GURU KASHI UNIVERSITY

B.Tech. Computer Science & Engineering (Artificial Intelligence & Machine Learning with Quantum Technology)

(Single Major)

Session: 2026-27

Faculty of Engineering & Technology

Graduate Attributes of the Programme: -

Type of learning outcomes	**The Learning Outcomes Descriptors**
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/interdisciplinary areas of learning	The programme focuses to design and develop computer programs in the areas related to algorithm, networking, web design and cloud computing to understand, analyze, develop and efficiently solve problems related to computer-based systems.
Generic learning outcomes	The generic learning outcomes for graduates typically include: Problem Analysis, Design and Development, Modern Tool Usage, Lifelong Learning
	1.Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems 2.Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. 3.Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. 4.Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. 5.Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. 6.Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. 7.Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. 8.Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

	9.Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. 10.Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions 11.Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. 12.Life-long learning**:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Learning outcomes: An Undergraduate Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 4.5:

Element of the Descriptor	**Programme learning outcomes relating to Undergraduate Certificate programme**
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
	Understand about engineering applications and its importance in society.
	Understand programming Skills to solve simple numerical method problems.
	Identify, formulate and analysis of mathematics, natural sciences, and engineering sciences.
General, technical and professional skills required to perform and accomplish tasks	Design experiments and acquires data in order to explore physical principles, effectively communicate results, and evaluate related scientific studies.
Application of knowledge and skills	Development of tools for job-ready skills, and entrepreneurship skills.
Generic learning outcomes	Understanding of global change and sustainability while placing the development of physics.
Constitutional, humanistic, ethical, and moral values	Development of physics in its historical and cultural context.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Design new instruments for entrepreneurship skills with practical knowledge. Acquire necessary skills/hand on experience/ working knowledge on live projects and experiments.
Credit requirements	52
Entry requirements	A candidate who has passed Senior Secondary Certificate Examination (Class XII level) of the Board of School Education, Punjab; or any other examination recognized as equivalent thereto with minimum passing marks in aggregate, shall be eligible to join First Semester of the Undergraduate (UG) Programme.

Programme Structure

Semester:1st									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**	**Int**	**Ext.**	**Total Marks**
BAI1100	Engineering Physics	Major Core Course	3	0	0	3	30	70	100
BAI1101	Engineering Mathematics-I	Major Core Course	3	1	0	4	30	70	100
BAI1102	Engineering Physics Practical	Major Core Course	0	0	2	1	30	70	100
BAI1103	Engineering Graphics & Drawing	DSEC	4	0	0	4	30	70	100
BAI1104	Communication Skills-I	Ability Enhancement Course	2	0	0	2	30	70	100
VAC0001	Environment Education	VAC	2	0	0	2	30	70	100
BAI1105	Principle of Economics	Multidisciplinary Course	3	0	0	3	30	70	100
BAI1106	Basic Electrical Engineering	Minor Course	3	0	0	3	30	70	100
BAI1107	Basic Electrical Engineering Practical	Minor Course	0	0	2	1	30	70	100
BAI1108	Computer Proficiency	Skill Enhancement Course	2	0	0	2	30	70	100
BAI1109	Computer Proficiency Practical	Skill Enhancement Course	0	0	2	1	30	70	100
BAI1110	Entrepreneurship Setup & Launch	Skill Enhancement Course	0	0	4	2	30	70	100
Total			**22**	**1**	**10**	**28**	**360**	**840**	**1200**

Semester-2nd									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No of Credits**	**Int**	**Ext**	**Total Marks**
BAI2150	Engineering Chemistry	Major Core Course	3	0	0	3	30	70	100
BAI2151	Engineering Mathematics-II	Major Core Course	3	1	0	4	30	70	100
BAI2152	Engineering Chemistry Practical	Major Core Course	0	0	2	1	30	70	100
BAI2153	Communication Skills-II	Ability Enhancement Course	2	0	0	2	30	70	100
BAI2154	Manufacturing Practices	Skill Enhancement Course	0	0	6	3	30	70	100
BAI2155	Indian Constitution	Multidisciplinary	3	0	0	3	30	70	100
VAC0002	Human Value and Professional Ethics	VAC	2	0	0	2	30	70	100
BAI2156	Programming for Problem Solving	Minor Course	3	0	0	3	30	70	100
BAI2157	Programming for Problem Solving Practical	Minor Course	0	0	2	1	30	70	100
BAI2158	Entrepreneurship & Marketing Basics	Skill Enhancement Course	0	0	4	2	30	70	100
Total			**16**	**1**	**14**	**24**	**300**	**700**	**1000**

Programme learning outcomes: An Undergraduate Diploma is awarded to students who have demonstrated the achievement of the outcomes located at level 5:

Element of the Descriptor	**Programme learning outcomes relating to Undergraduate Diploma programme**
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Understand the advanced and latest manufacturing techniques being used in engineering industry
	Apply knowledge of reading & writing Language skills
	Identify, formulate and analysis of mathematics, natural sciences, and engineering sciences.
General, technical and professional skills required to perform and accomplish tasks	Ability to analyze situations and propose logical solutions.
	Reading & Writing reports, presenting ideas, and articulating thoughts clearly. Keeping up with new concepts and changes in technology or business practice
	Ability to find credible sources, analyze data, and synthesize information.
Application of knowledge and skills	Develop knowledge of applications of algorithms for the creation, insertion, deletion, searching and sorting of each data structure problem. Develop solutions for a range of problems using objects and classes.
Generic learning outcomes	Ability to Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
Constitutional, humanistic, ethical, and moral values	Construct the ability to face difficult situations in life boldly and resolve them confidently.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Analyze and design various combinational and sequential circuits
Credit requirements	98
Entry requirements	A student can re-enter into second year of a programme if she/he has taken an exit option after first year(UG DIPLOMA in CSE-AI&ML)

Semester:3rd									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No of Credits**	**Int.**	**Ext.**	**Total Marks**
BAI3200	Object Oriented Programming Using C++	Major Core Course	3	0	0	3	30	70	100
BAI3201	Object Oriented Programming Using C++ (Practical)	Major Core Course	0	0	2	1	30	70	100
BAI3202	Data Structure & Algorithms	Minor Core	3	0	0	3	30	70	100
BAI3203	Data Structure & Algorithms Practical	Minor Core Course	0	0	2	1	30	70	100
BAI3204	Professional Communication	Ability Enhancement Course	2	0	0	2	30	70	100
BAI3205	Numerical Methods and Analysis	DSEC	4	0	0	4	30	70	100
IKS0006	Indian Health Sciences	VAC	2	0	0	2	30	70	100
BAI3206	Sustainable Development	Multidisciplinary Course	3	0	0	3	30	70	100
BAI3207	Operations and Scale	Skill-Based Course	0	0	4	2	30	70	100
Elective Course -1 Skill Enhancement (Any one of the following)									
BAI3208	Digital Electronics	Skill Enhancement Course	2	0	0	2	30	70	100
BAI3209	Digital Electronics (Practical)		0	0	2	1	30	70	100
BAI3210	Disaster Risk Reduction and Management: Skills for Safety and Resilience		2	0	2	3	30	70	100
BAI3211	Basics of Cyber Security		3	0	0	3	30	70	100
Total			**19/20**	**0**	**10/11**	**24**	**330/300**	**770/700**	**1100/1000**

Semester: 4th									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**	**Int.**	**Ext.**	**Total Marks**
BAI4250	Artificial Intelligence	Major Core Course	4	0	0	4	30	70	100
BAI4251	Operating System	Major Core Course	3	0	0	3	30	70	100
BAI4252	Operating System (Practical)	Major Core Course	0	0	2	1	30	70	100
BAI4253	Python Programming	Major Core Course	3	0	0	3	30	70	100
BAI4254	Python Programming (Practical)	Major Core Course	0	0	2	1	30	70	100
BAI4255	Discrete Mathematics	Vocational Core course	4	0	0	4	30	70	100
BAI4256	Report Writing	Ability Enhancement Course	2	0	0	2	30	70	100
IKS0009	Indian Agriculture	VAC	2	0	0	2	30	70	100
BAI4257	Organic Growth	Skill-Based Course	0	0	4	2	30	70	100
Discipline Specific Elective Course -1(Any one of the following)									
BAI4258	Computer Organization & Architecture	Discipline Specific Elective	4	0	0	4	30	70	100
BAI4259	Network Security								
Total			**22**	**0**	**8**	**26**	**300**	**700**	**1000**

Programme learning outcomes: An Bachelor of Vocational in CSE(AIML with Quantum Computing) awarded to students who have demonstrated the achievement of the outcomes located at level 5.5:

Element of the Descriptor	**Programme learning outcomes relating to 3year UG Degree programme**
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	An understanding of and apply current theories, models, programming and techniques that provide a basis for the software lifecycle Development & Training.
	Discuss the basic concepts of open source platform to understand programming skills.
	Identify, formulate and analysis of mathematics, natural sciences, and engineering sciences.
General, technical and professional skills required to perform and accomplish tasks	Develop the logic ability in order to master your programming skills Software Product, Software crisis, Handling complexity through Abstraction and. Decomposition,
Application of knowledge and skills	Develop solutions for a range of problems using different computers based experimentation and analyze, interpret data.
Generic learning outcomes	Design & Develop different applications software of different programming language on different platforms. Organize web media objects using editing software Problem-Solving & Analytical Thinking. Develop an entrepreneurial mindset by identifying market problems and creating tech solutions.
Constitutional, humanistic, ethical, and moral values	Construct the ability to face difficult situations in life boldly and resolve them confidently.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Ability to have Technical Skills (Hard Skills) in different fields like cybersecurity, Web Development, App Development: Android. Software Development Life Cycle (SDLC) & Agile Methodologies. Hands-on experience with real-world projects
Credit requirements	146
Entry requirements	A student can re-enter into third year of a programme if she/he has taken an exit option after 2nd year(U.G Diploma in CSE(AI&ML with Quantum Computing)

Semester: 5th									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**	**Int.**	**Ext.**	**Total Marks**
BAI5300	Java Programming	Major Core Course	3	0	0	3	30	70	100
BAI5301	Java Programming (Practical)	Major Core Course	0	0	2	1	30	70	100
BAI5302	Relational Database Management System	Major Core Course	3	0	0	3	30	70	100
BAI5303	Relational Database Management System (Practical)	Major Core Course	0	0	2	1	30	70	100
BAI5304	Web Designing & Development	Vocational Course	3	0	0	3	30	70	100
BAI5305	Web Designing & Development (Practical)	Vocational Course	0	0	2	1	30	70	100
BAI5306	Machine Learning	Major Core Course	3	0	0	3	30	70	100
BAI5307	AI Automation & Finance	Skill Based COurse	0	0	4	2	30	70	100
Discipline Specific Elective Course -II(Any one of the following)									
BAI5308	Soft Computing	**Discipline Elective Course**	4	0	0	4	30	70	100
BAI5309	Software Engineering								
Discipline Specific Elective Course -III (Select any subject with its Practical.)									
BAI5310	Introduction to Quantum Computing	**Discipline Elective Course**	3	0	0	3	30	70	100
BAI5311	Quantum Programming (Practical)		0	0	2	1	30	70	100
BAI5312	Computer Graphics		3	0	0	3	30	70	100
BAI5313	Computer Graphics (Practical)		0	0	2	1	30	70	100
Total			**20**	**0**	**12**	**25**	**330**	**770**	**1100**

Semester: 6th									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**	**Int.**	**Ext.**	**Total Marks**
BAI6350	Formal Language & Automata Theory	Major Core Course	4	0	0	4	30	70	100
BAI6351	Deep Learning	Major Core Course	4	0	0	4	30	70	100
BAI6352	Computer Networks	Major Core Course	4	0	0	4	30	70	100
BAI6353	Design & Development of Applications	Vocational Course	3	0	0	3	30	70	100
BAI6354	Design & Development of Applications (Practical)	Vocational Course	0	0	2	1	30	70	100
Discipline Specific Elective Course -IV(Any one of the Following									
BAI6355	Quantum Communication and Cryptography	**Discipline Elective**	4	0	0	4	30	70	100
BAI6356	Internet of Things (IoT)								
Discipline Specific Elective Course -V(Any one of the Following									
BAI6357	Digital Forensics	**Discipline Elective**	4	0	0	4	30	70	100
BAI6358	Foundation of Blockchain Architecture Design								
Total			**23**	**0**	**2**	**24**	**210**	**490**	**700**

Element of the Descriptor	Programme learning outcomes relating to Bachelor's Degree
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Understanding of advanced computer science concepts, industry trends, and research-oriented knowledge.
	focuses on specialization, innovation, and career preparation.
General, technical and professional skills required to perform and accomplish tasks	Advanced technical expertise, professional skills, and general competencies that prepare them for jobs, research, and entrepreneurship.
Application of knowledge and skills	Apply their theoretical knowledge and technical skills to real-world projects, industry-oriented tasks, research, and innovation.
Generic learning outcomes	Students will be Advanced Technical Proficiency. Project Management and Team ColPracticaloration skill. Recognizing the rapid evolution of technology, students should be prepared for continuous learning and professional development throughout their careers.
Constitutional, humanistic, ethical, and moral values	Construct the ability to face difficult situations in life boldly and resolve them confidently.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Ability to have Technical Skills (Hard Skills) in different fields like cybersecurity, Web Development, App Development: Android. Software Development Life Cycle (SDLC) & Agile Methodologies. Hands-on experience with real-world projects.
Credit requirements	190
Entry requirements	A student can re-enter into Fourth year of a programme if she/he has taken an exit option after 3rd year(B.Voc in CSE-AL&ML with Quantum Computing).

Semester:7th									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No of Credits**	**Int.**	**Ext.**	**Total Marks**
BAI7400	Introduction to Cloud Computing	Major Core Course	4	0	0	4	30	70	100
BAI7401	Natural Language Processing	Major Core Course	3	0	0	3	30	70	100
BAI7402	Natural Language Processing (Practical)	Major Core Course	0	0	2	1	30	70	100
BAI7403	Big Data	Major Core Course	4	0	0	4	30	70	100
BAI7404	Introduction to Robotics	Minor Course	4	0	0	4	30	70	100
BAI7405	Project (Experiential Learning)	Minor Course	0	0	4	2	30	70	100
Discipline Specific Elective Course -VI (Select any subject with its Practical.)									
BAI7406	Quantum Computing Applications and Project	**Discipline Elective**	3	0	0	3	30	70	100
BAI7407	Quantum Simulation Practical		0	0	2	1	30	70	100
BAI7408	Computer Vision		3	0	0	3	30	70	100
BAI7409	Computer Vision (Practical)		0	0	2	1	30	70	100
Total			**18**	**0**	**08**	**23**	**240**	**560**	**800**

Semester: 8th									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No of Credits**	**Int.**	**Ext.**	**Total Marks**
BAI8450	Internship	Skill Based	0	0	0	20	30	70	100
Total			0	0	0	20	30	70	100
Grand Total			**140**	**2**	**63/64**	**193/194**	**2070/2100**	**4830/4900**	**6900/7000**

SEMESTER-I

Course Title: ENGINEERING PHYSICS	L	T	P	Credits
Course Code: BAI1100	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
2. Use the knowledge regarding calculus along with physical principles to effectively solve problems encountered in everyday life, further study in science, and in the professional world.
3. Design experiments and acquires data in order to explore physical principles, effectively communicate results, and evaluate related scientific studies.
4. Assess the contributions of physics to our evolving understanding of global change and sustainability while placing the development of physics in its historical and cultural context.

Course Content

UNIT I **10 Hours**

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential, Boundary conditions of electric field and electrostatic potential; method of images. Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; solving simple electrostatics problems in presence of dielectrics – Point charge at the center of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

UNIT II **10 Hours**

Magneto statics: Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; vector potential and its solution for given current densities. Properties of magnetic materials: magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials.

Time Varying Field and Maxwell's Equation: Laws of Electromagnetic Induction, Self and Mutual induction, Concept of Displacement Current, Difference between Conduction Current and Displacement Current, Eddy Current, Maxwell's Equations, Derivation of Maxwell's Equations, Propagation of Electromagnetic Waves in Free Space, Solution of propagation of Plane Electromagnetic Wave in free space.

UNIT III **10 Hours**

Semiconductors: Intrinsic and extrinsic semiconductors, Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Semiconductor materials of interest for optoelectronic devices.

Modern Physics: Particle properties of wave: Planck's hypothesis, Qualitative discussion of Photoelectric effect and Compton Effect. Wave properties of particle: De Broglie wave as mater waves, Heisenberg's uncertainty principle and its application. Quantum Mechanics: Interpretation of wave function, Schrödinger equation (time dependent and time independent), particle in a box,

UNIT IV **15 Hours**

Wave Optics: Interference due to division of wavefront, Young's double slit expt., Principle of Superposition, Interference from parallel thin films, Newton rings, Michelson interferometer. Diffraction: Fresnel Diffraction, Diffraction at a straight edge, Fraunhoffer diffraction due to N slits, Diffraction grating, dispersive and resolving power of Grating. Polarization**:** production of plane polarized light by different methods, Brewster and Malus Laws. Double refraction, Quarter & half wave plate, Nicol prism, specific rotation, Laurent's half shade polarimetry.

Laser: Introduction, principle of Laser, stimulated and spontaneous emission, Einstein's Coefficients, He-Ne Laser, Ruby Laser, Application of Lasers.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *David J Griffths, Introduction to Electrodynamics. (Year 1981) Prentice Hall.*
- *Saslow, W.,Electricity, magnetism and light. e-book.*
- *Subramaniam N & BrijLal,Optics, S Chand & Co. Pvt. Ltd., New Delhi*
- *R Murugeshan, Kiruthiga, Sivaprasath, Modern Physics, S Chand & Co. Pvt. Ltd., New Delhi.*
- *M.N.Avadhanulu,Engineering Physics, S.Chand & Company Ltd.*
- *Arthur Beisser, Concepts of Modern Physics, (Year 1987) McGraw Hill Publications.*

Course Title: ENGINEERING MATHEMATICS-I	L	T	P	Credits
Course Code: BAI1101	3	1	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply differential and integral calculus to notions of curvature and to improper integrals. Analyze functions of several variables using partial derivatives, maxima-minima, and Lagrange multipliers for problem-solving.
2. Apply techniques of multiple integration and vector calculus to solve problems involving area, volume, and physical interpretations. Demonstrate understanding of trigonometric and complex number concepts.
3. Analyze convergence of sequences and series and represent functions using power and Fourier series for engineering applications.
4. Classify the concepts of vector spaces, linear transformations, eigenvalues, and inner product spaces to analyze and solve engineering problems involving matrices and linear systems.

Course Content

UNIT I **16 Hours**

Calculus: Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Rolle 's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and Hospital's rule; Maxima and minima.

Advanced Calculus: Differentiation: Limit continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

UNIT II **14 Hours**

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Gradient, curl and divergence. Theorems of Green, Gauss and Stokes (statement only), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

Trigonometry: Hyperbolic and circular functions, logarithms of complex number resolving real and imaginary parts of a complex quantity, De Moivre's Theorem.

UNIT III **15 Hours**

Sequences and series: Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT IV **15 Hours**

Algebra: Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank- nullity theorem, composition of linear maps, Matrix associated with a linear map.

Eigen values, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, Eigen bases, Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *G.B. Thomas and R.L. Finney. (2002). Calculus and Analytic geometry. Pearson.*
- *Veerarajan T. (2008). Engineering Mathematics for first year. Data McGraw-Hill, New Delhi.*
- *Ramana B.V. (2010). Higher Engineering Mathematics. Tata McGraw Hill New Delhi.*
- *N.P. Bali and Manish Goyal. (2010). A text book of Engineering Mathematics. Laxmi Publications.*
- *B.S. Grewal. (2000). Higher Engineering Mathematics. Khanna Publishers.*
- *V. Krishnamurthy, V.P. Mainra and J.L. Arora. (2005). An introduction to Linear Algebra. Affiliated East–West press.*
- *Erwin Kreyszig. (2006). Advanced Engineering Mathematics. John Wiley & Sons.*

Course Title: ENGINEERING PHYSICS LAB	L	T	P	Credits
Course Code: BAI1102	0	0	2	1

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.

2. Understand the Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuits.

3. Analysis of Single-Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.

4. Compare different types of Electrical machines and classify different electrical measuring equipments and understanding their principles

Course Content

List of Experiments:

1. To study basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. real-life resistors, capacitors and inductors.
2. To verify Ohm's law.
3. To verify Kirchhoff's voltage and current laws.
4. To verify Superposition Theorem.
5. To verify Thevenin Theorem.
6. To obtain the sinusoidal steady state response of R-L circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
7. To obtain the sinusoidal steady state response of R-C circuit – impedance calculation and verification. Observation of phase differences between current and voltage.
8. To study resonance phenomenon in R-L-C series circuits.
9. To perform open circuit and short circuit test on a single-phase transformer and calculate the efficiency.
10. Demonstration of cut-out sections of machines: Induction machine (squirrel cage rotor and slip ring arrangement) and single-phase induction machines.
11. To connect, start and reverse the direction of rotation by change of phase-sequence of connections of three phase induction motor.
12. To connect, start and reverse the direction of rotation of single-phase induction motor.
13. To demonstrate working of DOL starter for three-phase induction motor.

Course Title: ENGINEERING GRAPHICS & DRAWING	L	T	P	Credits
Course Code: BAI1103	4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand about engineering drawing applications and its importance in society.
2. Learn about the visual aspects of engineering design.
3. Discuss the engineering graphics standards.
4. Classify the concept of solid modeling techniques.

Course Content

UNIT I **15 Hours**

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involutes; Scales – Plain, Diagonal and Vernier Scales;

Orthographic Projections covering, Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

UNIT II **15 Hours**

Projections of Regular Solids covering, those inclined to both the Planes-Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT III **15 Hours**

Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, shares, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Customization& CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT IV **15 Hours**

Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to Credits ate drawings, Credits ate, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerance techniques; dimensioning and scale multi views of dwelling;

Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: Creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerance; Use of solid-modeling software for Credits eating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Gill, P.S. (2001). Engineering Drawing. S.K; Kataria and Sons, Ludhiana.*
- *Bhatt, N.D. (2012). Engineering Drawing. Charotar Book Stall, Tulsi Sadan, Anand.*
- *French, T.E. and Vierck. C.J. (1993). Graphic Science. McGraw-Hill, New York.*
- *Zozzora, F. (1958). Engineering Drawing.McGraw Hill, NewYork.*

  (Corresponding set of) CAD Software Theory and User Manuals

Course Title: Communication Skills-I	L	T	P	Credits
Course Code: BAI1104	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop the ability to communicate clearly and confidently in both written and verbal forms across various settings.
2. Write clear, concise, and well-structured technical documents, reports, and business communications.
3. Enhance their presentation skills, using verbal and non-verbal techniques to engage audiences effectively.
4. Apply communication strategies for team collaboration, handling feedback, and managing crises in a professional environment.

Course Content

Unit-I **7 Hours**

Basics of Communication

- Introduction to the concept and importance of communication
- Types of communication: Verbal, Non-verbal, Written, and Visual
- Communication process: Sender, Message, Channel, Receiver, Feedback, and Noise
- Barriers to communication and how to overcome them.

Unit-II **8 Hours**

Written Communication Skills

- Technical writing: Reports writing
- Business communication: Professional emails, letters.
- Structure and content of formal and informal business correspondence.
- Resume writing: Structure, content, and design

Unit-III **7 Hours**

Verbal and Presentation Skills

- Public speaking: Structuring and delivering speeches
- Using verbal and non-verbal communication (voice modulation, body language)
- Group discussion techniques: Active participation, listening, turn-taking.
- Interview preparation: Common questions, answering techniques, body language.

Unit-IV **8 Hours**

Advanced Communication and Professional Skills

- Interpersonal communication: Building rapport, conflict resolution
-Cross-cultural communication: Navigating cultural differences in professional settings
- Persuasion techniques and strategies for professional communication
- Negotiation skills: Approaches to negotiation and handling objections
-Handling feedback and performance reviews: Giving and receiving feedback constructively

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- "Business Communication: Building Critical Skills" by Kitty O. Locker & Stephen Kaczmarek
- "The Elements of Business Writing" by Gary Blake & Robert W. Bly
- "Crucial Conversations: Tools for Talking When Stakes Are High" by Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler
- "The Culture Map: Breaking Through the Invisible Boundaries of Global Business" by Erin Meyer

Course Title: Environmental Education	L	T	P	Credits
Course Code: VAC0001	2	0	0	2

Total Hours:30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Measure environmental variables and interpret results.
2. Evaluate local, regional and global environmental topics related to resource usage and management.
3. Propose solutions to environmental problems related to resource usage and management.
4. Interpret the results of scientific studies of environmental problems and describe threats to global biodiversity, their implications and potential solutions.

Course Content

Unit- 6 Hours

Introduction: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

Natural Resources: Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

Ecosystems: Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

Unit-II 10 Hours

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution.

Unit-III 8 Hours

Disaster Management: Floods, earthquake, cyclone and landslides.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste

products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

Unit-IV **6 Hours**

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Program. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- Agarwal, K. C. (1987). *Environment Biology*. Nidi Publ. Ltd.Bikaner.
- Jadhav, H, &Bhosale, V.M. (1995). *Environment Protection and Laws*. Himalaya Pub House,Delhi.
- Rao, M. N. &Dat.ta, A.K. (2008). *Waste Water Treatment.* Oxford & IBH Publ. Co. Pvt.Ltd

Course Title: Principle of Economics	L	T	P	Credits
Course Code: BAI1105	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the core micro and macroeconomic concepts, theories, models, principles, tools, and techniques
2. Understanding the role of market and prices in influencing key economic activities
3. Develop the skills to interpret, analyze the economic concepts and variables through diagrams, tables and graphs.
4. Relate the key economic principles to real life situations, especially in the context of development challenges which would help students to make informed decision.

Course Content

Unit-I **10 Hours**

Introduction to economics

Basic concepts of Economics, Understanding the philosophy o of economics, Nature of economics: Is economics a science or an art, Definitional pluralities and distinctions such as micro-versus macro, theories versus models, A brief history of ideas in economics, Techniques of economic analysis: theories, models and tools

Unit-II **15 Hours**

Demand, Supply, Elasticities, and Market Efficiency

The economic problem of scarcity, choice, and opportunity--y cost, Demand, supply, and market equilibrium, Demand and supply applications, Consumer surplus and producer's surplus, Market efficiency and their applications, Elasticity: its various forms and estimation methods, elasticity, and total revenue, Elasticity applications in the field of energy and environment, Utility, Preferences and Choice, Budget constraints, determination of optimal choices using indifference curve analysis and its applications, Behavioral economics as an alternative framework of consumer choice

Unit-III **10 Hours**

Production and Cost

Production Theory, Production function and different forms, Short-run and long-run production function, Isoquants, MRTS, Total, average, and marginal products Economies of scale and scope, Theory of cost, Short-run and long run

costs, cost minimization, Total, average and marginal costs, Applications of production and costs theory

Unit-IV **10 Hours**

Market structure and regulation

Market equilibrium and price determination under different market structure - Perfect and Imperfect market structure, welfare costs of monopoly, Market structure, efficiency, and regulation, Regulation of public monopolies, Application in case of
infrastructure industries such as energy and water

National Income Accounting

Measuring national income, output, and employment – different approaches, Determination of aggregate output, price level and interest rate – classical, Keynesian, and modern theories and approaches, GDP estimation in India

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Case, K. Ray Fair, & Sharon Oster, 2012, Principles of Economics.*
- *Lopus, J. S., & Paringer, L. (2011). The principles of economics textbook. International handbook on teaching and learning economics.*
- *Stiglitz, J. E., & Walsh, C. E. (2006). Economics. WW Norton & Company, Inc.*
- *LA, T., TH, P. P. F., TH, P. M. E., TH, P. F. E., & LIFE, E. I. E. MA ECONOMICS.*
- *Blanchard, O., & Sheen, J. (2013). Macroeconomics; Australasian Edition. Pearson Higher Education AU.*

Course Title: BASIC ELECTRICAL ENGINEERING	L	T	P	Credits
Course Code: BAI1106	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the DC and AC electrical circuit elements with RLC.
2. Analysis of simple circuits with dc excitation. Superposition, The venin and Norton Theorems.
3. Use Single Phase AC Circuits and representation of alternating quantities and determining the power in these circuits.
4. Classify the different types of Electrical machines.

Course Content

UNIT I **10 Hours**

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

UNIT II **15 Hours**

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.

Transformers: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT III **10 Hours**

Electrical Machines: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic

Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor, Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT IV **10 Hours**

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Kothari, D. P. and Nagrath, I. J. (2010). Basic Electrical Engineering. Tata McGraw Hill.*
- *Kulshreshtha, D. C. (2009). Basic Electrical Engineering. McGraw Hill.*
- *Bobrow, L. S. (2011). Fundamentals of Electrical Engineering. Oxford University Press.*
- *Hughes, E. (2010). Electrical and Electronics Technology. Pearson.*

Course Title: BASIC ELECTRICAL ENGINEERING LAB	L	T	P	Credits
Course Code: BAI1107	0	0	2	1

Total hours 15

Learning Outcomes On successful completion of this course, the students would be able to:

1. Illustrate the working p-n junction diode.
2. Analyse and solve various engineering problems.
3. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
4. Design new instruments with practical knowledge.

Course Content

List of experiments

To study the V-I characteristics of P-N junction.

1. To verify the logic gates.
2. To calculate the acceleration due to gravity “g” using simple pendulum.
3. To find the moment of inertia of flywheel.
4. To measure the diameter of a small spherical/cylindrical body using Vernier calipers/screw gauge.
5. To draw V-I characteristics of Zener diode and determine reverse breakdown voltage.
6. To study the controls and obtain a wave using Cathode Ray Oscilloscope.
7. To find the resolving power of the prism.
8. To determine the angle of the given prism.
9. To determine the refractive index of the material of a prism.
10. To understand the phenomenon Photoelectric effect as a whole.
11. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
12. To determine the Planck's constant from kinetic energy versus frequency graph.
13. To plot a graph connecting photocurrent and applied potential.
14. To determine the stopping potential from the photocurrent versus applied potential graph.

Note: Students will perform any 7-8 experiments from the syllabus.

Course Title: Computer Proficiency	L	T	P	Credits
Course Code: BAI1108	2	0	0	2

Total Hours:30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the concept of input and output devices of Computers
2. Study to use the Internet safely, legally, and responsibly.
3. discuss an operating system and its working, and solve common problems related to operating systems
4. Learn basic word processing, Spreadsheet and Presentation Graphics Software skills

Course Content

UNIT I **8 Hours**

Computer Hardware / Software: Definition, History, Generation, Characteristics, Types & Applications, Overview of a computer system:

Hardware/Software: Definition of Hardware**,** Input Unit: Keyboard, Mouse, Scanner etc.**,** CPU: Arithmetic Logic Unit (ALU), Control Unit (CU), Memory Unit (MU)**,** Output Unit: Monitor, Printer etc.**,** Storage Devices: Primary &Auxiliary Memory (Floppy Disk, Hard Disk, Compact Disk, DVD, Flash Disk etc.)**,** Others: Network Card, Modem, Sound Card etc.

Software: Definition & types of Software, Programming Language, Live ware, Firmware and Cache Memory

UNIT II **7 Hours**

Setting & Protection: of Computer Room and Computer- Concept of Computer related threats (virus, worms, Trojan, phishing etc.) remedies and protection

File Management Basics: Physical structure of disk

UNIT III **7 Hours**

Concept of E-mail / Internet / Extranet, World Wide Web (WWW): Familiarity with internet browsers (e.g., Internet Explorer, Firefox, Opera, Safari, Google Chrome etc.), Introduction of IP address, subnet mask and default gateway, Introduction to Network Media, topology and protocol, Setting up Microsoft Network, Dial-Up Networking

UNIT IV **8 Hours**

Number System: Introduction to binary, octal, decimal and hexadecimal number system

Introduction to ASCII and Unicode standards

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Rajaraman, V., & Adabala, N. (2014). Fundamentals of computers. PHI Learning Pvt. Ltd.*
- *Doja, M. N. (2005). Technology. Deep and Deep Publications.*
- *Bangia, R. (2008). Computer Fundamentals and Information Technology. Firewall Media.*

Course Title: Computer Proficiency Lab	L	T	P	Credits
Course Code: BAI1109	0	0	2	1

Total Hours:15

Course learning outcomes: On successful completion of this course, students will be able to:

1. Understanding the concept of input and output devices of Computers
2. Study to use the Internet safely, legally, and responsibly.
3. Understand an operating system and its working, and solve common problems related to operating systems
4. Learn basic word processing, Spreadsheet and Presentation Graphics Software skills

Course Content

1. Various Components of a Computer.
2. Introduction to Microsoft Word & Presentation
3. Make a simple presentation on your college,
4. use 3D effects, on prescribed presentation
5. Applications of Ms-Office Ms-Word
6. Ms-Excel.
7. Ms-PowerPoint.
8. Create web pages for your college using different tags.
9. web Browser and E- Mail
10. Conversion of a word documents into PDF/ Image conversion using image file format.

Course Title: ENTREPRENEURSHIP Setup & Launch	L	T	P	Cr.
Course Code: BAI1110	0	0	0	4

Learners Objective:

1. Understand the core concepts of entrepreneurship through relatable, real-life examples.
2. Begin to see themselves as problem-solvers and creators.
3. Learn about business paths and choose one to try based on interest or local fit.
4. Launch a micro-hustle (online or offline) to earn their first income.
5. Build confidence and self-belief by doing.

Outcome: By the end of this semester, learners will start a simple business activity, earn their first income, and build belief in their ability to do business.

Guiding Principles/Approach:

This syllabus is built on principles of **experiential learning, growth mindset development**, and **identity-first learning**. Drawing from learning science and behavior design, the course shifts students from passive learning to *active doing*, where they try out small business activities in real contexts. The design helps students not just learn entrepreneurship, but begin to see themselves as entrepreneurs. Emphasis is placed on *small wins, peer collaboration, and locally relevant opportunities* to ensure learning feels achievable and connected to their realities. The curriculum focuses on conceptual understanding without heavy theory, combining *practical action, reflection, and*

collaboration. By making progress visible and success feel possible, it plants the seeds of self-reliance, initiative, and long-term motivation.

Semester Syllabus:

Format: 12 weeks, 4 hours/week | 2 credits
Revenue Target: ₹10,000

Week	Learning Goal	Measurable Outcome
1	Understand what entrepreneurship is and who can be an entrepreneur	Students define entrepreneurship in their own words and list 2 entrepreneurs from their local area or community
2	Connect personal identity to entrepreneurship (strengths, interests, struggles)	Students create a "value map" showing how a skill/interest/problem from their life could become a business opportunity
3	Learn about 5 business paths: content creation, drop shipping, cloud kitchen/food business, gig economy and local services	Students explore 1–2 examples from each domain and share one they're most curious to try and why
4	Choose a path and generate a basic business idea	Students write down a clear offer (what, for whom, why) and one way to reach their customer
5	Take first real action: message, post, pitch, or sell	Students reach out to or serve 1 real potential customer and record what happened

6	Reflect on first attempt and share with peers	Students share their result, a challenge faced, and one idea to improve next time
7	Improve and try again: aim for first ₹100	Students apply a change, try again, and aim to make their first ₹100 or get meaningful response
8	Learn how to identify and understand your target customer	Students talk to 2 potential customers or observe them and list 3 insights about their needs
9	Learn how to serve your target audience better	Students improve one part of their offer (product, delivery, messaging, or interaction) based on customer feedback or need
10	Explore core entrepreneurial values (resilience, honesty, effort)	Students reflect on 1 value they're building and show it in a business task or peer story
11	Focus on earning and staying consistent	Students complete a second earning task and track their consistency (e.g., same product or message for 3 days)
12	Reflect on earnings, grit, and how to keep going	Students record total earnings, one resilience moment, and one support system or habit they'll continue with

Weekly Component:

Component	Duration	Description
Learning Module	~1.5 hrs	- Introduces key concepts in a simple and engaging way - Includes, examples, and 1–2 interactive discussions or quizzes

Action Lab	~2 hrs	- Hands-on task on the weekly concept - Includes step-by-step guidance, templates, and worksheets - Ends with a submission (e.g., video, reflection, or proof of action)
Resources	Self-paced	- Supplementary videos, short readings, real-life stories, and tools to deepen understanding at their own pace

Evaluation Criteria

Evaluation Component	Description	Weightage
Weekly Task Completion	Timely submission of weekly tasks including reflections, activities, quizzes etc.	40%
Target Completion	Performance-based evaluation on hitting **revenue or profit targets** (e.g., generating ₹10,000 revenue)	30%
Final Project	A comprehensive project based on the semester's theme	30%

SEMESTER-II

Course Title: Engineering Chemistry	L	T	P	Credits
Course Code: BAI2150	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Rationalize periodic properties such as ionization potential, electro-negativity, Oxidation states and electro-negativity.
2. Demonstrate Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and Nano particles,
3. Distinguish the ranges of Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging
4. Demonstrate organic reactions involving addition, substitution, elimination

Course Content

Unit-1 **12 Hours**

Periodic properties: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries,

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

Unit-II **11 Hours**

Atomic and molecular structure: De Broglie hypothesis and Heisenberg uncertainty principle, Schrodinger equation, Particle in a box solution. Valence Bond theory, its postulates and limitations, Molecular orbital theory and its application for diatomic molecules and plots of the multicenter orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene, Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

Unit-III **12 Hours**

Spectroscopic techniques and applications: Principles of spectroscopy and selection rules, electronic spectroscopy, Vibrational and rotational spectroscopy of diatomic molecules, Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, Fluorescence and its applications. Ionic, Dipolar and Vander Waals interactions, Equations of state of real gases and Critical phenomena.

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. The Nernst equation and applications.

Unit-IV **10 Hours**

Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Mahan, B. H. (1987). University chemistry.*
- *Sienko, M. J. & Plane, R. A. Chemistry. (1979): Principles and Applications. New York: McGraw-Hill.*
- *Banwell, C. N. (1966). Fundamentals of Molecular Spectroscopy. New York, McGraw-Hill.*
- *Tembe, B. L., Kamaluddin & Krishnan, (2008). M. S. Engineering Chemistry (NPTEL Web-book).*

Course Title: Engineering Mathematics –II	L	T	P	Credits
Course Code: BAI2151	3	1	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Demonstrate the methods of forming and solving Ordinary differential equations and solve linear differential equations with constant and variable coefficients
2. Explain the concept of differential equation and classifies the differential equations with respect to their order and linearity.
3. Solve first-order ordinary and exact differential equations and converts separable and homogeneous equations to exact differential equations by integrating factors.
4. Apply the method of undetermined coefficients to solve the non-homogeneous linear differential equations with constant coefficients.

Course Content

Unit-I **14 Hours**

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders: Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Unit-II **15 Hours**

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Unit-III **15 Hours**

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Unit-IV **16 Hours**

Transform Calculus: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions.
Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of Integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method, Fourier transforms.

Transactional Mode:
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Thomes, G.B.and Finney, R.L. (2010) Calculus and Analytic Geometry; Ninth Edition; Pearson Education*
- *Kreyszig, E. (1998) Advanced Engineering Mathematics; Eighth Edition, John Wiley and sons.*
- *Grewal, B.S. (1965) Higher Engineering Mathematics; Khanna Publishers, New Delhi.*
- *Babu Ram (2009) Advance Engineering Mathematics; First Edition; Pearson Education.*
- *Richard Courant and Fritz John (2012) Introduction to Calculus and Analysis, Volume II, V Springer Publica.*

Course Title: Engineering Chemistry Lab	L	T	P	Credits
Course Code: BAI2152	0	0	2	1

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Evaluate the estimate rate constants of reactions from concentration of reactants/products as a function of time.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
3. Apply the theoretical concepts for result analysis and interpret data obtained from experimentation.
4. Identify the compound using a combination of qualitative test and analytical methods.

Course Content

List of Experiments

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometric - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids.
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscometers to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Course Title: Communication Skills -II	L	T	P	Credits
Course Code: BAI2153	2	0	0	2

Total Hours: 30

Learning Outcomes: On successful completion of this course, the students would be able to:

1. Start conversations, respond appropriately, use visuals, and build vocabulary with various tools like synonyms and idioms.
2. Develop techniques for skimming, scanning, guessing meanings, and critical reading and master professional writing formats like resumes, emails, and technical reports.
3. Strengthen oral and written presentation skills with seminars, posters, and assignments.
4. Improve group dynamics, body language, and prepare with mock interviews.

Course Content

Unit-I **5 Hours**

Fundamentals of Inter-Personal Communication and Building Vocabulary: Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

Unit-II **10 Hours**

Reading Comprehension: General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.

Writing Skills: Structure and presentation of different types of writing – letter writing/Resume writing/ e-correspondence/Technical report writing/ – planning for writing – improving one's writing

Unit-III **8 Hours**

Presentation Skills: Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ emails/assignments etc.

Unit-IV **7 Hours**

Group Discussion and Interview Skills: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Self-Learning, Collaborative Learning.

Suggested Readings:

- *M Asharaf Rizvi. (2022). Effective Technical Communication. McGraw Hill Education (India) Pvt. Ltd.*
- *Stephen Bailey. (2018). Academic Writing: A Handbook for International Students. Routledge.*
- *Shiv K. Kumar and Hemalatha Nagarajan. (2007). Learn Correct English – A Book of Grammar, Usage and Composition. Pearson.*
- *Aruna Koneru. (2016). Professional Communication. McGraw Hill Education (India) Pvt. Ltd.*
- *Meenakshi Raman & Sangeeta Sharma. (2009). Technical Communication. Oxford University Press.*
- *Paul V. Anderson. (2007). Technical Communication. Cengage Learning pvt. Ltd. New Delhi.*
- *English Vocabulary in Use series, Cambridge University Press 2008.*
- *David A. McMurrey & Joanne Buckley. (2012). Handbook for Technical Communication. Cengage Learning.*
- *Leena Sen. (2009). Communication Skills. PHI Learning Pvt Ltd.*
- *Colm Downes. (2008). Job Hunting.Cambridge University Press.*
- *Aysha Vishwamohan. (2009). English for Technical Communication for Engineering Students. Tata McGraw Hill.*

Course Title: Manufacturing Practices	L	T	P	Credits
Course Code: BAI2154	0	0	6	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply the various manufacturing methods in different fields of engineering.
2. Use the different fabrication techniques
3. Learn about the practices in manufacturing of simple components using different materials.
4. Understand the advanced and latest manufacturing techniques being used in engineering industry

Course Content

Unit-I **15 Hours**

Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.

Unit-II **10 Hours**

CNC machining, Additive manufacturing, Fitting operations & power tools

Unit-II **10 Hours**

Electrical & Electronics Carpentry, Plastic molding, glass cutting

Unit-IV **10 Hours**

Metal casting, welding (arc welding & gas welding), brazing [More hours can be given to Welding for Civil Engineering students as they may have to deal with Steel structures fabrication and erection; 3D Printing is an evolving manufacturing technology and merits some lectures and hands-on training.]

Workshop Practice:

1. Machine shop - 10 hours
2. Fitting shop - 8 hours
3. Carpentry - 6 hours
4. Electrical & Electronics - 8 hours
5. Welding shop - 8 hours (Arc welding 4 hrs. + gas welding 4 hrs.)

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- Raghuwanshi, B.S. (2009*). A Course in Workshop Technology, Vol 1 &II*. Dhanpat Rai & Sons.
- Jain, R.K. (2010*). Production Technology. Khanna* Publishers.
- Singh, S. (2003). *Manufacturing Practice*. S.K. Kataria & Sons.

Course Title: Indian Constitution	L	T	P	Credits
Course Code: BAI2155	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Knowledge and legal literacy and thereby to take up competitive examinations
2. Understand state and central policies, fundamental duties, Electoral Process, and special provisions
3. Analyze powers and functions of Municipalities, Panchayats and Co-operative Societies, and
4. Classify the engineering ethics and responsibilities of Engineer and an awareness about basic human rights in India.

Course Content

Unit-I **5 Hours**

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.

Unit-II **10 Hours**

Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties.

Union Executives – President, Prime Minister Parliament Supreme Court of India.

State Executives – Governor Chief Minister, State Legislature High Court of State.

Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.

Unit-III **10 Hours**

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India

Powers and functions of Municipalities, Panchayats and Co – Operative Societies.

Unit-IV **5 Hours**

Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility.

Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Singh Mahendra, P. (2000). VN Shukla's Constitution of India. Eastern Book Company, Lucknow.*
- *Agrawal, P. K., & Gupta, V. (2023). The Constitution of India Bare Act with Short Notes-Useful for Competitive Examinations: Bestseller Book by Dr. PK Agrawal; Virag .*

Course Title: Human Values And Professional Ethics	L	T	P	Credits
Course Code: VAC0002	2	0	0	2

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to**:**

1. Develop the ability to distinguish between Value and ethics.
2. Construct the ability to face difficult situations in life boldly and resolve them confidently.
3. Implement the code of ethics in professional life.
4. Create Ethical reason and achieve harmony in life and Formulate moral responsibility and could themselves as good professionals

Course Content

Unit-I **10 Hours**

Human Values: Morals, Values and Ethics - Integrity - Work Ethic - Service Learning -Civic Virtue - Respect for Others - Living Peacefully - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - Commitment - Empathy - Self-Confidence - Character – Spirituality.

Unit-II **5 Hours**

Engineering Ethics: Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry- moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

Unit-III **10 Hours**

Engineering as Social Experimentation: Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

Unit-IV **5 Hours**

Safety, Responsibilities and Rights: Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three-mile island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Martin, M., & Schinzinger, R. (1996). Engineering as Social Experimentation. Martin, M. & Schinzinger, R. Ethics in Engineering, 3rd ed., McGraw-Hill, New York, 80-124.*
- *MATRIX, C. P. A. ETHICS & INDIAN CONSTITUTION.*

Course Title: Programming For Problem Solving	L	T	P	Credits
Course Code: BAI2156	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design the algorithms to write programs.
2. Illustrate arrays, pointers and structures to formulate algorithms and programs
3. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration
4. Implement conditional branching, iteration and recursion.

Course Content

Unit-I **10 Hours**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory Locations, Syntax and Logical Errors in compilation, object and executable code-

Unit-II **15 Hours**

Arithmetic expressions and precedence: Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching
Iteration and loops
Arrays: Arrays (1-D, 2-D), Character arrays and Strings
Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of Equations, notion of order of complexity through example programs (no formal definition requirement.

Unit-III **10 Hours**

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.
Recursion: Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit-IV **10 Hours**

Structure: Structures, Defining structures and Array of Structures

Pointers: Idea of pointers, defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
File handling (only if time is available, otherwise should be done as part of the lab.

Transaction Mode:
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Byron Gottfried, Schaum's (1995), Outline of Programming with C, McGraw-Hill.*
- *E. Balaguruswamy (2005) Programming in ANSI C, Tata McGraw-Hil*

Course Title: Programming For Problem Solving Lab	L	T	P	Credits
Course Code: BAI2157	0	0	2	1

Total Hours:15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Create read and write to and from simple text files.
2. Identify and correct logical errors encountered at run time
3. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.
4. Represent data in arrays, strings and structures and manipulate them through a program

Course Content

1. Problem solving using computers
2. Familiarization with programming Environment
3. Variable types and type conversions
4. Simple computational problems using arithmetic expressions
5. Branching and logical expressions
6. Problems involving if-then-else structures
7. Loops, while and for loops
8. Iterative problems e.g., sum of series
9. 1D Arrays: searching, sorting
10. 1DArray manipulation
11. 2D arrays and Strings, memory structure
12. Matrix problems, String operations
13. Functions, call by value
14. Simple functions
15. Numerical methods (Root finding, numerical differentiation, numerical integration)
16. Numerical methods problems
17. Recursion, structure of recursive calls
18. Recursive functions
19. Pointers, structures and dynamic memory allocation
20. Pointers and structures
21. File handling
22. File operations

SEMESTER-III

Course Title: Object Oriented Programming Using C++	L	T	P	Credits
Course Code: BAI3200	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Illustrate dynamic memory management techniques using pointers, constructors, destructors, etc.
3. Construct the concept of function overloading, operator overloading, virtual functions and polymorphism.
4. Classify inheritance with the understanding of early and late binding, usage of exception handling and generic programming.

Course Content

Unit-I **10 Hours**

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

Unit-II **15 Hours**

Standard Input/output: Concept of streams, hierarchy of console stream classes, input/output using overloaded operators >> and << and member functions of i/o stream classes, formatting output, formatting using ions class functions and flags, formatting using manipulators.

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifies, and static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

Unit-III **11 Hours**

Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures. Constructors/Destructors and Operator Overloading and Type Conversion: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors,
constructors and destructors with static members, initialize lists. Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type

Unit-IV **9 Hours**

Inheritance and Virtual functions & Polymorphism: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors. Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Lafore R. (1992). Object Oriented Programming in C++. WaiteGroup.*
- *BjarneStroustrup. (1985). The C++ Programming Language. AddisonWesley.*
- *Herbert Schildt. (1994). The Complete Reference to C++ Language. McGrawHill-Osborne.*
- *Lippman F. B. (1997). C++ Primer. AddisonWesle.*

Total Hours-15

Course Title: Object Oriented Programming Using C++ Lab	L	T	P	Credits
Course Code: BAI3201	**0**	**0**	**2**	**1**

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop solutions for a range of problems using objects and classes.
2. Implement the concept of constructors, destructors and operator overloading
3. Apply algorithmic problems including type casting,
4. Understand the concept of Inheritance and polymorphism.

Course Content

1. Program to show the of use cin, cout practical
2. Program to implement the operators
3. Program based on decision making statement (if else)
4. Program based on the loops (while, do while)
5. Program based on loops(for), switch statement
6. Program based on structures and enumerated data types
7. Program based functions, overloaded functions
8. Program to show usage of storage classes.
9. Program to show usage of function overloading, default arguments
10. Program to show usage of classes, objects
11. Program to show usage of constructors, destructors
12. Program to manipulate arrays and array of objects
13. Program to manipulate strings.
14. Program to show usage of inheritance of various type (multiple, multilevel etc.)
15. Program to show usage of unary operator overloading
16. Program to show usage of binary operator overloading
17. Program for conversion from basic to user defined data type
18. Program for conversion from user defined to basic
19. Program to show usage of basics of pointers
20. Program to show usage of pointers and arrays.
21. Program to show usage of pointers, function arguments
22. Program to show usage of new, delete, memory management
23. Program to show usage of virtual function
24. Program to show usage of friend, static function
25. Program to show usage of overloaded assignment operator, this pointer
26. Program to read & write contents of a text file
27. Program to show usage of file pointers.

28. Program to show usage of command line arguments
29. Program to show usage of overloading of right & left shift operators.
30. Program to show usage of exception handling mechanism
31. Program to show usage of uncaught exception (), the exception and bad exception classes
32. Program to show usage of templates
33. Program to show usage of generic classes
34. Implementation of File handling
35. Implementation of Wrapper classes
36. Implementation of container classes

Course Title: Data Structure & Algorithms	L	T	P	Credits
Course Code: BAI3202	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Describe how arrays, records, linked structures, stacks, queues, trees and graphs are represented in memory and used by algorithms
2. Design a program that use arrays, records, linked structures, stacks, queues and trees.
3. Develop knowledge of applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching and sorting of each data structure.
4. Classify the concept of recursion, give examples of its use, describe how it can be implemented using a stack

Course Content

Unit-I **8 Hours**

Introduction: Basic Terminologies, Elementary Data Organizations, Data Structure Operations insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Unit-II **12 Hours**

Stacks and ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queues: Simple Queue, Circular Queue, Priority Queue; Operations on each Types of Queues: Algorithms and their analysis.

Linked Lists: 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.

Unit-III **10 Hours**

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees

and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree, definitions, algorithms and analysis.

Unit-IV **15 Hours**

Sorting and Hashing: Objective and properties of different sorting algorithms, Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Mark Allen Weiss. (1995). Algorithms, Data Structures, and Problem Solving with C++ Algorithms. Addison-Wesley.*
- *R. G Dromey (2006). How to Solve it by Computer. Pearson Education.*

Course Title: Data Structure & Algorithm Lab	L	T	P	Credits
Course Code: BAI3203	0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop C program for Linear data structure operations and its applications
2. Design and implement basic operations such as insertion, deletion, search on stacks, queues, linked list, Circular Queue etc.
3. Implement Breadth First Search Techniques and Depth First Search Techniques
4. Classify the Non-linear data structure.

Course Content

1. Write a program to insert an element into an array.
2. Write a program to delete an element from an array.
3. Write a program to implement linear search algorithm.
4. Write a program to implement binary search algorithm.
5. Write a program to implement bubble sort algorithm.
6. Write a program to implement selection sort algorithm.
7. Write a program to implement PUSH operation in stacks.
8. Write a program to implement POP operation in stacks.
9. Write a program to implement Queues.
10. Write a program to insert an element in the beginning of the link list.
11. Write a program to insert an element in the middle of the link list.
12. Write a program to insert an element in the end of the link list.
13. Write a program to delete an element from the beginning of the link list.
14. Write a program to delete an element from the end of the link list.
15. Write a program for implementation of a graph.
16. Write a program for implementation of binary search tree.

Course Title: Professional Communication	L	T	P	Credits
Course Code: BAI3204	2	0	0	2

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Content

Unit-I **10 Hours**

Introduction to Soft Skills– Hard skills & soft skills, employability and career Skills, Grooming as a professional with values, Time Management General awareness of Current Affairs.

Self-Introduction-organizing the material – Introducing oneself to the audience, introducing the topic – answering questions – individual presentation practice - presenting the visuals effectively – 5 minute presentations.

Unit-II **10 Hours**

Introduction to Group Discussion— Participating in group discussions, understanding group dynamics – brainstorming the topic, questioning and clarifying -GD strategies- activities to improve GD skills.

Unit-III **5 Hours**

Interview etiquette, dress code, body language, attending job interviews-telephone/skype interview, one to one interview & panel interview, FAQs related to job interviews.

Unit-IV **5 Hours**

Recognizing differences between groups and teams- managing time – managing stress, networking professionally – respecting social protocols-understanding career management – developing a long-term career plan – making career changes.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Butterfield. (2015). Jeff Soft Skills for Everyone. Cengage Learning: New Delhi.*

- *E. Suresh Kumar et al. (2015). Communication for Professional Success. Orient Blackswan: Hyderabad.*
- *Interact English Lab Manual for Undergraduate Students. Orient Black Swan: Hyderabad, 2016.*
- *Raman, Meenakshi and Sharma. S. (2014). Professional Communication. Oxford University Press: Oxford.*

Course Title: Numerical Methods And Analysis	L	T	P	Credits
Course Code: BAI3205	4	0	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the errors, source of error and its effect on any numerical computations and also analysis the efficiency of any numerical algorithms.
2. Learn how to obtain numerical solution of nonlinear equations using bisection, secant, newton, and fixed-point iteration methods.
3. Solve system of linear equations numerically using direct and iterative methods and definite integrals and initial value problems numerically
4. Classify of approximate the functions using interpolating polynomials.

Course Content

Unit-I **15 Hours**

Floating-Point Numbers: Floating-point representation, rounding, chopping, error analysis, conditioning and stability.

Non-Linear Equations: Bisection, secant, fixed-point iteration, Newton method for simple and multiple roots, their convergence analysis and order of convergence.

Unit-II **15 Hours**

Linear Systems and Eigen-Values: Gauss elimination method using pivoting strategies, LU decomposition, Gauss-Seidel and successive-over-relaxation (SOR) iteration methods and their convergence, ill and well-conditioned systems, Rayleigh's power method for Eigen-values and Eigen-vectors.

Unit-III **15 Hours**

Interpolation and Approximations: Finite differences, Newton's forward and backward interpolation, Lagrange and Newton's divided difference interpolation formulas with error analysis, least square approximations.

Unit-IV **15 Hours**

Numerical Integration: Newton-Cotes quadrature formulae (Trapezoidal and Simpson's rules) and their error analysis, Gauss-Legendre quadrature formulae.

Differential Equations: Solution of initial value problems using Picard, Taylor series, Euler's and Runge-Kutta methods (up to fourth-order), system of first-order differential equations.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Gerald, C. F. (2004). Applied numerical analysis. Pearson Education India.*
- *Jain, M. K. (2003). Numerical methods for scientific and engineering computation. New*

Age International.

- *Mathews, J. H. (1992). Numerical methods for mathematics, science and engineering (Vol.*

10). Prentice-Hall International.

- *Burden, R. L., Faires, J. D., & Burden, A. M. (2015). Numerical analysis. Cengage learning*

Course Title: Indian Health Sciences	L	T	P	Credits
Course Code: IKS0006	2	0	0	2

Total Hours-30

Learning Outcomes: On the completion of the course, the students will be able to:

1. Understand knowledge of India's traditional health systems
2. Critically analyze India's healthcare policies
3. Understand the patterns, causes, and effects of diseases in India and strategies for prevention and control.
4. Learn about nutrition, sanitation, mental health, and lifestyle diseases like diabetes and cardiovascular disorders, along with preventive healthcare measures.

Course Content

Unit-I **7 Hours**

Introduction, Vedic foundations of Ayurveda. Ayurveda is concerned both with maintenance of good health and treatment of diseases.

Unit-II **8 Hours**

Basic concepts of Ayurveda. The three Gunas and Three Doshas, Pancha-mahabhuta and Sapta-dhatu.

The importance of Agni (digestion). Six Rasas and their relation to Doshas. Ayurvedic view of the cause of diseases.

Unit-III **8 Hours**

Dinacharya or daily regimen for the maintenance of good health. Ritucharya or seasonal regimen. Important Texts of Ayurveda. Selected extracts from *Astāngahrdaya* (selections from *Sūtrasthāna*)

and *Suśruta-Samhitā* (sections on plastic surgery, cataract surgery and anal fistula). The large pharmacopeia of Ayurveda.

Unit-IV **7 Hours**

Charaka and Sushruta on the qualities of a Vaidya. The whole world is a teacher of the good Vaidya.

Charaka's description of a hospital. Hospitals in ancient and medieval India.

Transactional Mode:

Seminars, Group discussion, Team teaching, Focused group discussion, Assignments, Project-based learning, Simulations, reflection and Self-assessment

Suggested Readings:

- Park, K. (2005). Park's textbook of preventive and social medicine. *Preventive Medicine in Obstet, Paediatrics and Geriatrics.*
- Lad, V. (1984). *Ayurveda: The science of self-healing: A practical guide*. Lotus press.
- Bali, A. S., & Ramesh, M. (2021). Governing healthcare in India: A policy capacity perspective. *International Review of Administrative Sciences*, *87*(2), 275-293.

Teitelbaum, J., & Wilensky, S. (2009). *Essential readings in health policy and law* (Vol. 3). Jones & Bartlett Publishers.

Course Title: Sustainable Development	L	T	P	Credits
Course Code: BAI3206	3	0	0	3

Total Hours- 45

Learning Outcomes: On the completion of the course, the students will be able to:

1. Understand the three pillars of sustainability and theories of sustainability
2. Understand the concept of sustainable development, theories of sustainability
3. Got a knowledge of sustainable development goals 2030 and their target, ranking, government initiatives for sustainable development
4. Apply measurement and indicators and understand the contemporary issues of sustainable development

Course Content

Unit-I **10 Hours**

Sustainability- Concept, Meaning, and Definitions – Importance of sustainability goals of sustainability – History of sustainability – Three Pillars of Sustainability – Theories of Sustainability: Systems Theory, Popular sustainability theory, and Ideal scientific model - Issues and Challenges relating to sustainability.

Unit-II **10 Hours**

Sustainable Development - Concept, meanings, scope, and definitions of s sustainable development – Principle of Sustainable Development – The pillars of sustainable development – Approaches to Sustainable Development: Status Quo Approach, Community, Capacity Building Approach, Industrial Sector Approach, Integrated Systems Approach, Human Development Approach, and Green Account Approach.

Unit-III **10 Hours**

Goals of Sustainable Development -Nature of Sustainable Development Goals – 2030 Global Agenda for Sustainable Development – Government Policies and their implications for sustainable development in India – Contribution of International Organizations and NGOs – Government Initiatives for Sustainable Development.

Unit-IV **10 Hours**

Challenges in Sustainable Development-Diversity and Social Exclusion: Concept and implications, human development of the sociocultural and other ethnic groups of the society; Contemporary Issues of Development – Bottom of the pyramid approach; Understanding the importance of social capital, social mobilization, social security, and population stabilization.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Agrawal, A N (1995). Indian Economy: Problems of development and planning. pune: Vishwa Prakashan.*
- *Baldev Raj Nayar, Globalization and Nationalism: The Changing Balance of India's Economic Policy, 1950–2000 (New Delhi: Sage, 2001)*
- *Beckman, M. (1968), Location Theory, Random House, London.*
- *Bidyut Mohanty (1993) Urbanization in Developing Countries Basic Services and commUnit--y Participation, Institute of Social Science, Concept Publishing House.*
- *Brahmadanda, P.R. and V.R. Panchmukhi (Eds.) (2001), Development Experience in the Indian Economy: Inter-State Perspectives, Bookwell, Delhi.*
- *Dholakia, R.H. (1985), Regional Disparity in Economic Growth in India, Himalaya Publishing House, Bombay.*

Course Title: Digital Electronics	L	T	P	Credits
Course Code: BAI3208	2	0	0	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the used of fundamentals concepts and techniques in digital electronics
2. Examine the structure of various number systems and its application in digital design.
3. Analyze and design various combinational and sequential circuits.
4. Categorize a digital logic and apply it to solve real life problems.

Course Content

Unit-I **7 Hours**

Fundamentals of Digital Systems and logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples officiate, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

Unit-II **7 Hours**

Standard representation for logic functions: K-map representation and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De- Multiplexer/Decoders, Adders, Sub-tractors, BCD arithmetic, carry look ahead adder, serial adder.

Unit-III **8 Hours**

Sequential circuits and systems :A 1-bit memory, the circuit properties of Bus table latch, the clocked SR flip flop, J- K-T and D- Types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, application counters, A/D and D/Converters

Unit-IV **8 Hours**

Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled

device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *R. P. Jain. (2009). Modern Digital Electronics. McGraw Hill Education.*
- *M. M. Mano. (2016). Digital logic and Computer design. Pearson Education India.*
- *A. Kumar. (2016). Fundamentals of Digital Circuits. Prentice Hall India.*

Course Title: Digital Electronics Lab	L	T	P	Credits
Course Code: BAI3209	0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Classify the design combinational circuit and sequential circuit.
2. Examine half adder using XOR and NAND gates and verification of their operation
3. Design and implement 4bit adder, 2's complement sub tractor circuit using a 4-bit adder IC.
4. Relate Boolean laws to simplify the digital circuits.

Course Content

1. Verification of the truth tables of TTL gates, e.g., 7400, 7402, 7404, 7408, 7432, 7486.
2. Design, fabrication and testing of low frequency TTL clocks using NAND gates.
3. Verification of the truth table of the Multiplexer 74150.
4. Verification of the truth table of the De-Multiplexer 74154.
5. Design and verification of the truth tables of half adder and full adder circuits using gates 7843.
6. Study and verification of the operations of ALU 74181 with regard to addition / subtraction /comparison.
7. Design, fabricate and test a switch denounce using 7400.
8. Design and test of an S-R flip-flop using NOR/NAND gates.
9. Verify the truth table of a J-K flip-flop (7476)
10. Verify the truth table of a D flip-flop (7474) and study its operation in the toggle and asynchronous modes.

Course Title: Disaster Risk Reduction and Management: Skills for Safety and Resilience	L	T	P	Cr.
Course Code: BAI3210	2	0	2	3

Total Hours: 45

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

1. Identify hazards, vulnerabilities and risks at individual, institutional and community levels.
2. Outline the legal and institutional frameworks of DRR in India and globally.
3. Demonstrate life-saving skills, emergency communication, disaster response and risk mitigation techniques.
4. Utilize and implement basic tools and technologies for risk assessment, preparedness and resilience-building.
5. Prepare disaster management plans and design community awareness activities, or prototypes in regional/local contexts.

Course Content

UNIT-I **5 hours**

Understanding Disaster Risk Reduction and Management:

- Basic concepts and terminology: Hazard, Vulnerability, Capacity, Exposure, Disaster, Risk, Disaster Management & Disaster Risk Reduction.
- Hazard profile of India: Regional profile.
- Disaster Management Cycle: Mitigation, preparedness, response, relief, recovery, rehabilitation.
- Policy and legal frameworks: DM Act 2005, DM Amendment Act 2025, National Policy, State-specific Acts; PM 10 Points agenda.
- International frameworks: Sendai Framework, Paris Agreement, SDGs.
- Role of Institutions in DRR (overview only): NDMA, NIDM, IMD, CWC, GSI, BIS, ISRO, INCOIS, SDMA, DDMA, NDRF.
- Case studies of different disasters in India: Lessons learned (minimum 2).

UNIT-II **5 hours**

Preparedness, Mitigation and Response Planning

- Framework for Developing Disaster Management Plans.
- Hazard, Vulnerability, Capacity and Risk (HVCR) Assessment tools and techniques: Transect walk, Hazard mapping, Problem tree, Chapatti diagram etc.
- Mitigation and Preparedness: Evacuation planning, mock drills, tabletop exercises; disaster-specific mitigation, Crowd Management techniques.
- Basics of Incident Response System (IRS).
- Role of emergency forces: NDRF, SDRF, police, fire services, armed forces, NCC, NSS.
- Planning for more vulnerable groups.
- Emerging technologies: Drones, digital literacy, mobile apps (GIRI tool, SAFAR, Meghdoot, UMANG, Sachet, CWC Flood Alerts, IMD, BIS, IHIP), social media for DRR.
- Basics of safe construction and structural & nonstructural audit exercise (safety of home/ college buildings).
- Funding mechanisms for disasters in India.
- Emergency Communication Network.

UNIT-III **5 hours**

Life-Saving Skills

- First Aid in disasters: Golden hour concept, CPR, wounds, choking, burns, fractures, animal bites (snake/dog/rabid), heat-related illnesses, triaging, stampede.
- Household and personal preparedness and protection: 72-hour emergency kit, safe food storage, water purification, ORS use, water sanitation and hygiene (WASH) and Infection Prevention Control (IPC) practices, Basic Sign Language.
- Search and Rescue methods.
- Fire safety and electrical/gas/LPG safety: Causes, prevention, fire extinguisher demonstration, indigenous methods (Natural first-aid remedies- aloe vera, turmeric, coconut oil, salt solution); traditional risk-reduction practices.
- Disaster-specific response: Floods, landslides, earthquakes, CBRN emergencies, pandemics, drowning, lightning, gas leakage, cyclone, heatwave, coldwave.
- Psychosocial support in DRR; Steps for implementing psychological first aid and its importance.

- Public health preparedness: Public health impacts of various disasters, Prevention of post-disaster water-borne and vector-borne diseases.

UNIT-IV **30 hours**

Field Exposure and Community Engagement

- Field visits: District Emergency Operations Centre, State Disaster Response Force/ National Disaster Response Force units, fire stations, State Emergency Operations Center, hazard-prone communities, heat-prone areas (flood-prone village, fire-vulnerable urban slum).
- Practical exposure: Mock drills, demonstrations and simulations (multi-hazard, evacuation, earthquake, flood); interaction with responders and officials (Aapda Mitras, National Cadet Corps/National Service Scheme/Nehru Yuva Kendra Sangathan, Red Cross).
- Community Engagement projects: Street plays (nukkad natak), awareness campaigns, DRR clubs (institute and community level clubs), Information, Education and Communication material (podcasts, videos, comics, photo essays, posters, Knowledge exchange webinars).
- Environmental hazards: Youth/community participation (tree plantation, soil conservation).
- Project/assignment: Preparation of institutional/household DM plan in local language; budget-friendly multi-disaster survival kit prototype; reflective field report, youth-led community engagement projects and creation of IEC/digital communication materials.
- Multidisciplinary integration: Links with local governments, HEIs, youth/adolescent networks.
- Activities for mitigating disaster risks: Increasing green cover, plantation and knowledge of human anatomy.
- Interaction with: State, district, gram panchayat level officials, DRR helpline numbers, and knowledge of physical resources required and available locally; interview /session with disaster survivors.

Transactional Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Books/Handbooks

1. Sphere Handbook for humanitarian response standards. Link: https://spherestandards.org/handbook/
2. Health emergency and disaster risk management framework (Health EDRM), WHO.
Link: https://www.who.int/publications/i/item/9789241516181

Course Title: Basics of Cyber Security	L	T	P	Cr.
Course Code: BAI3211	3	0	0	3

Total Hours: 45

Course Learning Outcomes: *After completing all the units, students will able to:*

1) the concept of Cyber security and issues and challenges associated with it.
2) the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.
3) appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.
4) the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

Course Content

Unit-I. *Introduction to Cyber security* **8 Hours**

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

Unit-II: *Cyber crime and Cyber law* **12 Hours**

Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.

Unit-III: *Social Media Overview and Security* **12 Hours**

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

Unit-IV: *E - Commerce, Digital Payments Digital Devices Security, Tools and Technologies for Cyber Security* ***13 Hours***

Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payament Settlement Act,2007, End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.

Suggested Readings: *-*

1. *Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.*
2. *Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal*

Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)

3. *Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)*
4. *Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.*
5. *Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.*
6. *Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition,*

Wiley India Pvt. Ltd.

7. *Fundamentals of Network Security by E. Maiwald, McGraw Hill.*

SEMESTER-IV

Course Title: ARTIFICIAL INTELLIGENCE	L	T	P	Credits
Course Code: BAI4250	4	0	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design expert system by using AI tools.
2. Compare and develop expert system with the help of Neural Networks
3. Classify the expert system using Machine Learning.
4. Analysis of the expert system using Fuzzy Logic.

Course Content

UNIT I **15 Hours**

Introduction: What is AI, Importance of AI, Early work in AI, Applications of AI, Knowledge and its definition. Knowledge Representation: Prepositional logic, FOPL, Properties of Well-formed formulas, Conversion to Clausal form, Inference rules, Resolution principle.

Structured Knowledge: Introduction, Associate frame structures, Conceptual dependencies and scripts.

UNIT II **15 Hours**

Knowledge Organization and Manipulation: Concepts, Uninformed or Blind search, informed search, Searching- And-OR graphs, Pattern Recognition, Recognition Classification process, Classification patterns, Recognizing and understanding speech.

Generative AI: How does generative AI work? Generative AI models, what are Dall-E, ChatGPT and Bard, use cases, benefits and its limitations, Ethics and bias, Generative AI vs. AI, Generative AI history.

UNIT III **15 Hours**

Planning: planning as search, partial order planning, construction and use of planning graphs. Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory and sample applications.

UNIT IV **15 Hours**

Expert System: Definition, Rule based architecture, dealing with uncertainty, Knowledge acquisition and validation, knowledge system building tools.

Knowledge Acquisition: Types of learning, General Learning model, Performance measures. Learning nearest neighbor, naive Bayes, and decision tree classifiers.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Dan W. Patterson. (1990). Introduction to Artificial Intelligence and Expert Systems.PHI Publication.*
- *Peter Jackson. (1998). Introduction to Expert System. AddisonWesley.*

Course Title: Operating System	**L**	**T**	**P**	**Credits**
Course Code: BAI4251	**3**	**0**	**0**	**3**

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design the algorithms to write programs.
2. Understand the concept of arrays, pointers and structures to formulate algorithms and programs
3. Apply programming to solve simple numerical method problems, namely rot finding
4. Describe the Function, differentiation of function and simple integration

Course Content

Unit-I **10 Hours**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System**.**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Unit-II **15 Hours**

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time,

Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problematic.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock Recovery

Unit-III **10 Hours**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation –Hardware support for paging, Protection and sharing, Disadvantages of paging. Failures and recovery management.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Unit-IV **10 Hours**

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Charles Crowley. (1996). Operating System; A Design-oriented Approach. 1st Edition, Irwin Publishing.*
- *Gary J.*

- *Nutt, Addison. (2002). Operating Systems: A Modern Perspective. 2nd Edition Wesley.*
- *Maurice Bach, Prentice-Hall of India (1986). Design of the Unix Operation Systems. 8th Edition.*
- *Daniel P. Bovet, Marco Cesati, O'Reilly and Associates. (2005). Understanding the Linux Kernel. 3rd Edition*
- *Waddington, D. G., and D. Hutchison. (1999): "Resource partitioning in general purpose operating systems." ACM SIGOPS Operating Systems Review 33, no. 4*
- *Abraham Silberschatz,(2021) Peter Baer Galvin, Greg Gagne, "Operating System Principles", 10th edition.*

Web Links

- *https://www.techtarget.com/whatis/definition/operating-system-*
- *https://www.coursera.org/courses?query= operating system.*
- *https://www.cse.iitb.ac.in/~mythili- operating-system*
- *https://computer.howstuffworks.com/web-operating-system.htm-operating-system-*

Course Title: Operating System Lab	L	T	P	Credits
Course Code: BAI4252	0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Acquire the knowledge of Linux operating system.
2. Develop and debug the various Linux commands.
3. Perform various shell commands.
4. Discuss shell programming & its concepts.

Course Content

Installation Process of various operating systems

1. **Commands for files & directories:** cd, ls, cp, md, rm, mkdir, rmdir. Creating and viewing files using cat. File comparisons. Disk related commands: checking disk free spaces. Processes in Linux, connecting processes with pipes, background processing, managing multiple processes. Manual help. Background process: changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep. Printing commands, grep, fgrep, find, sort, Cal, banner, touch, file. File related commands ws, sat, cut, grep.
2. **Administrative commands:** ACCEPT DATE, LIBVOLUME, EXPORT commands, IMPORT commands, LOCK commands, MOVE commands, QUERY commands, REGISTER commands, ACTIVATE POLICYSET (Activate a new policy set), ASSIGN DEFMGMTCLASS)AUDIT commands, LDAPDIRECTORY, BACKUP commands , BEGIN EVENTLOGGING (Begin logging events), CANCEL commands, CHECKIN LIBVOLUME (Check a storage volume into a library), CHECKOUT LIBVOLUME (Check a storage volume out of a library), CLEAN DRIVE (Clean a drive), COMMIT (Control committing of commands in a macro), COPY commands, DEFINE commands, DELETE commands, DISABLE commands, DISMOUNT command, DISPLAY OBJNAME (Display a full object name), ENABLE commands, EXPORT commands, IMPORT commands, LOCK commands, MOVE commands, QUERY commands, REGISTER commands, PERFORM LIBACTION, PING SERVER, QUERY ,QUIT, RECLAIM STGPOOL, RECONCILE VOLUMES, REGISTER, REMOVE commands, RENAME commands, REPLICATE NODE, REPLY, RESET PASSEXP, PASSEXP, RESET , RESTART EXPORT, RESTORE commands, MACRO, MIGRATE STGPOOL, REVOKE commands, ROLLBACK, RUN, SET commands, SELECT, SETOPT, SHRED DATA (Shred data), SETOPT, SUSPEND EXPORT UNLOCK commands, UPDATE commands, VALIDATE commands, VARY,

AUDIT commands, BACKUP commands, CANCEL commands, COPY commands.

Shell Programming: Basic of shell programming, various types of shell, Shell Programming in bash, conditional & looping statement, case Statement, parameter passing and arguments, shell variables, shell keywords, creating shell programs for automate system tasks, report printing.

Course Title: PYTHON PROGRAMMING	L	T	P	Credits
Course Code: BAI4253	3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand and use R – Data types and R – Data Structures.
2. Develop programming logic using R – Packages and analyze data sets using R – programming capabilities
3. Acquire the knowledge of programming skills in core Python and Implement Object Oriented concepts to develop live projects.
4. Design graphical user Interfaces in Python and create database connectivity to create, search and sort the information.

Course Content

UNIT I **15 Hours**

Introduction: Python Installation and Working with Python, Understanding Python variables, Python basic Operators, Understanding python blocks.

Python Data Types Declaring and using Numeric data types: int, float, complex, using string data type and string operations, defining list and list slicing, Use of Tuple data type.

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

UNIT II **15 Hours**

Python Functions: Modules and Packages Organizing python codes using functions, organizing python projects into modules, importing own module as well as external modules, Understanding Packages, Powerful Lambda function in python Programming using functions, modules and external packages.

Python String: List and Dictionary Manipulations Building blocks of python programs, understanding string in build methods, List manipulation using in build methods, Dictionary manipulation, Programming using string, list and dictionary in build functions.

Libraries and APIs: Standard Libraries of Python, API Using Python, Python Web Framework, Computer Vision using Python

UNIT III **15 Hours**

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

Python Object Oriented Programming: Oops Concept of class, object and instances Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance, overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support.

Python Regular Expression: Powerful pattern matching and searching Power of pattern searching using regex in python, Real time parsing of networking or system data using regex, Password, email, URL validation using regular expression, Pattern finding programs using regular expression

UNIT IV **15 Hours**

Python Exception Handling: Avoiding code break using exception handling, safe guarding file operation using exception handling, Handling and helping developer with error code, Programming using Exception handling

Python Database Interaction SQL: Database connection using python, creating and searching tables, Reading and storing configure information on database, Programming using database connections

Python Multithreading: Understanding threads, forking threads, synchronizing the threads.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- John V Guttag. (2013). *Introduction to Computation and Programming Using Python Revised and expanded Edition.* MITPress
- Robert Sedgewick, Kevin Wayne, Robert Dondero. (2016). *Introduction to Programming in Python: An Inter-disciplinary Approach.* Pearson India Education Services Pvt.Ltd.
- Timothy A. Budd. (2015). *Exploring Python.,* Mc-Graw Hill Education (India)PrivateLtd.
- Kenneth A. Lambert. (2012). *Fundamentals of Python First Programs.*", CENGAGE Learning.
- Charles Dvierbach. (2013). *Introduction to Computer Science using Python. A ComputationalProblem-Solving Focus*. Wiley IndiaEdition.
- Paul Gries, Jennifer Campbell and Jason Montojo. (2013). *Practical Programming: An Introduction to Computer Science using Python 3.* Second edition, Pragmatic Programs, LLC.
- *Dave Brueck and Stephen Tanner " Python Prograaming Wiley, June 2001*,
- *PYTHON in a nutshell : A DESKTOP QUICK REFERENCE by Alex Martelli*

Web Links

- *https://posit.co/blog/three-ways-to- Python using R-Programming*
- *https://rstudio.github.io/reticulate/ Python using R-Programming*
- *https://www.quora.com/What-are-the-best-sites-to-learn- Python using R-Programming*

Course Title: PYTHON PROGRAMMING LAB	**L**	**T**	**P**	**Credits**
Course Code: BAI4254	**2**	**0**	**0**	**2**

Total Hours: 15

Course Learning Outcome: On successful completion of this course, the students will be able to:

1. *Apply the basic principles of python programming.*
2. *Create applications using python programming*
3. *Develop looping functions using python programming.*
4. *Understand the methods to manipulate python programs by utilizing the data structures like lists.*
5. *Develop and use Web Services using python*

Course Content

List of Programs:

1. *Write a program to perform arithmetic operations.*
2. *Implement conditional statements (if-else).*
3. *Print patterns using loops.*
4. *Perform string operations.*
5. *Demonstrate list, tuple, set, and dictionary operations.*
6. *Create and use functions.*
7. *Implement recursion (factorial, Fibonacci).*
8. *Read from and write to text files.*
9. *Handle exceptions using try-except.*
10. *Create a class and demonstrate OOP concepts.*
11. *Use modules like math, random, and datetime.*
12. *Connect Python with an SQLite database.*
13. *Build a GUI calculator using Tkinter.*

14. *Build a Notepad using Tkinter.*
15. *Fetch data from a public API.*
16. *Develop a mini project (e.g., Student Management System).*

Course Title: Discrete Mathematics	**L**	**T**	**P**	**Credits**
Course Code: BAI4255	**4**	**0**	**0**	**4**

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Use mathematically correct terminology and notations
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Analysis the counter examples.

Course Content

Unit-I **15 Hours**

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Unit-II **15 Hours**

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination. Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The

Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Unit-III **15 Hours**

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi- Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Unit-IV **15 Hours**

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Aurelian and Hamiltonian Walks, Graph Coloring, coloring maps and Planar Graphs, Coloring Vertices, Coloring Edges, List Coloring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi- connected component and Articulation Points, Shortest distances.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *J.P. Tremblay and R. Manohar. (1997). Discrete Mathematical Structure and Its Application to Computer Science". TMG Edition,Tatamcgraw-Hill.*
- *Norman L. Biggs. (2010). Discrete Mathematics. 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, MarcLipson.*
- *Mott, Abraham Kandel. (2011). Discrete Mathematic. TataMcGraw-Hill.*

Course Title: Report Writing	L	T	P	Credits
Course Code: BAI4256	2	0	0	2

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the basic related to writing the reports.
2. Understanding the concepts related to formatting and structuring the report.
3. Comprehend the concept of proofreading, proposals and practice.
4. Recognize when to use data to back up your report

Course Content

Unit-I **10 Hours**

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing. Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a seminar/technical report, Minutes of meeting writing.

Unit-II **12 Hours**

Drafting report and design issues: The use of drafts, Illustrations and graphics. Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit-III **13 Hours**

Proofreading and summaries: Proofreading, summaries, Activities on summaries. Presenting final reports: Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

Using word processor: Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, adding an Index, creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes

Unit-IV **10 Hours**

Using word processor: Working with Footnotes and Endnotes, inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros.

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property.

Transaction Mode:

Lecture, e-Team Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings:

- *Meenakshi R and Sangeeta S. (2008). Technical Communication- Principles & Practice. Oxford.*
- *B.N. Basu. (2008). Technical writing. PHI learning.*
- *Alok J, Pravin S.R. Bhatia, A.M. Sheikh. (2006). Professional Communication Skills. S Chand.*
- *Andrea J Rutherford. (2001). Basic Communication Skills for technology. Pearson.*
- *T. Ramappa. (2008). Intellectual Property Rights Under WTO, S. Chand Publishers.*
- *R. P. Merges, P. S. Menell, Mark A. Lemley. (1997). Intellectual Property in New Technological Age.*

Web Links

- *https://www.udemy.com/course/reportwriting/*
- *https://www.udemy.com/course/professional-business-english-and-technical-report-writing/*
- *https://www.udemy.com/course/betterbusinesswriting/*

Course Title: Indian Agriculture	L	T	P	Credits
Course Code: IKS0009	2	0	0	2

Total Hours-30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the significance of agriculture and irrigation in ancient Indian texts.
2. Analyze historical accounts of Indian agriculture by Greek historians and travelers.
3. Explore ancient water management systems and advanced agricultural technologies.
4. Assess agricultural productivity in medieval and early modern India through historical reports.

Course Content

Unit-I **7 Hours**

Introduction, the significance of agriculture and irrigation as emphasized in the Ramayana, Mahabharata and other texts.

Unit-II **7 Hours**

Mention of Indian agriculture by the Greek historians and later travelers. Significance of agriculture and irrigation for the kings of Indian tradition.

Unit--III **8 Hours**

Major water-bodies of the ancient times. The Ery system of south India. Excellence of Indian agricultural technologies as observed by more recent European observers.

Unit-IV **8 Hours**

Productivity of Indian agriculture in medieval Thanjavur and eighteenth-century Allahabad, Chengalpattu, etc. Indian attitude towards agriculture, based on Walker and later reports.

Transactional Mode:

Seminars, Group discussion, Team teaching, Focused group discussion, Assignments, Project-based learning, Simulations, reflection and Self-assessment

Suggested Readings:

- Srivastava, V. C. (2008). *History of Agriculture in India, up to c. 1200 AD* (Vol. 5). Concept Publishing Company.
- Raychaudhuri, S. P., & Kaw, R. K. (1964). Agriculture in ancient

Course Title: Computer Organization & Architecture	L	T	P	Credits
Course Code: BAI4258	4	0	0	4

Total Hours - 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the basic concept of computer fundamentals, Number system, Boolean algebra, Karnaugh map and Perform problems
2. Explain the concept of stored program, role of operating system, Instruction sets and Addressing modes and Demonstrate problems on Addressing modes.
3. Use of control unit and various I/O operations
4. Classify the concept of Instruction pipeline, RISC, CISC

Course Content

UNIT I **15 Hours**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL0interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common cpus.

Data representation: signed number representation, fixed and floating-point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. Multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

UNIT II **15 Hour**

Introduction to x86 architecture: CPU control unit design: hardwired and micro-program design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers-program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, US

UNIT III **15 Hours**

Pipelining: Basic concepts of pipelining, through put and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel-processors, Concurrent access to

Memory and cache coherency.

UNIT IV **15 Hours**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. Block size, mapping functions, replacement algorithms, write policies.

Transaction Modes Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *John P. Hayes. (1988). Computer Architecture and Organization. 3rd Edition, WCB/McGraw- Hill.*
- *William Stallings. (2016). Computer Organization and Architecture. Designing for Performance. 10th Edition, Pearson Education.*
- *Vincent P. Heuring and Harry F. Jordan. (2004). Computer System Design and Architecture, 2nd Edition by Pearson Education.*

Course Title: Network Security	L	T	P	Credits
Course Code: BAI4259	4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify the different types of network devices and their functions within a network.
2. Describe network architectures and classifications.
3. Summarize the intrusion detection and its solutions to overcome the attacks.
4. Describe various network applications, and network security considerations.

Course Content

Unit-I **16 Hours**

Introduction: Overview of computer networks, seven-layer architecture, TCP/IP suite of protocols, etc.MAC protocols for high-speed LANS, MANS and wireless LANs. (For Example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet, etc.)

Unit-II **10 Hours**

Fast Access Technologies: ADSL, Cable Modem, etc. IP Multicasting, Multicast routing protocols, address assignments, session discovery, etc.

Unit-III **17 Hours**

Ipv6: Basic Protocol, extensions and options, support for QoS, security, etc., neighbors' discovery, auto configuration, routing. Changes to other protocols. Application Programming Interface for IPV6.Mobility in networks. Mobile IP, Difference between Private and Public IP addresses Security related issues, Firewall History,

Cryptography and its Types: Introduction**, Features of Cryptography,** Steganography, Classical Cryptography and Quantum Cryptography, Custom Building Cryptography Algorithms (Hybrid Cryptography), Cryptology ,Encryption, PRG, PRF and PRP in Cryptography, Caesar Cipher in Cryptography.

Unit-IV **17 Hours**

TCP/IP protocol: TCP Extension for high-speed networks, transaction-oriented applications. Other new options in TCP. Network security at various layers. Secure-HTTP, SSL, ESP, Authentication header, distribution protocols, Digital signatures, digital certificates.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *William Stallings (2010). Network Security Essentials: Applications and Standards, Prentice Hall.*
- *Michael T. Goodrich and Roberto Tamassia (2011). Introduction to Computer Security, Addison Wesley.*
- *Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone. (2001). Handbook of Applied Cryptography, CRC Press.*

SEMESTER-V

Course Title: Java Programming	L	T	P	Credits
Course Code: BAI5300	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Discuss the basic concepts of java like if-else, control structures, array and strings.
2. Classify the structure and model of the Java programming language.
3. Synthesize Java programming language for various programming technologies
4. Develop software in the Java programming language on different platforms.

Course Content

Unit-I **10 Hours**

An overview of Java: Object oriented programming, Two paradigms, abstraction, the OOP principles, Java class libraries

Date types, variables and arrays: Integers, floating-point types, characters, Boolean, Iterates, Variable, Data types and casting, array operators.

Operators: Arithmetic operators, bit wise operators, relational operators, Boolean logical operators, assignment operators, operator precedence

Control Statement: Java's selection Statement, iteration Statement, jumps Statement.

Introduction to classes: Class fundamentals, declaring object reference variable, introducing methods, constructors, the keywords, garbage collection, the finalize () method.

Methods and Classes: Overloading methods, using objects as parameters, recursion.

Unit-II **10 Hours**

Inheritance: Inheritance basics, using super, method overriding, dynamic method dispatch, using abstract Classes, using final with inheritance, Package and Interfaces, Package protection, importing packages

Exception handling: Exception handling fundamentals, Exception types, Uncaught Exceptions, using try and catch, multiple catch clauses, nested try

Statement throw, and finally Java built in exception creating your own exception, sub classes, using exceptions

Unit-III **10 Hours**

Multithreaded Programming: The Java thread model, the main thread, creating thread, creating multiple thread, using is alive () and join (). Thread priorities, synchronization, inter thread communications, suspending resuming and stopping thread using multithreading.

String handling: The string constructor, string length, special string operator character extraction, string comparison, searching string, modifying string, data conversion, changing the case of characters, string buffer.

Unit-IV **15 Hours**

Networking: Networking basics, Java and the Internet Address, TCP/IP client Sockets URL, URL connection, TCP/IP server Sockets, the Applet Class. Stream API

The Applet Class: Architecture displays method, The HTML APPLET, Passing parameters to Applet. The get Documentation Base () and get Code Base () methods Applet Context and Show Document ().

Micro servicing: Standards and Syntax, Advantages of Micro services, Java Micro Services Framework, Spring Cloud and Spring Boot, Different strategies used in Micro service deployment, Domain-Driven Design containers in Micro services, Contract Testing, Monolithic, SOA, and Micro Services Architecture, Docker, DC, Bounded Context

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Schildt, H. (2000). Java 2: The complete reference. McGraw-Hill Professional.*
- *Horstmann, C. S. (2024). Core java, volume I: fundamentals. Pearson Education.*
- *Balaguruswamy, E. (2014). Programming with Java-A Primer. McGraw-Hill Professionals.*
- *Arnold, K., Gosling, J., Holmes, D., & Holmes, D. (2000). The Java programming language (Vol. 2). Reading: Addison-wesley.*
- *Eckel, B. (2003). Thinking in JAVA. Prentice Hall Professional.*

Web Links

- *https://www.codementor.io/@sureshatta/11-websites-that-help- Java Programming*

- *https://www3.ntu.edu.sg/home/ehchua/programming/howto/References.html- Java Programming*
- *https://www.tradepub.com/free-offer/advanced-java-tutorial/w_java34?sr=hicat&_t=hicat:827- Java Programming.*

Course Title: Java Programming Lab	L	T	P	Credits
Course Code: BAI5301	0	0	2	1

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Solve the computational problems using basic statements like if-else, control structures, array, and strings.
2. Learn about the user requirements for software functionality and Run software applications in Java programming language.
3. Know about basic principles of creating Java applications with Applet programming.
4. Develop a given program using the basic elements like Control and Conditional statements

Course Content

List of Programs:

1. Introduction to JAVA, its features & basic program
2. Write a program for Operators in JAVA
3. Write a program to show use of IF-Else Statements in JAVA
4. Write a program use switch case in JAVA
5. Write a program to use looping in JAVA
6. Write a program to use methods in JAVA
7. Write a program to create class and objects
8. Write a program to use Method Overloading a method overriding
9. Write a program to use Final Keyword.
10. Write a program to show Implementation of Array.
11. Write a program to show Implementation of Inheritance
12. Write a program to show creation and use of package
13. Write a program to show use of Interface
14. Write a program to apply replace, concate methods on String.
15. Write a program to sort strings of array
16. Write a program to Show Implementation of Threads
17. Write a program to create applet
18. Write a program to create applet with passing parameters
19. Write a program to show use of Exception Handling
20. Write a program to make usage of JAVA lang.awt package and design GUI. Usage of event handling in Java GUI (Graphical user interface) programs.

Course Title: Relational Database Management System	L	T	P	Credits
Course Code: BAI5302	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop the queries using SQL, solutions to a broad range of query and data update problems.
2. Describe various database concepts and database management system software.
3. Understand the major DBMS components and their function.
4. Design a model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.

Course Content

Unit-I **15 Hours**

Database Management: Introduction, Types of DBMS and their advantages and disadvantages, Characteristics of Database Approach, Data Models, Data Abstraction and Knowledge Representation, Database Language.

DBMS Architecture and Data Independence: Attributes and Keys, Relationships, Relationship Types, Roles, ER Diagrams, Relational Model concepts, functional dependence.

Unit-II **10 Hours**

SQL, PL SQL, SQL *PLUS, Managing Database and Queries: Creating, Defining and Modifying Table structure, Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations, Example of Queries in Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus, granting and revoking privileges.

Unit-III **10 Hours**

Normalization: Overview of Recovery and Backup, Normalization & its forms.

Transaction: Processing Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, multi-version and optimistic Concurrency Control schemes. Database recovery.

Unit-IV **10 Hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, Integrity in Data Base. Types of Integrity, SQL injection.

SQL Server: Introduction to SQL Server and Oracle Server, Indexes, Views, Cursors, Packages, Triggers, Stored Procedures.
No SQL: Introduction to NoSQL, Key Features, Advantages and Disadvantages of NoSQL, Types of NoSQL database.
Non-relational data and NoSQL: Document data stores, columnar data stores, Key/value data stores, Graph data stores, Object data stores, External index data stores, typical requirements.

Transaction Mode:
Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- Ullman, J. D. (1988). Principles of database and knowledge-base systems.
- Elmasri, R. (2008). Fundamentals of database systems. Pearson Education India.
- Abiteboul, S., Hull, R., & Vianu, V. (2000). Foundations of Databases. SIGMOD Record, 29(3), 76-87.
- Coronel, C., & Morris, S. (2019). Database systems: design, implementation and management. Cengage learning.
- Singh, S. K. (2009). Database systems: concepts, design and applications. Pearson Education India.

Web Links

- https://cloud.google.com/learn/- Relational Database Management System
- https://codeinstitute.net/global/blog/what-is-a-relational-database-management-system/- Relational Database Management System
- https://zenkit.com/en/blog/everything-you-need-to-know-about-web-databases/- Relational Database Management System.

Course Title: Relational Database Management System Lab	**L**	**T**	**P**	**Credits**

Course Code: BAI5303	0	0	2	1

Total Hours: 15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Explain the features of database management systems and Relational database.
2. Design conceptual models of a database using ER modeling or real-life Applications and also construct queries in Relational Algebra.
3. Create and populate a RDBMS for a real-life application, with constraints and keys, using SQL.
4. compile any type of information from a data base by formulating complex queries in SQL.

Course Content

List of Experiments:

1. Introduction to SQL and installation of SQL Server / Oracle.
2. Data Types, Creating Tables and Retrieval of Rows using Select Statement, Conditional Retrieval of Rows, Alter and Drop Statement.
3. Working with Null Values, matching a Pattern from a Table, Ordering the Result of a Query, Aggregate Functions, Grouping the Result of a Query, Update and Delete Statement.
4. Set Operators, Nested Queries, Joins, Sequences.
5. Views, Indexes, Database Security and Privileges: Grant and Revoke Commands, Commit and Rollback Commands.
6. PL/SQL Architecture, Assignments and Expressions, Writing PL/SQL Code, Referencing, Non-SQL parameters.
7. Stored Procedures and Exception Handling.
8. Triggers and Cursor Management in PL/SQL.
9. Suggested Tools – My SQL, DB2, Oracle, SQL Server 2012

Course Title: Web Designing & Development	L	T	P	Credits
Course Code: BAI5304	3	0	0	3

Total Hours-45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design web pages using JavaScript in HTML
2. Understand the fundamental skills to maintain web server services required to host a website
3. Develop scripting languages and web services to transfer data and add interactive components to web pages
4. Organize web media objects using editing software

Course Content

Unit-I **10 Hours**

Introduction to HTML: HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets; Introduction to JavaScript: Scripts, Objects in Java Script, Dynamic HTML with Java Script XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX

Unit-II **15 Hours**

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's Web Servers and Servlets: Tomcat web server, Introduction to Servlets: Lifecycle of a Servlet, JSDK, The Servlet API, Thejavax.servlet Package, Reading Servlet parameters, and Reading Initialization parameters. The javax. servlet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues

Unit-III **10 Hours**

JavaScript & Document Object Model: Introduction to JavaScript, Variables and Objects, Decision Making Statement, Loops, Arrays, Functions & Prototypes, Core JavaScript Objects, DOM Introduction, Event Model, Function

Flutter: Introduction , Container class in Flutter, Flutter – Tabs, Flutter Horizontal List, Flutter – Expansion Tile Card, Icon Classes, Expand Class, Dialogs, Circular & Linear Progress Indicators, Staggered Grid View

Hybrid Course Design: Models of hybrid Courses, Benefits and challenges, Challenges of hybrid

Responsive Web designing: HTML Responsive Web Design, Responsive Images, Responsive Text Size, Responsive Web Design

Unit-IV **10 Hours**

Frameworks Angular JS : Intro, Expressions, Modules, Directives, Model, Data Binding, Controllers, Scopes , Filters, Services, Http, Tables, Select, SQL , AngularJS DOM, Events , Validation, API, W3.CSS, Includes, Animations, Routing, Application.

Database Access: Database Programming using JDBC, Studying Javax. sql. * Package, accessing a Database from a JSP Page, Application – Specific Database Actions, Deploying JAVA Beans in a JSP Page, Introduction to struts framework. One android application development.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- Bates, C. (2002). *Web Programming Building Internet Applications*. John Wiley & Sons.
- Bergsten, H., & László, I. (2001). *JavaServer pages*. Sebastopol, CA: O'reilly.
- *Dietel and Nieto. (2001). Internet and World Wide Web. PHI/ Pearson Education Asia.*
- *Joglekar. (2009). Web Warrier guide to web design technologies. Cengage Learning, New Delhi.*
- *Byrne, Jim. 60 hot to touch Accessible Web Design tips – the tips no web developer can live without!, Jim Byrne, 2006.*
- *Chisholm, and May. Universal Design for Web Applications: Web Applications That Reach Everyone, O'Reilly Media, 2008.*

Web Links

- https://www.flux-academy.com/blog/the-best-sites-for-learning-web-design
- https://www.upwork.com/resources/web-design-vs-web-development-
  https://www.flux-academy.com/blog/the-best-sites-for-learning-web-design

Course Title: Web Designing & Development Lab	L	T	P	Credits
Course Code: BAI5305	0	0	2	1

Total Hours-15

Learning Outcomes: After completion of this course, the learner will be able to:

1. Develop a dynamic webpage by the use of java script.
2. Connect a java program to a DBMS.
3. Design a well-formed and valid and XML and DHTML document.
4. Examine a server-side java application called Servlet to update and delete operations on DBMS table.

Course Content

1. Create a basic web page to show use of head, title, and body tag.
2. Create a web page to show use heading and text formatting tags.
3. Create a web page to show use img, ul, ol and anchors.
4. Create a web page to show use tables and div tags.
5. Create a web page using class, id and inline styles.
6. Create a web page to create a form.
7. Create a web page to show an alert using java script.
8. Show the use of get Element by Id in java script.
9. Create a web page using variables, loop and Conditions in java script.
10. Create a web page using Switch in java script.
11. Create a web page to show use of j query.
12. Create a web page to implement get & post in Ajax.
13. Create a web page to print your name using PHP.
14. Create a web page to show use of all data types in PHP
15. Create a web page to show use loops &Conditional Statement.
16. Create a web page to show use arrays in PHP.

Course Title: MACHINE LEARNING	L	T	P	Credits
Course Code: BAI5306	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Examine the technology and business trends impacting mobile applications
2. Understand the characterization and architecture of mobile applications.
3. Classify the enterprise scale requirements of mobile applications.
4. Design and develop mobile applications using one application development framework.

Course Content

UNIT I **15 Hours**

Supervised Learning (Regression/Classification) Basic methods: Distance-based methods, Nearest-
Neighbors', Decision Trees. Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear. Models Support Vector Machines, Nonlinearity and Kernel Methods. Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

UNIT II **10 Hours**

Unsupervised Learning Clustering: K-means/Kernel K-means. Dimensionality Reduction: PCA and kernel PCA. Matrix Factorization and Matrix Completion Generative Models (mixture models and latent factor models)

UNIT III **10 Hours**

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, and Random Forests).
Python libraries for machine learning

UNIT IV **10 Hours**

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature
Representation Learning.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012*
- *Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer (2009) (freely available online)*
- *Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.*
- *Tamodt, Agnar, and Enric Plaza. "Case-based reasoning: Foundational issues, methodological variations, and system approaches." AI communications*

WEB Links.

- *https://posit.co/blog/three-ways-to- Python using R-Programming*
- *https://rstudio.github.io/reticulate/ Python using R-Programming*
- *https://www.quora.com/What-are-the-best-sites-to-learn- Python using R-Programming*

Course Title: Soft Computing	**L**	**T**	**P**	**Credits**
Course Code: BAI5308	**4**	**0**	**0**	**4**

Total Hours: 60

Course Learning Outcomes: On successful completion of this course, the students will be able to:

1. Determine Working of a simple Genetic Algorithm and the related definitions: Representation/Encoding Schemes, initializing a GA population
2. Explain evaluation function, genetic operators, study of parameters of genetic algorithms and its performance, sampling and selection mechanisms
3. Genetic Algorithm variations: Scaling fitness, Niching and speciation, Crowding Technique for Multimodal Problems
4. Determine Neural networks: Basic terminology and definitions, Model of an artificial neuron, Sigmoid function, Neural Network Architectures, Characteristics of neural networks, Learning methods, Rosenblatt's Perception
5. Explain Fuzzy sets: Basic terminology and definitions, Operations on Fuzzy sets, MF formulations and parameterization

Course Content

UNIT– I **10Hours**

Working of a simple Genetic Algorithm and the related definitions: Representation/ Encoding Schemes, initializing a GA population, evaluation function, genetic operators, study of parameters of genetic algorithms and its performance, sampling and selection mechanisms, mathematical foundations of genetic algorithms, schemata theorem and building block hypothesis, Optimizing numerical functions using GA.

UNIT– II **10Hours**

Genetic Algorithm Variations: Scaling fitness, Niching and speciation, Crowding Technique for Multimodal Problems, Multi-Objective Genetic Algorithms, Master Slave and Distributed Genetic Algorithms, Designing GAs for numerical optimization, knapsack problem, travelling salesperson and other similar problems.

UNIT– III **10Hours**

Neural Networks: Basic terminology and definitions, Model of an artificial neuron, Sigmoid function, Neural Network Architectures, Characteristics of neural networks, Learning methods, Rosenblatt's Perceptron, Fixed increment perceptron learning algorithm for a classification problem, Examples of learning of AND/OR gate by perception, XOR problem. Back Propagation Neural Networks Architecture of a back propagation network, Model for multi-layer perceptron, Back propagation learning, Delta or gradient descent learning rule and effect of learning rate, Back propagation learning algorithm.

UNIT– IV **10Hours**

Fuzzy Sets: Basic terminology and definitions, Operations on Fuzzy sets, MF formulations and parameterization, Derivatives of parameterized MFs, Fuzzy numbers, Extension principal and fuzzy relations, Linguistic variables, Fuzzy If-Then Rules, Fuzzy reasoning and compositional rule of inference.

Software and Tools to be learnt:MATLAB tool boxes on global optimization, neural networks and fuzzy logic, R Programming, GALIB 247 and KEEL

Course Title: Software Engineering	L	T	P	Credits
Course Code: BAI5309	4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Participation as an individual and as part of a multidisciplinary team to develop and deliver quality software.
2. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle.
3. Examine the format and cost of source code using LOC (line of code).
4. Develop and conduct appropriate experimentation, analyze and interpret data and use Engineering judgment to draw conclusions.

Course Content

UNIT I **15 Hours**

Introduction: The software engineering, Discipline-Evolution and impact, why study software Engineering? Emergence of software Engineering.

Software Life Cycle Models: Why use a lifecycle model? Classical Waterfall Model, RAD Model, Spiral Model V-model, Incremental Model, Agile Model, Iterative Model, Big-Bang Model, Prototype Model & their Comparison.

UNIT II **15 Hours**

Software Project Management: Project Planning, Metrics for Project Size estimation- LOC and Function- Point & Feature Point, Project Estimation Techniques, COCOMO Model, Team Structure, Software Configuration Management.

Requirements Analysis and Specification: Software Requirement Specifications (SRS), Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management

UNIT III **15 Hours**

Software Design: Issues in software Design, Function oriented design, Object oriented Design, Object Modeling Using UML, and User Interface Design.

Coding and Testing: Code review, Verification and validation, Unit testing, Black Box Testing, Integration and System Testing. Verification and validation, Integration testing, Validation testing, alpha and beta testing, System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, process debugging approaches. Software re-engineering: Reverse engineering, restructuring, forward engineering.

UNIT IV **15Hours**

Software Reliability and Quality Assurance: Quality concepts, Software quality assurance: SQA activities; Software reviews; cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting record keeping, review guidelines; Formal approaches to SQA; Software Maintenance: Characteristics of Software maintenance.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Ghezzi C., Jazayeri M. And MandrioliD. (1991). Fundamentals of Software Engineering. Prentice Hall, N. J.*
- *Pfleedger S. L. (1991). Software Engineering: The Production of Quality software. Second Edition, Macmillan Publishing Company.*
- *Oehm B. W. (1998). A Spiral Model of Software Development and Enhancement. IEEE Computer, 21. pp61-72.*
- *Fairley R. (1985). Software Engineering Concepts. McGraw Hill, New York.*

Course Title: Introduction to Quantum Computing	**L**	**T**	**P**	**Credits**
Course Code: BAI5310	**3**	**0**	**0**	**3**

Total Hours: 45

Learning Outcomes: On successful completion of this course, the students will be able to

1. Understand and apply basic mathematical tools used in quantum science.
2. To realize the basics of linear vector spaces.
3. To understand the postulates of quantum mechanics.
4. Describe the basic ideas of statistical physics and information science relevant to
   quantum systems.
5. Understand basic concepts of Information science and Computational complexity
   and their connection to quantum computing.

Course Contents

UNIT I **10 Hours**

Quantum Mechanics

Brief overview of classical physics (This segment is meant for the student to understand what a Hamiltonian is, which will feature later in quantum

mechanics). Hamiltonian formalism: Generalized momenta, Hamiltonian function, Physical significance and the Hamilton's equations of motion, Examples of the simple harmonic oscillator. Principle of least action: derivation of equation of motion, variation and end points. Hamiltonian function and Hamilton's equations. – free particle, particle moving in a conservative potential, hydrogen atom. Historical evolution of quantum mechanics. Planck's quantum hypothesis. Photo electric effect. Atomic spectra Bohr's quantization principle. De Broglie's Wave particle duality.

UNIT II **10 Hours**

Linear Vector spaces : Matrix formalism of quantum mechanics Linear vector spaces - orthogonality and linear independence, bases and dimensions, completeness, Hilbert's spaces. Hermitian operators. Bra and Ket notations for vectors. Representation theory. Schwartz's inequality theorem - proof of Heisenberg uncertainty relation.

UNIT III **10 Hours**

Postulates of Quantum Mechanics: Schrodinger Equation and Time evolution of quantum states. Measurement Postulate. Schrodinger, Heisenberg and Interaction pictures. Eigen values, Expectation values and Matrix elements. Density operator formalism of quantum mechanics – pure and mixed states.
Superposition and Entanglement in quantum mechanics. No cloning theorem. Applications of postulates –Particle in a box, Hydrogen atom, Harmonic Oscillator. Number states, ladder operators and Coherent states of a harmonic oscillator. Spin and Angular momentum – spin half particles. Rabi problem of a spin-half particle in a rotating magnetic field. Bosons and Fermions.

UNIT IV **15 Hours**

Statistical Physics: Quick review of first and second laws of thermodynamics. Thermal Equilibrium and Gibbs principle. Applying Gibbs principle to Classical and Quantum harmonic oscillators. Bosons and Fermions and Quantum statistics – Fermi-Dirac and Bose- Einstein distributions.

Information Science and Brief overview of Computational Complexity : Digital communication and information. Quantifying information in terms of Shannon entropy. Basic ideas of quantum information. Decoherence and noise. Introductory ideas of Kraus operators. Qualitative ideas of a Turing machine. Types of Turing machines. Time and Space complexity – P vs NP, PSPACE. Quantum complexity classes – Q, EQP, BQP, BPP, QMA. Post Quantum Cryptography (PQC).

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Introduction to Quantum Mechanics, Griffiths D. J., 3rd Edition, Cambridge University Press (2024).*
- *Principles of Quantum Mechanics, Shankar, R., 2nd edition, Springer (2014).*
- *Quantum Information Science – Manenti R., Motta M., 1st Edition, Oxford University Press (2023).*

Course Title: Quantum Programming Practical	**L**	**T**	**P**	**Credits**
Course Code: BAI5311	**0**	**0**	**2**	**1**

Total Hours:30

Course Learning Outcome: On successful completion of this course, the students will be able to:

1. Apply the basic principles of python programming.
2. Create applications using python programming
3. Develop looping functions using python programming.
4. Understand the methods to manipulate python programs by utilizing the data structures like lists.
5. Develop and use Web Services using python

Course Content

List of Programs:

1. Creating and Measuring Quantum Superposition States in Qubits.
2. Generating and Measuring Entangled Bell States Using Two Qubits
3. Simulating Classical System Behavior Using Quantum Circuits Based on Feynman's Quantum Simulator Concept
4. Understanding Qubits and Quantum Gates
5. Quantum Circuit with CNOT Gate for Entanglement

6. Simulating a Simple Quantum Algorithm (Shor's Algorithm)

7. Implementing Quantum Error Correction

8. Basic Quantum Magnetometry (Simulating a Magnetic Field Interaction)

9. Ramsey Interferometry: Measuring Quantum Phase Shifts and Coherence in Qubits

Using Rotational Pulses Quantum Key Distribution (QKD) Using BB84 Protocol

List of Experiments – II

1. Diffraction Analysis with Single Slit and Diffraction Grating

2. Characterization of Polarization Optics

3. Resonance in Series and Parallel RLC Circuits

4. Measurement of Intrinsic Losses in RLC Circuits

5. Design and Testing of Basic Digital Circuits

6. Measurement of S-parameters for 2-port and 3-port RF Networks

7. Running Quantum Algorithms on Simulators

Course Title: Computer Graphics	**L**	**T**	**P**	**Credits**
Course Code: BAI5312	**3**	**0**	**0**	**3**

Total Hours: 45

Course Learning Outcomes: On successful completion of this course, the students will be able to**:**

1. Construct the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Implement 2D graphics and algorithms including: line drawing, polygon filling, clipping, and transformations.
3. Solve geometric transformations on graphics objects and their application in composite form.
4. Examine the geometrical transformations and 3D viewing.
5. Outline clipping methods and its transformation to graphics display device.

Course Content

UNIT-I **15Hours**

Introduction: What is Computer Graphics, Elements of a Graphics, Applications and Components, working of Interactive Graphics, Display Processors, Graphic Devices, Raster scan and Random Scan displays, Resolution, Aspect Ratio, Refresh CRT, Color CRT monitors, Lookup tables, Plasma Panel and LCD monitors, interlacing, grey shades?

Interactive Input Devices: keyboard, mouse, trackball, joystick, light pen, digitizing tablet, image scanners, voice system.

Hard Copy Devices: printers, plotters.

UNIT-II **10Hours**

Basic Raster Graphics: Scan conversion &Drawing Geometry: Coordinate Systems; Output Primitives: symmetrical and simple DDA line drawing algorithm, Brenham's line drawing, loading frame buffer; symmetrical DDA for drawing circle, Polynomial method for circle drawing; circle drawing using polar coordinates, Brenham's circle drawing, Filling: Stack-based seed fill algorithm, Scan-line seed fill algorithm.

UNIT-III **10Hours**

Geometric Manipulation: 2D Transformations: Translation, Rotation, Scaling, Matrix representations and Homogeneous coordinate

Transformations Matrices, Homogeneous Co-ordinates. 2-DViewing: Windowing, Viewport. Clipping operations: Point and Line clipping, Cohen-Sutherland line clipping, Mid-point Sub Division line clipping, Sutherland-Hodgeman polygon clipping.

UNIT-IV **10Hours**

Elementary 3-D Graphics: 3-D Graphics, 3-D modeling of objects, 3-D transformation matrices for Translation, Scaling and Rotation, Parallel Projection: Orthographic and Oblique Projection, Perspective projection. Hidden surface removal /Visibility: Image and object precision, Z- buffer algorithms, area based algorithms, floating horizon.

Advanced Issues: Curves and surfaces: Parametric Representation, Bezier and B-Spline curves, Rendering, Raytracing, Antialiasing, fractals, Gourard and Phong shading.

Suggested Readings

1. D.Rogers and J. Adams.(1976). *Mathematical Elements for Computer Graphics*.McGraw -Hill International Edition.
2. David F. Rogers.(1997). *Procedural Elements for Computer Graphics*. McGraw Hill Book Company.
3. Newmann& Sproul.(1979). *Principles of Interactive Computer Graphics*.McGraw Hill International Edition.

Course Title: Computer Graphics Lab	**L**	**T**	**P**	**Credits**
Course Code: BAI5313	**2**	**0**	**0**	**2**

Total Hours:30

Course Learning Outcome: On successful completion of this course, the students will be able to:

1. Examine the basic concepts of computer graphics.

2. Design scans conversion problems using C++ programming.
3. Explain clipping and filling techniques for modifying an object.
4. Identify the concepts of different type of geometric transformation of objects in 2D and 3D.
5. To understand the practical implementation of modeling, rendering, viewing of objects in 2D.

Course Content

List of Experiments:

Task 1: WAP to draw different geometric structures using different functions.

Task 2: Implement DDA line generating algorithm.

Task 3: Implement Bresenham's line generating algorithm.

Task 4: Implement Mid-point circle line generating algorithm.

Task 5: Implementation of Bresenham's circle drawing algorithm.

Task 6: Implementation of mid-point circle generating Algorithm.

Task 7: Implementation of ellipse generating Algorithm.

Task 8: WAP of color filling the polygon using Boundary fill and Flood fill algorithm.

Task 9: To translate an object with translation parameters in X and Y directions.

Task 10: To scale an object with scaling factors along X and Y directions.

Task 11: Program of line clipping using Cohen-Sutherland algorithm.

Task 12: To perform composite transformations of an object.

Task 13: To perform the reflection of an object about major.

SEMESTER-VI

Course Title: Formal Language & Automata Theory	L	T	P	Credits
Course Code: BAI6350	4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Write a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Formulate the context free grammars to generate strings of context free language.
4. Determine equivalence of languages accepted by Push Down Automata and languages

Course Content

Unit-I **15 Hours**

Theory of Computation: Deterministic Finite Automata, Acceptance by Finite Automata, Transition systems, Non-Deterministic Finite Automata, Equivalence of DFA and NDFA, Moore and Mealy machines, Equivalence of Moore and Mealy machine, Minimization of Finite Automata, Applications and limitations of Finite Automata.

Formal Languages: Basics of strings, alphabets, grammar, formal language, Chomsky classification of languages, languages and their relation, operations on languages, Closure properties of language classes.

Unit-II **12 Hours**

Regular grammar: Regular grammars, Regular expressions, Algebraic method using Arden's theorem, Equivalence of Finite Automata and Regular expressions, Properties of regular languages, pumping lemma.

Unit-III **18 Hours**

Context Free Language: Derivation, ambiguity, simplification of context free grammar, normal forms- Chomsky Normal Form, Greibach Normal Form, pumping lemma. Context Sensitive Language, The model of Linear Bounded Automata, Relation between Linear Bounded Automata and Context Sensitive Language

Unit-IV **15 Hours**

Push down Automata: Description and Definition, acceptance by Push Down Automata, Equivalence of Push Down Automata and context free grammars and languages.

Turing Machine: Definition and Model, Representation of Turing Machine, Design of Turing Machine, Variants of Turing Machine, Decidability and Recursively Enumerable Languages, Halting Problem, Post Correspondence Problem.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Harry R. Lewis and Christos H. Papadimitriou. (1998). Elements of the Theory of Computation.*
- *Pearson Education Asia.*
- *Dexter C. Kozen. (1997). Automata and Computability. Undergraduate Texts in Computer*
- *Science, Springer.*
- *Michael Sipser. (1997). Introduction to the Theory of Computation.PWS Publishing.*
- *John Martin. (2007). Introduction to Languages and The Theory of Computation. Tata McGrawHill.*
- *Hopcroft J.E., Ullman J.D. (2006). Introduction to Automata Theory, Languages, and Computation (3rd Edn). Reading, MA: Addison-Wesley.*
- *Lewis F.D. (2007). Essentials of Theoretical Computer Science.*

Web Links

- *https://stackoverflow.com/questions/17252374/what-are-the-best-sites-to-learn-about- Formal Language & Automata Theory*
- *https://www.udemy.com/course/formal-languages-and-automata-theory-e/- Formal Language & Automata Theory*
- *https://eecs.wsu.edu/~ananth/CptS317- Formal Language & Automata Theory*

Course Title: Deep Learning	L	T	P	Credits
Course Code: BAI6351	4	0	0	4

Total Hours: 60

Learning Outcomes:

After completion of this course, the learner will be able to:

1. Understand the methods and terminologies involved in deep neural network,
differentiate the learning methods used in Deep-nets.
2. Identify and apply suitable deep learning approaches for given application.
3. Design and develop custom Deep-nets for human intuitive applications
4. Design of test procedures to assess the efficiency of the developed model.

Course Content

UNIT I **15 Hours**

Introduction

History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation

UNIT II **15 Hours**

Activation functions and parameters , Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parameters v/s Hyper-parameters

UNIT III **15 Hours**

Auto-encoders & Regularization Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization

UNIT IV **15 Hours**

Deep Learning Models

Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Introduction to RNNs, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs

Deep Learning Applications

Image Processing, Natural Language Processing, Speech recognition, Video Analytics

Course Title: Computer Networks	L	T	P	Credits
Course Code: BAI6352	4	0	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the fundamentals of computer networking.
2. Learn the basic terminology of the computer networking area.
3. Analysis the various congestion control algorithms.
4. Describe the functions of the different layer of the OSI Protocol.

Course Content

Unit-I **15 Hours**

Data Communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN.

Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit-II **15 Hours**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CDCDMA/CA

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Unit-III **15 Hours**

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit-IV **15 Hours**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, and Basic concepts of Cryptography.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Andrew S. Tanenbaum, Pearson New International Edition. (2013). Computer Networks. 8th Edition.*
- *Prentice Hall of India. (2015). Internetworking with TCP/IP Volume 1. 6th Edition Douglas Comer.*
- *W. Richard Stevens, Addison-Wesley, Unit--ed States of America. (2005). TCP/I Illustrated. Volume1.*
- *Kurose, J.F. and K.W. Ross (2003) Computer Networking: A Top Down Approach Featuring the Internet, Addison Wesley.*
- *Mir, N.F. (2006) Computer and Communication Networks, Prentice Hall.*

Course Title: Design & Development of Applications	L	T	P	Credits
Course Code: BAI6353	3	0	0	3

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design and develop user Interfaces for the Android platform.
2. Demonstrate knowledge of mobile ecosystem technologies
3. Evaluate existing mobile ecosystem solutions for real-world business problems.
4. Understand the concept of security, privacy and ethical issues associated with mobile ecosystems.

Course Content

Unit-I **15 Hours**

Introduction: Mobile operating system, operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features.

Unit-II **15 Hours**

Introduction to Mobile development IDE's: Introduction to Work light basics, Optimization, pages and fragments, writing a basic program- in Work Light Studio, Client technologies, Client-side debugging, creating adapters, invoking adapters from Work Light Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova, Offline access, Encrypted cache deprecated, Using JSON Store

Unit-III **15 Hours**

Understanding Apple iOS development: Android development, Shell Development, Creating Java ME application, Exploring the Work light Server, working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization, Web View overlay, Creating Authentication application: development for Apple iOS by using a login module, Device Analytics, Work light Server Administration

Unit-IV **15 Hours**

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment. Case Study: Design and development of Application using mobile application development platforms e.g., Work Light, Kendo, Appcon, Xcode, Xpages Unit-- VI: iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment. Case Study: Design

and development of Application using mobile application development platforms e.g., Work Light, Kendo, Appcon, Xcode, Xpages

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *AnubhavPradhan, Anil V Deshpande. (2014). Mobile Apps Development. Edition: I*
- *Jeff McWherter, Scott Gowell. (2012). Professional Mobile Application Development.John Wiley & Sons.*
- *Barry Burd. (2015). Android Application Development All in one for Dummies. Edition: I*
- *SAMS. (2010). Teach Yourself Android Application Development In 24 Hour. Edition: I, Publication.*
- *Neal Goldstein, Tony Bove. (2011). iPhone Application Development All-In-One forDummies. John Wiley & Sons.*
- *Henry Lee, Eugene Chuvyrov. (2012). Beginning Windows Phone App Development.Apress.*

Course Title: Design & Development of Applications Lab	L	T	P	Credits
Course Code: BAI6354	**2**	**0**	**0**	**2**

Total Hours:30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Design and develop user Interfaces for the Android platform.
2. Demonstrate knowledge of mobile ecosystem technologies.
3. Evaluate existing mobile ecosystem solutions for real-world business problems.
4. Understand the concept of security, privacy and ethical issues associated with mobile ecosystems.

Course Content

List of Experiments:

1. Write a Kotlin program that defines a class HelloWorld with a constructor that takes a String parameter name1 and a method word() that prints "name: [name1]" to the console.
2. Write a Kotlin program that demonstrates the declaration and initialization of various variable types, including String, Byte, Short, Int, Long, Float, Double, Char, and Boolean. The program should also print the values of these variables to the console.
3. Write a Kotlin program that demonstrates the use of integer variables and their assignment.
4. Write a simple Kotlin program that accepts the user's name as input and prints it to the console.
5. Write a Kotlin program that demonstrates different ways to iterate through ranges using for loops. The program should use various range operations such as .., step, and downTo.
6. Develop an Android application that uses a ConstraintLayout containing a TextView and an EditText.

7. Develop an Android application that uses a RelativeLayout containing a Button and an ImageButton.
8. Develop an Android application that uses a LinearLayout containing a DatePicker and a TimePicker.
9. Develop an Android application that uses a RelativeLayout containing RadioButton and CheckBox controls.
10. Develop an Android application that stores and retrieves data using SharedPreferences.
11. Develop an Android application that stores and retrieves data using an SQLite database.
12. Develop an Android application that performs insert, update, delete, and retrieve (CRUD) operations using an SQLite database.

Course Title: Quantum Communication and Cryptography	**L**	**T**	**P**	**Credits**
Course Code: BAI6355	**4**	**0**	**0**	**4**

Total Hours:60

Learning Outcomes

1. Understand the fundamental principles of the course area.
2. Explain theoretical foundations and related models.
3. Analyze and implement algorithms or techniques related to the subject.
4. Use appropriate software tools or frameworks where applicable.

Course Content

UNIT – I **15 Hours**

Basics of quantum communication, Evolution from classical to quantum communication, Principles and applications of quantum communication.

Quantum states transmission, Quantum channels, Noise in quantum communication, Preparation and encoding of quantum states, Quantum state evolution, Transmission over optical fiber and free-space channels.

UNIT – II **15 Hours**

Quantum teleportation - Principle of quantum teleportation, Teleportation protocol, Bell-state measurement.

Superdense coding- Encoding and decoding procedures.

Quantum repeaters- Long-distance quantum communication, Entanglement swapping, Entanglement purification.

UNIT – III **15 Hours**

Quantum key distribution fundamentals- Principles of QKD, Security based on quantum mechanics. BB84 protocol- Protocol architecture, Polarization encoding, Key generation steps.

B92 protocol- Working principle, Two-state quantum communication.

E91 protocol- Entanglement-based QKD, Bell's inequality, Security using entangled particles

UNIT – IV **15 Hours**

Eavesdropping strategies, Security proofs for QKD, Information-theoretic security, Unconditional security, Quantum cryptographic protocols, Post-quantum cryptography overview, Impact of quantum computers on classical cryptography, Lattice-based cryptography, Hash-based signatures, Future quantum communication networks.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press.
- Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press.
- Jack D. Hidary, Quantum Computing: An Applied Approach, Springer.
- N. David Mermin, Quantum Computer Science: An Introduction, Cambridge University Press.

Course Title: Internet of Things	**L**	**T**	**P**	**Credits**

Course Code: BAI6356	4	0	0	4

Total Hours: 60

Course Outcome: On successful completion of this course, students will be able to:

13. Understand the application areas of IOT.
14. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
15. Building blocks of Internet of Things and characteristics.
16. Use IOT in real world applications.

Course Content

UNIT-1 **15 Hours**

Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels.

UNIT-II **15 Hours**

Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

UNIT-III **15 Hours**

M2M & System Management with NETCONF-YANG: M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG.

UNIT-IV **15 Hours**

Developing Internet of Things & Logical Design using Python: Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data

Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages.

IOT Physical Devices &Endpoints: Introduction to IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, and Programming & IOT Devices.

Suggested Readings

1. Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On-Approach",2014, ISBN:978 0996025515
2. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0
3. Daniel Kellmereit, "The Silent Intelligence: The Internet of Things". 2013, ISBN 0989973700
4. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014. 2. Marco Schwartz, "Internet of Things with the Arduino Yun", Pack Publishing, 2014.

Course Title: DIGITAL FORENSICS	**L**	**T**	**P**	**Credits**
Course Code: BAI6357	**4**	**0**	**0**	**4**

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Determine the hardware and operating system requirements for digital forensics
2. Compare and Analysis of digital forensics by organization of data and metadata in computer systems.
3. Analyze file recovery and hidden file extraction techniques and Integrate security of computer systems with digital forensics and evaluate its performance.
4. Identify various types of forensics in the arena of information technology and Critic the computer crimes by studying the security Laws and legal Landscape around the world.

Course Content

UNIT I **15 Hours**

Introduction to Digital Forensics: digital crimes, digital investigation, evidence, extraction, preservation etc.; overview of hardware and operating systems: structure of storage media/devices, Windows/Macintosh/Linux registry, boot process; disk and file system analysis, data acquisition of physical storage devices

UNIT II **15 Hours**

Data recovery: identifying hidden data, recovering deleted files; digital evidence controls: uncovering attacks that evade detection by event viewer, task manager and other windows GUI tools; disk imaging, recovering swap files, temporary and cache files; automating analysis and extending capabilities.

UNIT III **15 Hours**

Network Forensics: collecting and analyzing network-based evidence, reconstructing web browsing, email activity, intrusion detection, tracking offenders, windows registry changes, etc.; Mobile Network forensics: introduction, investigations, collecting evidences, where to seek digital data for further investigations; Email and database forensics; memory acquisition

UNIT IV

15 Hours

Computer crime and legal issues: intellectual property, privacy issues, criminal justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation and deposition of legal evidence in a court of law.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Thomas J Holt, Adam M Bossler, Kathryn C Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge, 2015.*
- *Cory Altheide and Harlan Carvey, Digital Forensics with Open-Source Tools, Elsevier publication, April 2011.*
- *B. Nelson, A. Phillips, F. Enfinger, C. Steuart, Guide to Computer Forensics and Investigations 4 th edition, Thomson, 2009.*
- *Campbell, A. (2011) Report of the Fingerprint Inquiry Scotland*
- *Miller, C. G. (2013) 'Fingerprint identification not infallible, nor scientific & based on fraud', cliffordmiller law,*

Web lINKS

- *https://nij.ojp.gov/digital-evidence-and-forensics- Digital Forensics*
- *https://dl.acm.org/doi/fullHtml/10.1145/3503047.3503082- Digital Forensics*

Course Title: Foundation Of Block Chain Architecture Design	L	T	P	Credits
Course Code: BAI6358	**4**	**0**	**0**	**4**

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the basic concepts and technology used for block chain
2. Describe the primitives of the distributed computing and cryptography related to block chain.
3. Apply security features in block chain technologies.
4. Use smart contract in real world applications.

Course Content

UNIT1 **15 Hours**

Introduction to Block chain: Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, And Privacy. Block chain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hash chain to Block chain, Basic consensus mechanisms

UNIT II **15 Hours**

Consensus: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Block chain consensus protocols Permissioned Block Chain Design goals, Consensus protocols for Permissioned Block chain.

UNIT III **15 Hours**

Hyper ledger Fabric (A): Decomposing the consensus process, Hyper ledger fabric components, Chain code Design and Implementation

Hyper ledger Fabric (B): Beyond Chain code: fabric SDK and Front End (b) Hyper ledger composer tool

UNIT IV **15 Hours**

Use case 1: Block chain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance

Use case 2: Block chain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc 08 V

Use case 3: Block chain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Block Chain Cryptography, Privacy and Security on Block chain.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Narayanan, Bonneau, Felten, Miller and Goldfeder, "Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction", Princeton University Press (2016).*
- *Josh Thompson, 'Block chain: The Block chain for Beginnings, Guild to Block Chain Technology and Block Chain Programming', Create Space Independent Publishing Platform, 2017.*
- *Imran Bashir, "Mastering Block chain: Distributed ledger technology, decentralization, and smart contracts explained", Packt Publishing, 2017.*
- *Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Block Chain Applications Using Ethereum-supported Tools, Services, and Protocols", Packet Publishing, 2018.*

SEMESTER-VII

Course Title: INTRODUCTION TO CLOUD COMPUTING	L	T	P	Credits
Course Code: BAI7400	4	0	0	4

Total Hours-60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the application of cloud, Reference Model, Benefits, Limitations, Open Challenges, Grid and Utility Computing.
2. Demonstrate Service Models, Deployment Models, Cloud Entities, Cloud Clients, and Cloud Programming Models.
3. Describe Cloud Security: Infrastructure Security, Data Security, Identity and Access Management, Privacy Management, Security as a Service on Cloud
4. Acquire the knowledge the Resource Provisioning, Bill Management, Multitenancy and Isolation, Service Level Agreement (SLA) and Quality of Service (QoS)

Course Content

UNIT I **15 Hours**

Cloud Computing: Overview, Applications, Intranet and the Cloud, First Movers on the cloud, the need for Cloud Computing, Benefits of cloud Computing, Limitations of the

Cloud Computing, security concerns and regulatory issues, over view of different cloud computing applications which are implemented, Business case for implementing a Cloud.

UNIT II **15 Hours**

Cloud computing and Service Models: Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies

Service models: Infrastructure-as- a- Service (IaaS), Platform-as-a- service (Paas) and Software-as-a-Service (SaaS)

Architectural Design of Compute and Storage Clouds: A Generic Cloud Architecture Design, Layered Cloud Architectural development, Architectural Design Challenges. Cloud Standards: Applications, Client, Infrastructure, Services.

UNIT III **15 Hours**

Cloud Computing Mechanisms: Software as a service: Overview, Driving Forces, Company offerings, Industries, Software services, Overview Mobile Device Integration, Providers, Microsoft Online Application development, Google, Microsoft, Intuit Quick base, Cast Iron Cloud, Bungee Connect, Development Platforms: Google, Sales Force, Azure, Trouble shooting, Application management

UNIT IV **15 Hours**

Local Clouds: Virtualization, server solutions, Thin Clients

Migrating to the clouds: Cloud services for individuals, Mid-market, and Enterprise wide, Migration, best practices, analysing the service.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Mastering Cloud Computing, RajkumarBuyya, Christian Vecchiola, and ThamaraiSelvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India,Feb 2013.*
- *Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-2980-3, New Delhi, India, 2011.*
- *Cloud Computing: Principles and paradigms, Raj Kumar Buyya, James Broberg, AndrezeiM.Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6, New Delhi, India, 2011.*
- *Dr. Saurabh Kumar, Cloud Computing: Insights into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.*

Course Title: NATURAL LANGUAGE PROCESSING	L	T	P	Credits
Course Code: BAI7401	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Grasp the significance of Natural Language Processing (NLP) in solving real-world problems.
2. Preprocess and analyze text using mathematical techniques.
3. Apply machine learning techniques used in NLP, such as HMM and RNN.
4. Understand approaches to syntax and semantics analysis in NLP.

Course Content

UNIT I **10 Hours**

Introduction and Basic Text Processing: Knowledge in Speech and Language Processing, The problem of Ambiguity, Typical NLP Tasks, Tokenization, Stemming, Lemmatization, Stop-word removal, Regular Expressions, Text Normalization, and Edit Distance.

UNIT II **15 Hours**

Language Modeling and Sequence Labeling: Unigrams, Bigrams, Trigrams, N-grams, N-gram Language Models, Smoothing and Entropy, Part-of-Speech Tagging, Named Entities and Named Entity Tagging/Recognition, Hidden Markov Model (Forward and Viterbi algorithms), and EM training.

UNIT III **10 Hours**

Vector Semantics, Embeddings and Applications of Text Mining: Lexical Semantics, Vector Semantics, Words and Vectors, TF-IDF: Weighting terms in the vector and its applications, Learning Word Embeddings – Word2Vec and Gensim, Vector Space Models, Text classification, and Sentiment Analysis.

UNIT IV **10 Hours**

Deep Learning Models for NLP: Feedforward Neural Networks, Recurrent Neural Networks, LSTM, Transformer Models, and Applications of Deep Learning in Natural Language Processing.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

- *Allen,James, "Natural Language Understanding", Second Edition, Benjamin/ Cum-ming, 1995.*
- *Jurafsky, Danand Martin, James," Speech and Language Processing", Second Edition, Prentice Hall,2008*

- *Ela Kumar, "Natural Language Processing", IK international Publication, second edition 2014*

Course Title: NATURAL LANGUAGE PROCESSING LAB	**L**	**T**	**P**	**Credits**
Course Code: BAI7402	**2**	**0**	**0**	**2**

Total Hours:30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Grasp the significance of Natural Language Processing (NLP) in solving real-world problems.
2. Preprocess and analyze text using mathematical techniques.
3. Apply machine learning techniques used in NLP, such as HMM and RNN.
4. Understand approaches to syntax and semantics analysis in NLP.

Course Content

List of Experiments:

Python packages such as Scikit-learn (SKLearn), NLTK, spaCy, Gensim, PyTorch, and Transformers (Hugging Face) may be used for programming.

1. Prepare/pre-process a text corpus to make it more suitable for NLP tasks using tokenization, stop-word removal, punctuation removal, stemming, and lemmatization.
2. List the most common words (along with their frequencies) in a given text, excluding stop words.
3. Extract usernames from the email addresses present in a given text.
4. Perform Part-of-Speech (POS) tagging on a given text file. Extract all nouns present in the text. Create and print a dictionary showing the frequency of each part of speech in the document. Find the similarity between any two text documents.
5. Perform dependency parsing on a text file and print the root word of every sentence.
6. Create a TF-IDF (Term Frequency–Inverse Document Frequency) matrix for a given set of text documents.
7. Extract all bigrams and trigrams using the NLTK library.
8. Identify and print the named entities using Named Entity Recognition (NER) for a collection of news headlines.

9. Find the latent topics in a document using LDA (Latent Dirichlet Allocation) and display the top five terms that contribute to each topic along with their strengths. Also visualize the distribution of term contributions to the topics.
10. Classify IMDB movie reviews as positive or negative using the IMDB dataset containing 50,000 movie reviews. Dataset: https://www.kaggle.com/datasets/lakshmi25npathi/imdb-dataset-of-50k-movie-reviews
11. Build and train a text classifier for the given dataset using TextBlob or the Simple Transformers library.
12. Generate text using a character-based RNN with an appropriate dataset. Given a sequence of characters from a dataset (e.g., Shakespeare), train a model to predict the next character in the sequence (e.g., predicting "e").

Course Title: Big Data	L	T	P	Credits
Course Code: BAI7403	4	0	0	4

Total Hours: 60

Course Learning Outcome Outcomes: On successful completion of this course, the students will be able to:

1. Develop a dynamic webpage by using java script.
2. Connect a java program to a DBMS.
3. Design a well formed and valid XML and DHTML document.
4. Write a server side java application called Servlet to update and delete operations on DBMS table.
5. Design a page for internal links; when the user clicks on different links on the web page it should go to the appropriate locations/sections in the same page.

Course Content

UNIT-I **15 Hours**

Introduction to Big Data: Overview of Big Data, Stages of analytical evolution, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs. Reporting, Modern Data Analytic Tools, Statistical Concepts: Sampling Distributions - Re-Sampling, Statistical Inference - Prediction Error

UNIT-II **15 Hours**

Mining Data Streams: Introduction To Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform(RTAP) Applications

UNIT-III **15 Hours**

Hadoop: History of Hadoop, The Hadoop Distributed File System, Components of Hadoop, Analyzing the Data with Hadoop, Scaling Out- Hadoop Streaming, Design of HDFS-Java interfaces to HDFSBasics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run-Failures, Job Scheduling-Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features

UNIT-IV **15 Hours**

Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig Hive services, HiveQL, Querying Data in Hive, Fundamentals of

HBase and Zookeeper, Visualizations: Visual data analysis techniques, interaction techniques. Systems and applications

Suggested Readings

1. Michael Berthold, David J. Hand.(2007*). Intelligent Data Analysis. Springer.*
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos.(2012).*Understanding Big Data: Analytics for Enterprise ClassHadoop and* Tom White, Hadoop.(2012). *The Definitive Guide Third Edition. O'reillyMedia*.
3. AnandRajaraman and Jeffrey David Ullman.(2012). *Mining of Massive Datasets.* Cambridge UniversityPress.
4. Bill Franks. (2012*). Taming the Big Data Tidal Wave: Finding Opportunitiesin Huge Data Streams with Advanced B Analytics.* JohnWiley&sons.

Course Title: Introduction to Robotics	**L**	**T**	**P**	**Credits**
Course Code: BAI7404	**4**	**0**	**0**	**4**

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Use latest multimedia devices and programming software.
2. Design and construct a hardware and software system, component or process to meet desired needs.
3. Classify the multidisciplinary Problems of project.
4. Work as professionals, with portfolio ranging from data management, network configuration, designing hardware, database and software design to management and administration of entire systems.

Course Content

Unit-I **17 Hours**

Introduction: Introduction to Robotics Fundamentals of Robotics, Robot Kinematics: Position Analysis, Dynamic Analysis and Forces, Robot Programming languages & systems: Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

Unit-II **16 Hours**

Need of AI in Robotics: History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents.

Game Playing: AI and game playing, plausible move generator, static evaluation move generator, game playing strategies, problems in game playing.

Unit-III **10 Hours**

Robotics fundamentals: Robot Classification, Robot Specification, notation, kinematic representations and transformations, dynamics techniques; trajectory planning and control.

Unit-IV **17 Hours**

Robotics and Its applications: DDD concept, Intelligent robots, Robot Anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple Problems-Specifications of Robot-Speed of Robot, Robot joints and Links-Robot Classifications Architecture of robotic Systems-Robot Drive Systems-Hydraulic, Pneumatic and Electric system

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Peter Corke,*
- *Springer, 2011.*
- *Robotics: Everything You Need to Know About Robotics from Beginner to Expert, Peter*
- *McKinnon, Createspace Independent Publishing Platform, 2016.*
- *Introduction to AI Robotics, Second Edition, By Robin R. Murphy, MIT press, 2001.*
- *Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using*
- *AI techniques, Francis X. Govers, Packt Publishers, 2018.*

Course Title: PROJECT (Experimental Learning)	L	T	P	Credits
Course Code: BAI7405	0	0	8	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learner will be able to:

1. Use latest multimedia devices and programming software.
2. Design and construct a hardware and software system, component or process to meet desired needs.
3. Understand the multidisciplinary applications Problems.
4. Examine work as professionals, with portfolio ranging from data management, network configuration, designing hardware, database and software design to management and administration of entire systems.

Course Content

1. Project should include following phases: System Analysis and Design
2. Coding - Implementation Testing
3. It should be a working project Must have a future perspective
4. The Domain of project can be from: Databases
5. Application software
6. System software
7. Multimedia
8. Web Applications, etc.

A complete project report must be submitted along with softcopy of project. Project report may include Requirements of Project, Flow Chart, DFD's, Coding and Test Results

Course Title: Quantum Computing Applications and Project	L	T	P	Credits
Course Code: BAI7406	3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learner will be able to:

1. Understand the fundamental principles of the course area.

2. Explain theoretical foundations and related models.

3. Analyze and implement algorithms or techniques related to the subject.

4. Use appropriate software tools or frameworks where applicable.

Course Content

UNIT – I **10 Hours**

Applications in optimization- Classical optimization problems Types of optimization (Linear, Nonlinear, Integer), Combinatorial optimization problems- Traveling Salesman Problem (TSP), Knapsack Problem, Graph coloring, Maximum Cut (Max-Cut), Quantum annealing overview- Principles of quantum annealing, Adiabatic quantum computation

UNIT – II **15 Hours**

Quantum chemistry simulations- Introduction to Quantum Chemistry, Simulation of molecular systems, Born–Oppenheimer approximation, Basis sets and molecular orbitals, Molecular energy calculations- Ground-state energy estimation, Excited-state calculations, Variational Quantum Eigensolver applications- Working principle of VQE, Parameterized quantum circuits, Applications of VQE

UNIT – III **10 Hours**

Quantum machine learning- Classical vs Quantum Machine Learning, Quantum data representation, Quantum advantage in ML, Quantum feature spaces- Quantum feature maps, Kernel methods, High-dimensional embeddings, Feature transformation, Variational quantum classifiers- Architecture of VQC, Parameterized quantum circuits, Training process

UNIT – IV **10 Hours**

Quantum sensing and metrology- Introduction to Quantum Sensing, Quantum Sensors, Quantum Imaging, Precision measurement concepts, Standard quantum limit, Precision measurements- Medical imaging, Navigation systems, GPS improvement, Mini project work, ,Problem formulation, Quantum algorithm implementation, Project presentation and evaluation

Suggested Readings:

- Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information,Cambridge University Press.
- Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press.
- Jack D. Hidary, Quantum Computing: An Applied Approach, Springer.
- N. David Mermin, Quantum Computer Science: An Introduction, Cambridge University Press.

Course Title: Quantum Simulation Practical	**L**	**T**	**P**	**Credits**
Course Code: BAI7407	**0**	**0**	**2**	**1**

Total Hours:30

Learning Outcomes:

1. Understand the fundamental principles of the course area.

2. Explain theoretical foundations and related models.

3. Analyze and implement algorithms or techniques related to the subject.

4. Use appropriate software tools or frameworks where applicable.

List of Experiments:

1. Introduction to Qiskit environment
2. Installing and configuring Qiskit
3. Creating simple quantum circuits
4. Single qubit gate implementation
5. Multi-qubit circuits
6. Measurement operations
7. Simulation of quantum circuits and Statevector simulator
8. Quantum assembly language basics
9. Implementation of Deutsch algorithm and Implementation of Grover search algorithm
10. Visualization of results
11. Running circuits on IBM Quantum hardware
12. Noise analysis
13. Report preparation and experiment documentation

Course Title: Computer Vision	**L**	**T**	**P**	**Credits**
Course Code: BAI7408	**3**	**0**	**0**	**3**

Total Hours: 45

COURSE OBJECTIVES

1. To introduce various components of image processing techniques for computer vision.

2. To understand filters and computing Image Gradient.

3. To understand segmentation, model fitting and tracking

4. To impart knowledge about object registration and object matching

Course Content

UNIT-I **10 Hours**

IMAGE FORMATION: Geometric Camera Models, Intrinsic and Extrinsic Parameters, Geometric Camera Calibration – Linear and Non – linear approach, Light and Shading - Inference from, Modeling, Inter reflection, Human Color Perception.

UNIT-II **10 Hours**

EARLY VISION: Linear Filters - Convolution, Fourier Transforms, Sampling and Aliasing, Filters as Templates, Correlation, Local Image Features - Computing the Image Gradient, Gradient Based Edge Detectors, Orientations, Texture - Local Texture Representations Using Filters, Shape from Texture.

UNIT-III **10 Hours**

MID-LEVEL VISION: Segmentation by Clustering - Basic Clustering Methods, The Watershed Algorithm, Segmentation Using K-means, Grouping and Model Fitting - Fitting Lines with the Hough Transform, Fitting Curved Structures, Tracking - Tracking by Detection, Tracking Translations by Matching, Tracking Linear Dynamical Models with Kalman Filters.

UNIT-IV **15 Hours**

HIGH-LEVEL VISION: Registration, Registering Rigid and Deformable Objects, Smooth Surfaces and Their Outlines - Contour Geometry, Koenderink's Theorem, The Bitangent Ray Manifold, Object Matching using Interpretation Trees and Spin Images, Classification, Error, and Loss.

OBJECT DETECTION AND RECOGNITION: Detecting Objects in Images - The Sliding Window Method, Face Detection, Detecting Humans, Boundaries and Deformable Objects, Object Recognition– Categorization, Selection, Applications – Tracking People, Activity Recognition.

Transaction Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- Forsyth, Jean Ponce David A. "Computer Vision: A Modern Approach", Second Edition,Pearson Education Limited 2015.
- Szeliski, Richard, "Computer vision: algorithms and applications", Springer Science & Business Media, 2010.
- Hau, Chen Chi, "Handbook of pattern recognition and computer vision", World Scientific, Fifth Edition, 2015.

- Muhammad Sarfraz, “Computer Vision and Image Processing in Intelligent Systems and

Course Title: Computer Vision Lab	**L**	**T**	**P**	**Credits**
Course Code: BAI7409	**0**	**0**	**2**	**2**

Total Hours: 30

Learning Outcomes: After completion of this course, the learner will be able to:

1. Implement image formation and camera modeling techniques for acquiring and understanding digital images.
2. Apply filtering, edge detection, gradient computation, and texture analysis techniques for image feature extraction.
3. Develop segmentation, model fitting, and object tracking algorithms using classical computer vision techniques
4. Implement object registration, object matching, object detection, and recognition techniques for real-world computer vision applications

Course Content

List of Experiments:

1. Study of Image Acquisition, Color Spaces, and Camera Geometry
2. Camera Calibration using Checkerboard Images
3. Image Enhancement using Convolution and Spatial Filters
4. Fourier Transform, Frequency Domain Filtering, Sampling and Aliasing
5. Image Gradient and Edge Detection using Sobel, Prewitt, Laplacian and Canny Operators
6. Texture Analysis using Gabor Filters and Local Binary Pattern (LBP)
7. Image Segmentation using K-Means Clustering and Watershed Algorithm
8. Line Detection using Hough Transform
9. Object Tracking using Template Matching and Kalman Filter
10. Image Registration using Feature Matching (SIFT/ORB)
11. Face Detection and Human Detection using Haar Cascade and HOG Detector
12. Object Recognition using Classical Features and Machine Learning (SVM/KNN)

SEMESTER-VIII

Course Title: INTERNSHIP	**L**	**T**	**P**	**Credits**
Course Code: BAI8450	**0**	**0**	**0**	**20**

Learning Outcomes: After completion of this course, the learner will be able to:

1. The capability to create, analyze and critically evaluate different technical/architectural solutions.
2. A consciousness of the ethical aspects of research and development work.
3. The capability to create, analyze and critically evaluate different technical/architectural solutions.
4. The capability to critically and systematically integrate knowledge.

Course Content

The industrial training will normally contain:

- An account of the process of obtaining the data required for the industrial training projects and the results obtained; relationship to other research, and any methodological or theoretical implications;
- The relationship of the findings to existing professional understanding and, where
- Appropriate, potential implementation difficulties.
- It is not intended to restrict students to a precisely defined format for the dissertation but it
- Should follow the standard practices of dissertation writing. Although a written report will
- Normally be expected, it should be accompanied by soft copy on CD.