2nd Edition, MIT Press, 2011.
2. **Bruno Siciliano and Lorenzo Sciavicco**, *Robotics: Modelling, Planning and Control*, Springer, 2009.
3. **John J. Craig**, *Introduction to Robotics: Mechanics and Control*, 4th Edition, Pearson, 2017.
4. **George A. Bekey**, *Autonomous Robots: From Biological Inspiration to Implementation and Control*, MIT Press, 2005.

Course Outcomes:

CO1	Describe the structure and functioning of autonomous robotic systems.
CO2	Apply principles of kinematics, motion planning, and navigation to mobile robots.
CO3	Utilize various sensors and perception techniques for robot localization and mapping.
CO4	Design control architectures and decision-making algorithms for autonomy.
CO5	Evaluate real-world applications, trends, and ethical considerations in autonomous robotics.

BCS320	Total Quality Management	L-T-P 3-0-0	Credits: 3

CO1	To provide a comprehensive understanding of quality concepts and the importance of TQM in organizations.
CO2	To introduce quality management tools and techniques for continuous improvement.
CO3	To understand the role of leadership and employee involvement in quality improvement.
CO4	To explore various quality standards, certifications, and benchmarking practices.
CO5	To study statistical tools and Six Sigma methodologies for quality control and assurance.

Open Electives:

Course Objectives:

Unit-I

Introduction to Total Quality Management: Definitions and dimensions of quality, Evolution of TQM and its principles, Contributions of quality gurus: Deming, Juran, Crosby, Feigenbaum, Customer focus and satisfaction, Cost of quality.

Unit-II

TQM Tools and Techniques: Seven basic tools: Flowcharts, Check sheets, Histograms, Pareto charts, Cause-and-effect diagrams, Control charts, Scatter diagrams, New management tools: Affinity diagram, Tree diagram, Matrix diagram, PDPC, Continuous improvement (Kaizen), 5S and Poka-Yoke (mistake-proofing).

.

Unit-III

Quality Management Systems: ISO 9000 series standards, Quality auditing and documentation, Environmental management systems (ISO 14000), Quality certification processes, Benchmarking and Quality Function Deployment (QFD)

Unit-IV

Statistical Quality Control (SQC): Fundamentals of statistics and probability, Control charts for variables and attributes, Process capability analysis (Cp, Cpk), Acceptance sampling and operating characteristic curves, Design of experiments (DOE)

Unit-V

Six Sigma and Leadership in TQM: Introduction to Six Sigma methodology: DMAIC, Roles and responsibilities in Six Sigma (Green Belt, Black Belt, etc.), Leadership and strategic planning for TQM, Employee involvement and teamwork, Organizational culture and change management in TQM.

Textbooks and References:

1. **Dale H. Besterfield**, *Total Quality Management*, 3rd Edition, Pearson Education, 2011.
2. **Subburaj Ramasamy**, *Total Quality Management*, McGraw Hill Education, 2013.
3. **Joel E. Ross**, *Total Quality Management: Text, Cases and Readings*, 3rd Edition, CRC Press, 1999.
4. **James R. Evans and William M. Lindsay**, *Managing for Quality and Performance Excellence*, 9th Edition, Cengage Learning, 2016.

Course Outcomes:

CO1	Define and explain core concepts and principles of Total Quality Management.
CO2	Apply quality improvement tools and techniques in real-world scenarios.
CO3	Analyze and interpret quality data using statistical quality control tools.
CO4	Evaluate the role of leadership, teamwork, and culture in TQM.
CO5	Implement quality standards such as ISO and Six Sigma in organizational processes.

BCS322	Human Computer Interaction	L-T-P 3-0-0	Credits: 3

CO1	To understand the fundamental concepts of Human-Computer Interaction.

Course Objectives:

CO2	To explore the design and evaluation of user interfaces.
CO3	To study human factors in the context of interaction with digital systems.
CO4	To apply usability principles and HCI design processes in real-world applications.
CO5	To learn modern tools and methods for user-centered design and interaction evaluation.

Unit-I

Introduction to HCI: Definition, importance, and goals of HCI, Human factors in HCI: memory, attention, perception, and cognition, Interaction models and paradigms, HCI in the context of system design, HCI and usability engineering

Unit-II

Design Process and User Requirements: Human-centered design process, User modeling and personas, Task analysis and scenario development, Requirements gathering techniques: interviews, observations, surveys, User interface design guidelines and standards

.

Unit-III

Interaction Styles and Interface Design: Command-line, menu-based, form-based, graphical, and web interfaces, Direct manipulation and virtual environments, Mobile and ubiquitous computing interfaces, Principles of good design: visibility, feedback, consistency, Navigation, layout, and accessibility

Unit-IV

Usability Evaluation and Prototyping: Usability evaluation methods: heuristic evaluation, cognitive walkthroughs, User testing and usability metrics, Low-fidelity and high-fidelity prototyping, Tools for prototyping: Figma, Adobe XD, Balsamiq, Case studies in usability testing

Unit-V

Advanced Topics in HCI: Affective computing and emotional design, Adaptive and intelligent user interfaces, Multimodal and natural user interfaces (NUIs), Brain-Computer Interfaces (BCIs), Ethics, privacy, and inclusivity in interface design

Textbooks and References:

1. **Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale**, *Human-Computer Interaction*, 3rd Edition, Pearson Education, 2004.
2. **Ben Shneiderman, Catherine Plaisant**, *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 6th Edition, Pearson, 2016.
3. **Donald A. Norman**, *The Design of Everyday Things*, Revised Edition, Basic Books, 2013.
4. **Jenny Preece, Yvonne Rogers, Helen Sharp**, *Interaction Design: Beyond Human-Computer Interaction*, 5th Edition, Wiley, 2019.

Course Outcomes:

CO1	Understand the principles of human-computer interaction and usability.
CO2	Analyze user needs and design interactive systems that meet those needs.
CO3	Apply cognitive and psychological principles to interface design.
CO4	Evaluate the usability and performance of user interfaces.
CO5	Use modern tools and techniques for prototyping and user interface development.

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MBA650	**Entrepreneurship Development**	**L-T-P** **3-0-0**	**Credits: 3**

Course Objectives:

CO1	To introduce students to the fundamental concepts of entrepreneurship.
CO2	Including the roles and functions of entrepreneurs, as well as the challenges they face the real-world business environment.
CO3	To equip students with the knowledge and skills needed to transform an idea into a viable business opportunity.
CO4	Providing a deep understanding of various funding sources available for startups.
CO5	To learn modern tools and methods for emerging technologies.

Unit-I

Fundamentals of Entrepreneurship: Meaning, definition, and concept of entrepreneurship, Evolution and importance of entrepreneurship in economic development, Characteristics, traits, and competencies of successful entrepreneurs, Difference between entrepreneur and manager, Types of entrepreneurs: innovative, imitative, drone, Fabian, social, and rural, Entrepreneurial mindset and behavior, Functions and roles of entrepreneurs in different sectors, Entrepreneurial decision-making process, Challenges and opportunities for entrepreneurs in emerging technologies.

Unit-II

Entrepreneurial Finance and Government Support: Financial planning for startups, Estimating fund requirements and working capital, Sources of finance: banks, NBFCs, venture capital, angel investors, crowdfunding, Overview of financial institutions: SIDBI, NABARD, NSIC, etc., Role of Central and State Governments in entrepreneurship development, Incentives, subsidies, and grants offered by the government, Export-oriented units: fiscal and tax concessions, Startup India, Make in India, and Digital India initiatives, Overview of MSME policy and its impact on entrepreneurship.

Unit-III

Innovation, Creativity, and Business Design: Meaning and significance of creativity and innovation in entrepreneurship, Types of innovation: product, process, business model, service, design-led, Startups vs. large firm innovation: differences and challenges, Open innovation and co-creation models, Developing an innovation strategy for startups, Role of emerging technologies (AI, ML, IoT) in entrepreneurial innovation, Creating an innovative business culture and environment, Design thinking and improvisation in startups, Intellectual Property Rights (IPR) basics for innovators**.**

Unit-IV

Idea Generation and Business Planning: Idea generation techniques and classification, Identification of market gaps and opportunity assessment, Individual creativity and ideation tools, Introduction to business model canvas, Process of starting a new venture and startup lifecycle, Business planning: elements and structure, Preparation of project report and pitch deck, Feasibility analysis: technical, market, economic, financial

Unit-V

Venture Launch, Legalities and Growth Strategies: Steps to launch a business: planning to execution, Legal structures: proprietorship, partnership, LLP, private/public limited, Registration process and licenses required for startups, Business scaling, growth strategies, and risk management, Marketing strategies for new ventures, Role of technology in scaling businesses, IPOs and exit strategies, Revival and closure of ventures: when and how, Ethical and social responsibilities of entrepreneurs.

Textbooks and References:

1.Khanka, S.S.; Entrepreneurial Development; S. Chand and Co.

2. Mitra, Jay: The Business of Innovation, 2017, SAGE Publishing

3.*Entrepreneurship* – Rajeev Roy, Oxford University Press

5. *Entrepreneurship Development and Small Business Enterprises* – Poornima M. Charantimath, Pearson Education

6. *Innovation and Entrepreneurship* – Peter F. Drucker, Harper Business

7. *The Lean Startup* – Eric Ries, Crown Publishing

8. *Business Model Generation* – Alexander Osterwalder & Yves Pigneur, Wiley

Course Outcomes:

CO1	Understand the meaning, definition, and concept of entrepreneurship and its evolution in economic development.
CO2	Understand the meaning, definition, and concept of entrepreneurship and its evolution in economic development
CO3	Differentiate between an entrepreneur and a manager and identify various types of entrepreneurs
CO4	Evaluate the entrepreneurial mindset, behavior, and the decision-making process i process in the entrepreneurial journey.
CO5	Recognize the challenges and opportunities for entrepreneurs, particularly in emerging technologies.

BAS326	Non-Conventional Energy Resource	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To introduce the importance and scope of renewable and non-conventional energy resources.
CO2	To provide knowledge of solar, wind, biomass, and other alternative energy technologies.
CO3	To study the design and application of energy systems using renewable sources.
CO4	To create awareness about environmental and economic aspects of non-conventional energy.
CO5	To promote sustainable and energy-efficient practices in engineering and daily life.

Unit-I

Introduction to Energy Resources: Overview of global and Indian energy scenario, Classification of energy sources: conventional vs non-conventional, Need for renewable energy and sustainability, Energy consumption patterns and future trends, Energy economics and environmental impacts

Unit-II

Solar Energy: Solar radiation and measurement, Solar thermal systems: flat plate collectors, concentrating collectors, Solar photovoltaic (PV) systems: working principle, types of PV cells, Applications: solar water heater, solar cooker, solar dryer, solar street lighting, Grid-connected and off-grid solar systems

Unit-III

Wind Energy: Wind characteristics and site selection, Basic components and types of wind turbines, Wind energy conversion systems (WECS), Performance analysis of wind systems, Environmental impact and challenges of wind energy

Unit-IV

Biomass and Bioenergy: Biomass resources: types and availability, Biogas production: anaerobic digestion, plant design, Biofuels: biodiesel, ethanol, Biomass gasification and combustion, Waste-to-energy technologies

Unit-V

Other Renewable Energy Sources: Small hydroelectric power: types and layout, Geothermal energy: sources, types, and utilization, Ocean energy: tidal, wave, and ocean thermal energy conversion (OTEC), Hydrogen energy and fuel cells, Hybrid renewable energy systems

Textbooks and References:

1. G.D**. Rai**, *Non-Conventional Energy Sources*, Khanna Publishers, 5th Edition, 2011.

2. **D.S. Chauhan**, *Non-Conventional Energy Resources*, New Age International Publishers, 2010.

3. **S.P. Sukhatme and J.K. Nayak**, *Solar Energy: Principles of Thermal Collection and Storage*, 3rd Edition, Tata McGraw Hill, 2008.

4. **S. Rao and Dr. B.B. Parulekar**, *Energy Technology: Non-Conventional, Renewable and Conventional*, Khanna Publishers, 2017.

Course Outcomes:

CO1	Understand the need for and types of non-conventional energy resources..
CO2	Explain the working principles of solar, wind, biomass, and other renewable systems.
CO3	Analyze the performance of various non-conventional energy systems.
CO4	Evaluate the economic and environmental benefits of renewable energy.
CO5	Apply knowledge of renewable energy systems in real-life energy planning and management.

BAS328	Operational Research	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To introduce students to the basic concepts and techniques of operations research.
CO2	To develop skills in formulating mathematical models for decision-making problems.
CO3	To provide an understanding of optimization techniques like linear programming and transportation models.
CO4	To enable students to apply analytical methods to solve real-world business and engineering problems
CO5	To foster critical thinking in choosing appropriate tools for decision support.

Unit-I

Introduction and Linear Programming: Introduction to Operational Research (OR) and its applications, Characteristics and phases of OR, Formulation of Linear Programming Problems (LPP), Graphical method and Simplex method, Duality and sensitivity analysis.

Unit-II

Transportation and Assignment Models: Transportation problem: formulation, initial basic feasible solution (North-West Corner Rule, Least Cost, Vogel's Approximation), Optimality test (MODI method), Assignment problem: Hungarian method for optimal assignment, Variants of assignment problem (unbalanced, maximization, restricted)

Unit-III

Decision Theory and Game Theory: Decision-making under uncertainty and risk, Decision trees, Game theory: two-person zero-sum games, Pure and mixed strategies, Saddle point and dominance rules

Unit-IV

Queuing Theory and Inventory Control: Characteristics of a queuing system, Queuing models: M/M/1 and M/M/C (infinite population), Inventory models: deterministic models (EOQ, quantity discount), probabilistic models, Safety stock and reorder point calculation

Unit-V

Network Analysis and Simulation: Project Management: PERT and CPM, Network construction, time estimates, critical path, slack, Crashing of networks and cost optimization, Basics of simulation: Monte Carlo simulation, Applications in inventory and queuing systems.

Textbooks and References:

1. **Hamdy A. Taha**, *Operations Research: An Introduction*, 10th Edition, Pearson, 2017.

2. **P.K. Gupta & D.S. Hira**, *Operations Research*, S. Chand & Co., 2014.

3. **Kanti Swarup, P.K. Gupta, Man Mohan**, *Operations Research*, Sultan Chand & Sons, 2017.

4. **J.K. Sharma**, *Operations Research: Theory and Applications*, Macmillan India, 5th Edition, 2013.

Course Outcomes:

CO1	Formulate and solve linear programming problems using graphical and simplex methods.
CO2	Apply transportation and assignment models for logistics and resource allocation.
CO3	Use decision theory and game theory for strategic decision-making under uncertainty.
CO4	Solve queuing and inventory problems using standard models.
CO5	Utilize simulation and project management techniques in operational research contexts.

BAS425	Soft Skills and Interpersonal Communications	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To help students understand the significance of soft skills in personal and professional success.
CO2	To enhance communication skills, both verbal and non-verbal, for effective interpersonal interactions.
CO3	To develop teamwork, leadership, and problem-solving skills.
CO4	To improve emotional intelligence and time management for workplace readiness.
CO5	To instill confidence and prepare students for interviews and group discussions.

Unit-I

Introduction to Soft Skills: Definition and importance of soft skills, Categories of soft skills: personal, social, communication-based, and thinking skills, Attributes of a successful professional, Self-awareness and personal development, SWOT analysis and goal setting

Unit-II

Communication Skills: Verbal and non-verbal communication, Barriers to effective communication, Listening skills and feedback mechanisms, Business communication: emails, memos, reports, Oral communication: public speaking, storytelling, voice modulation

Unit-III

Interpersonal and Teamwork Skills: Interpersonal relationships and rapport building, Team dynamics and collaboration, Leadership styles and qualities, Conflict management and negotiation skills, Empathy and emotional intelligence

Unit-IV

Professional and Workplace Skills: Time management and stress management, Adaptability and resilience, Decision-making and problem-solving techniques, Ethics and professionalism in the workplace, Managing criticism and workplace etiquette

Unit-V

Job Readiness and Presentation Skills: Resume and cover letter writing, Group discussions: structure, preparation, and practice, Interview skills: types of interviews, mock interviews, Presentation skills: planning, organizing, and delivering presentations, Body language and grooming for success

Textbooks and References:

1. **Barun K. Mitra**, *Personality Development and Soft Skills*, Oxford University Press, 2016.
2. **Meenakshi Raman & Sangeeta Sharma**, *Technical Communication: Principles and Practice*, Oxford University Press, 2015.
3. **K. Alex**, *Soft Skills: Know Yourself and Know the World*, S. Chand Publishing, 2014.
4. **Goleman, Daniel**, *Emotional Intelligence*, Bantam Books, 2006.

Course Outcomes:

CO1	Demonstrate effective verbal, non-verbal, and written communication in various contexts.
CO2	Exhibit strong interpersonal and teamwork skills in group settings.
CO3	Apply leadership, emotional intelligence, and time management techniques in practical scenarios.
CO4	Identify and use appropriate strategies for conflict resolution and decision-making.
CO5	Prepare and perform successfully in interviews, presentations, and professional discussions.

MBA651	Human Resource Development and Organizational Behaviour	L-T-P 3-0-0	Credits: 3

Course Objectives:

CO1	To provide students with a foundational understanding of Human Resource Management, including its scope, functions, and the strategic role of HR professionals in modern organizations.
CO2	To equip students with knowledge of human resource planning, recruitment, selection, training, and development processes essential for effective talent management.
CO3	To develop an understanding of employee performance appraisal, compensation systems, and welfare measures, and their role in organizational effectiveness
CO4	To familiarize students with key concepts of Organizational Behaviour, including individual behavior, perception, personality, learning, group dynamics, and teamwork.
CO5	To enable students to understand the principles of motivation, leadership, stress management, and conflict resolution, and their application in enhancing organizational productivity and employee well-being.

Unit-I

Introduction to Human Resource Management and Planning Concept, Scope, and Importance of HRM, Functions of HRM, Role of HR Manager in Modern Organizations, HRM vs. Personnel Management; HRM vs. HRD, Human Resource Planning: Process and Importance, Job Analysis, Job Description, and Job Specification,Recruitment: Sources and Methods, Selection Process and Techniques.

Unit-II

Training, Development, and Performance Management: Concept and Importance of Training and Development, Methods of Employee Training and Development, Performance Appraisal: Purpose, Process, and

Methods, Career Planning and Succession Planning, Components of Compensation, Wage and Salary Administration, Incentives and Fringe Benefits, Employee Welfare and Social Security Measures

Unit-III

Employee Relations, Ethics, and Human Resource Accounting : Industrial Relations, Employee Discipline and Grievance Handling, Ethical Issues in HRM, Human Resource Accounting (HRA): Meaning, Objectives and Scope of HRA

Unit-IV

Foundations of Organizational Behaviour and Individual Dynamics Organizational Behaviour (OB): Meaning, Features, Nature, and Scope, Challenges and Opportunities for OB, Organizational Goals and Models of OB, Impact of Global and Cultural Diversity on OB, Individual Behaviour: Meaning, Definition, Factors Affecting Individual Behaviour: Personality, Determinants of Personality, Personality Traits and Theories, Perception: Perceptual Process and Factors Affecting Perception, Learning: Concepts and Implications

Unit-V

Group Behaviour, Motivation, Leadership, and Stress Management: Group Dynamics: Meaning, Features, and Types of Group Behaviour, Formal and Informal Group Behaviour, Group Norms and Group Cohesiveness, Teamwork: Types, Teams vs. Groups, , Motivation: Concept, Financial and Non-Financial Motivators, Theories of Motivation: Maslow, Herzberg, McGregor (Theory X and Y), Leadership: Types, Leadership Theories, Leadership Styles, Modern Approaches, Stress Management: Meaning, Types and Causes of Stress, Consequences of Work, Stress and Conflict: Types and Levels, Organisational Development: Meaning, Need, Benefits, and Limitations

Textbooks and References:

1. Aswathappa, K.; *Human Resource Management: Text and Cases.* 9th Edition, McGraw Hill Education, New Delhi, 2020.
2. Gupta, C. B.; *Human Resource Management.* 1st Edition, Sultan Chand and Sons,New Delhi, 2019.
3. Aswathappa K., Human Resource and Personnel Management, TMH, 5thEdition.
4. Rao V.S.P.,Human Resource Management: Text and Cases, Excel Books, 2nd Edition.
5. Ivansevich, Human Resource Management, Tata McGraw Hill, 10th Edition.

***The latest editions of all the suggested books are recommended.**

Course Outcomes:

CO1	Understand the core concepts, scope, and functions of Human Resource Management, including planning, recruitment, and selection processes.
CO2	Analyze the significance of training, development, performance appraisal, and compensation in enhancing employee effectiveness
CO3	Evaluate employee relations, ethical issues, and the role of Human Resource Accounting in organizational decision-making..
CO4	Demonstrate an understanding of individual behavior, personality, perception, and learning within an organizational context..
CO5	Examine group dynamics, motivation, leadership, and stress management

	techniques for improving organizational performance.

BCS429	Product Development	L-T-P 3-0-0	Credits: 3

CO1	To understand the processes and methodologies involved in new product development.
CO2	To equip students with the ability to generate and evaluate product ideas.
CO3	To introduce tools for designing, prototyping, and analyzing product performance.
CO4	To impart knowledge of product lifecycle, innovation, and market strategies.
CO5	To develop skills in cross-functional teamwork and customer-centric design.

Course Objectives:

Unit-I

Introduction to Product Development: Definition and importance of product development, Types of products: consumer, industrial, software, Product development process and stages, Roles of design, engineering, marketing, and manufacturing, Innovation and technology trends

.

Unit-II

Product Planning and Concept Development: Identifying customer needs, Market research and opportunity identification, Product specifications and requirement gathering, Idea generation techniques: brainstorming, TRIZ, mind mapping, Concept development and selection

Unit-III

Product Design and Architecture: Product architecture and modularity, Design for manufacturing and assembly (DFMA), Industrial design and aesthetics, Ergonomics and usability considerations, Design review and risk analysis

Unit-IV

Prototyping and Testing: Prototyping techniques: virtual, physical, rapid prototyping, Design validation and testing, Failure mode and effects analysis (FMEA), Iterative design and improvement, Case studies of successful product iterations.

Unit-V

Product Launch and Lifecycle Management: Product costing and pricing strategies, Marketing strategies for product launch, Supply chain and production planning, Product lifecycle management (PLM), Post-launch review and continuous improvement.

Textbooks and References:

1. **Karl T. Ulrich & Steven D. Eppinger**, *Product Design and Development*, 6th Edition, McGraw- Hill Education, 2015.
2. **Anil Mital, Anoop Desai, Anand Subramanian**, *Product Development: A Structured Approach to Consumer Product Development, Design, and Manufacture*, Academic Press, 2014.
3. **Tim Jones**, *New Product Development: An Introduction to a Multifunctional Process*, Butterworth-Heinemann, 1997.
4. **Don Norman**, *The Design of Everyday Things*, Basic Books, 2013.
5. **Jennifer E. Goodman**, *Product Innovation Toolbox*, Wiley, 2012.

Course Outcomes:

CO1	Understand the fundamentals and phases of the product development process.
CO2	Apply techniques for idea generation, concept selection, and product architecture.
CO3	Use tools and strategies for prototyping, testing, and improving product design.
CO4	Analyze the economic and market viability of a product.
CO5	Work in cross-functional teams to plan and manage a product development project.

BAS427	Queuing Theory and Modelling	L-T-P 3-0-0	Credits: 3

CO1	To introduce the fundamental concepts of queuing theory and its role in performance modeling.
CO2	To analyze various types of queuing systems and their real-world applications.
CO3	To understand stochastic processes and their application in modeling queues.
CO4	To equip students with analytical tools to model and solve queuing problems.
CO5	To prepare students to apply queuing theory in domains like computer networks, operations management, and service systems.

Course Objectives:

Unit-I

Introduction to Queuing Theory: Basic structure and characteristics of a queuing system, Kendall's notation, Performance measures: queue length, waiting time, server utilization, Applications of queuing theory, Introduction to stochastic processes

. Unit-II

Markovian Queues – M/M/1 and M/M/c: Poisson process and exponential distribution, M/M/1 queue: steady-state analysis, performance metrics, M/M/c queue: multiple servers, Erlang's formula, Birth-death process, System stability and throughput

Unit-III

Advanced Queuing Models: M/M/∞ and M/M/1 with finite system capacity, M/M/c with limited capacity (blocking systems), M/G/1 queue: Pollaczek–Khinchine formula, G/M/1 queue, Queues with priorities and balking/reneging behavior

Unit-IV

Networks of Queues and Applications: Jackson networks and open/closed queuing networks, Applications in computer systems (e.g., CPU scheduling, buffer queues), Modeling call centers, hospital systems, and communication networks, Performance evaluation and bottleneck analysis

Unit-V

Simulation of Queuing Systems: Introduction to simulation techniques, Discrete event simulation for queuing models, Generation of random variables and events, Simulation tools (e.g., MATLAB, Python, Arena), Case studies and real-time system modeling

Textbooks and References:

1. **Donald Gross, John F. Shortle, James M. Thompson, Carl M. Harris**, *Fundamentals of Queueing Theory*, 4th Edition, Wiley, 2008.

2. **Trivedi, Kishor S.**, *Probability and Statistics with Reliability, Queuing and Computer Science Applications*, 2nd Edition, Wiley India, 2008.

3. **Leonard Kleinrock**, *Queueing Systems, Volume 1: Theory*, Wiley-Interscience, 1975.
4. **J. Medhi**, *Stochastic Models in Queueing Theory*, Academic Press, 2nd Edition, 2002.
5. **Robert B. Cooper**, *Introduction to Queueing Theory*, North Holland, 1981.

Course Outcomes:

CO1	Understand the structure, notation, and types of queuing systems.
CO2	Analyze and solve basic Markovian (M/M/1, M/M/c) queuing models.
CO3	Evaluate non-Markovian and advanced queuing models (M/G/1, G/M/1).
CO4	Apply queuing models to computer networks, service operations, and manufacturing.
CO5	Use simulation techniques to model and analyze complex queuing scenarios.

BCS427	E-Governance and Digital Transformation	L-T-P 3-0-0	Credits: 3

CO1	To introduce the concepts and frameworks of e-Governance and digital transformation.

Course Objectives:

CO2	To understand the role of ICT in public administration and governance
CO3	To explore various models, policies, and strategies used in implementing e-Governance..
CO4	To analyze digital transformation initiatives in different sectors and countries.
CO5	To evaluate the impact, challenges, and future trends in e-Governance systems.

Unit-I Introduction to E-Governance: Evolution and scope of e-Governance, Difference between e-Governance and e-Government, Objectives and benefits of e-Governance, Key enablers: ICT, Internet, Mobile, Cloud, and AI, Stakeholders in e-Governance

. Unit-II

E-Governance Models and Infrastructure: Government-to-Government (G2G), Government-to-Citizen (G2C), Government-to-Business (G2B), and Government-to-Employee (G2E) models, National e-Governance Plan (NeGP), Digital India, Common Service Centers (CSCs), SWAN, SDC, e-Seva, Role of UIDAI, Aadhar, and DigiLocker, Open Government Data (OGD)

Unit-III

Policies, Legal Framework & Cybersecurity: E-Governance policies and guidelines, IT Act 2000 and amendments, Data privacy and protection in digital governance, Cybersecurity concerns in e-Governance, Ethics and accountability in digital governance

Unit-IV

Digital Transformation in Governance: Digital transformation: definition, scope, and significance, E-Governance maturity models and evaluation, Emerging technologies: AI, Blockchain, IoT in governance, Citizen-centric services and digital inclusion, Smart governance and urban transformation (Smart Cities Mission)

Unit-V

Case Studies and Future Trends: Case studies from India (e.g., e-Choupal, Bhoomi Project, Passport Seva, e-District), Global case studies: Estonia, Singapore, UK, Digital literacy and capacity building, Challenges: digital divide, resistance to change, infrastructure, Future trends in digital governance: GovTech, cloud-first policy, predictive analytics

Textbooks and References:

1. **Pankaj Sharma**, *E-Governance: The New Age Governance*, APH Publishing, 2004.
2. **Satyanarayana J.**, *E-Government: The Science of the Possible*, PHI Learning, 2006.
3. **Heeks, Richard**, *Implementing and Managing E-Government: An International Text*, SAGE Publications, 2006.
4. **Shailendra C. Jain Palvia et al.**, *E-Government and E-Governance: Definitions, Domain Framework and Status around the World*, ICEG 2007.
5. Government of India Reports: *Digital India Initiative*, *NeGP*, *MeitY Guidelines*, etc.

Course Outcomes:

CO1	Understand the evolution, concepts, and frameworks of e-Governance.

CO2	Analyze various models, infrastructure, and applications of e-Governance in public administration.
CO3	Evaluate policies, legal frameworks, and citizen-centric services.
CO4	Explore digital transformation strategies and their role in governance reforms.
CO5	Examine case studies and identify challenges and future trends in digital governance.