

# **GURU KASHI UNIVERSITY**



**B. Tech CSE – Artificial Intelligence & Machine Learning (AIML)**

**Session: 2024-25**

**Department of Computer Science & Engineering**

## **GRADUATE OUTCOME OF THE PROGRAMME**

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.

## **PROGRAMME LEARNING OUTCOMES**

After completing the programme, the learner will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate and analysis complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. 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.
5. 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.
6. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
7. 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.
8. 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 Structure**

<b>Semester: I</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
BAI101	Basic Electrical Engineering	Engineering Sciences Course	3	1	0	4
BAI102	Engineering Physics	Basic Science Course	3	1	0	4
BAI103	Engineering Mathematics-I	Basic Science Course	3	1	0	4
BAI104	Engineering Graphics & Drawing	Engineering Sciences Course(Theory)	1	0	4	3
BAI105	Engineering Physics Lab	Basic Science Course	0	0	2	1
BAI106	Basic Electrical Engineering Lab	Engineering Sciences Course	0	0	2	1
BAI107	Fundamental of Computer and Information Technology Lab	Engineering Sciences Course	0	0	2	1
BAI108	Basic of Domestic Appliances	Engineering Sciences Course	2	0	0	2
BAI109	Basic of Domestic Appliances lab	Engineering Sciences Course	0	0	2	1
<b>Total</b>			<b>12</b>	<b>3</b>	<b>12</b>	<b>21</b>

<b>Semester: II</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
BAI201	Engineering Chemistry	Basic Science Course	3	0	0	3
BAI202	Engineering Mathematics-II	Basic Science Course	3	1	0	4
BAI203	Programming for Problem Solving	Engineering Sciences Course	3	0	0	3
BAI204	Communication Skills	Basic Science Course	3	0	0	3
BAI205	Manufacturing Practices	Engineering Sciences Course(Practical)	1	0	4	3
BAI206	Engineering Chemistry Lab	Basic Science Course	0	0	2	1
BAI207	Programming for Problem Solving Lab	Engineering Sciences Course	0	0	2	1
BAI208	Communication Skills Lab	Basic Science Course	0	0	2	1
BAI209	Indian Constitution	VAC	2	0	0	NC
<b>Total</b>			<b>15</b>	<b>1</b>	<b>10</b>	<b>19</b>

**Note: Noncredit(NC) course will be evaluated as per satisfactory/ unsatisfactory remarks.**

**Semester: III**

<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
BAI301	Object Oriented Programming Using C++	Program core course	3	0	0	3
BAI302	Data Structure & Algorithms	Program core course	3	0	0	3
BAI303	Digital Electronics	Engineering Science Course	3	0	0	3
BAI304	Numerical Methods and Analysis	Basic Science Course	4	0	0	4
BAI305	Object Oriented Programming Using C++ Lab	Program core course	0	0	4	2
BAI306	Data Structure & Algorithms Lab	Program core course	0	0	4	2
BAI307	Digital Electronics Lab	Engineering Science Course	0	0	2	1
BAI308	Human values & Ethics	Humanities – 1	3	0	0	3
BAI309	Institutional Training	Internship	0	0	0	2
<b>Total</b>			<b>16</b>	<b>0</b>	<b>10</b>	<b>23</b>

**Note: Institutional Training will be imparted in the Institute at the end of 2nd Semester for 6-weeks duration. However, this Subject is not applicable to LEET Students.**

**Semester: IV**

<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
BAI401	Discrete Mathematics	Program core course	3	1	0	4
BAI402	Operating System	Program core course	3	0	0	3
BAI403	Design & Analysis of Algorithms	Program core course	4	0	0	4
BAI404	Computer Organization & Architecture	Program core course	3	0	0	3
BAI405	Operating System Lab	Program core course	0	0	4	2
BAI406	Design & Analysis of Algorithms Lab	Program core course	0	0	4	2
BAI407	Organizational Behavior	Humanities	3	0	0	3
BAI408	Environmental Science	VAC	2	0	0	NC
<b>Total</b>			<b>18</b>	<b>1</b>	<b>8</b>	<b>21</b>

**Note: Noncredit(NC) course will be evaluated as per satisfactory/ unsatisfactory remarks.**

<b>Semester: V</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
BAI501	Software Engineering	Program core course	3	0	0	3
BAI502	Java Programming	Program core course	3	1	0	4
BAI503	Relational Database Management System	Program core course	3	0	0	3
BAI504	Web Designing & Development	Program core course	4	0	0	4
BAI505	Relational Database Management System Lab	Program core course	0	0	4	2
BAI506	Web Designing & Development Lab	Program core course	0	0	4	2
BAI507	Java Programming Lab	Program core course	0	0	4	2
BAI508	Numerical Aptitude & Reasoning Ability	Basic Science Course	2	0	0	2
BAI509	Basics of Management	VAC	2	0	0	NC*
<b>Total</b>			<b>17</b>	<b>1</b>	<b>12</b>	<b>22</b>

**Note: Noncredit(NC) course will be evaluated as per satisfactory/ unsatisfactory remarks.**

<b>Semester: VI</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
BAI601	Formal Language & Automata Theory	Program core course	3	1	0	3
BAI602	Artificial Intelligence	Program core course	3	0	0	3
BAI603	Python with data structure for ML	Program core course	4	0	0	4
BAI604	Python with data structure for ML lab	Program core course	0	0	4	2
BAI605	Project-1	Project Based	0	0	4	2
<b>Professional Elective Course-I(Any one of the following)</b>						
BAI606	Network Security	Professional Elective Course-I	3	0	0	3
BAI607	Mobile Application Development					
<b>Professional Elective Course-II(Any one of the following)</b>						
BAI608	Internet of Things	Professional Elective Course-II	3	0	0	3
BAI609	Soft Computing					
<b>Professional Elective Course-III (Any One of the following)</b>						
BAI610	Cyber Law & Ethics in computer Vision	Professional Elective Course-III	3	0	0	3
BAI611	Machine Vision					
<b>Total</b>			<b>19</b>	<b>1</b>	<b>8</b>	<b>23</b>



<b>Semester: VII</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
BAI701	Machine Learning	Program core course	3	0	0	3
BAI702	Deep Learning	Program core course	3	0	0	3
BAI703	Data & Visual Analytics in AI	Program core course	3	0	0	3
BAI704	Introduction to Robotics	Program core course	3	0	0	3
BAI705	Project-II	Project Based	0	0	4	2
BAI706	Industrial Training	Internship	0	0	0	4
<b>Professional Elective Course-IV(Any one of the following)</b>						
BAI707	Block chain Architecture Design	Professional Elective Course-III	3	0	0	3
BAI708	Digital Forensics					
<b>Open Elective-I (II Any One of the following ) for Other Engineering department students</b>						
OEC087	Data ware housing & Data Mining	Open Elective-II	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
OEC088	Big Data					
<b>Total</b>			<b>18</b>	<b>0</b>	<b>04</b>	<b>24</b>

<b>Semester: VIII</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
BAI801	Project-III	Skill based	0	0	10	5
BAI802	Entrepreneurship Development	VAC	2	0	0	NC
<b>Professional Elective-V (Any one of the following)</b>						
BAI803	Neural Network with Tensor flow	Discipline Elective-IV	3	0	0	3
BAI804	Autonomous Drones.					
<b>Open Elective -II( for Other Engineering department students)</b>						
OEC089	Adhoc & Sensor Network	Open Elective Course	3	0	0	3
OEC090	Design & Development of Applications					
<b>Total</b>			<b>6</b>	<b>0</b>	<b>10</b>	<b>11</b>
<b>Grand Total</b>			<b>126</b>	<b>05</b>	<b>82</b>	<b>164</b>

**Note: Noncredit(NC) course will be evaluated as per satisfactory/ unsatisfactory remarks.**

**Evaluation Criteria for Theory Courses**

- A. Continuous Assessment: [25 Marks]
  - CA1-Surprise Test (Two best out of Three) - (10 Marks)
  - CA2-Assignment(s) (10 Marks)
  - CA3-Term Paper/Quiz/Presentations (05 Marks)
- B. Attendance: [05 marks]
- C. Mid Semester Test: [30 Marks]
- D. End-Term Exam: [40 Marks]

**Evaluation Criteria for Practical Courses:** Performance of each practical- (10 Marks), Report- (5 Marks)

Practical Viva – (5 Marks)  
Total - (20 Marks) (Each Practical)

**Course Title: BASIC ELECTRICAL ENGINEERING**

**Course Code: BAI101**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **SEMESTER-I**

**Total Hours: 60**

**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, Thevenin 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**

**15 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**

**15 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****15 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: ENGINEERING PHYSICS**

**Course Code: BAI102**

L	T	P	Credits
3	1	0	4

**Total Hours: 60**

**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**

**15 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**

**15 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

**15 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 matter 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, Fraunhofer 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 Griffiths, 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 Murugesan, 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****Course code: BAI103**

L	T	P	Credits
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. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. Classify of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. Illustrate the Tool of power series and Fourier series for learning advanced Engineering Mathematics.
4. Use of functions of several variables that is essential in most branches of engineering and tools of matrices and linear algebra in a comprehensive manner.

**Course Content****UNIT I****16 Hours**

**Calculus:** Evaluates and involutes; 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; Gradient, curl and divergence.

Integration: 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). Theorems of Green, Gauss and Stokes, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

**UNIT II****14 Hours**

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

**Theory of equations:** Relation between roots and coefficients, reciprocal Equations, transformation of equations and diminishing the roots.

### 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

- *Thomas, G. B. (1992). Calculus and analytic geometry. Massachusetts Institute of Technology, Massachusetts, USA, Addison-Wesley Publishing Company, ISBN: 0-201-60700-X.*
- *UNIT, I. 16MA101 ENGINEERING MATHEMATICS-I LTFC. SNS COLLEGE OF TECHNOLOGY, 7, 19.*
- *Bali, N. P., & Goyal, M. (2010). A Textbook of Engineering Mathematics (PTU, Jalandhar) Sem-III/IV. Laxmi publications.*
- *PO, P. Edition, New Delhi, 2012. 6. Ramana BV, "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010. DEPARTMENT OF INSTRUMENTATION ENGINEERING ANNA UNIVERSITY, CHENNAI, 24.*



**Course Title: ENGINEERING GRAPHICS & DRAWING****Course Code: BAI104**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>1</b>	<b>0</b>	<b>4</b>	<b>3</b>

**Total Hours: 45****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****9 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 Involute; 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****12 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****14 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**

**10 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, New York.  
(Corresponding set of) CAD Software Theory and User Manuals

**Course Title: BASIC ELECTRICAL ENGINEERING  
LAB****Course Code: BAI105**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
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.

**Course Title: ENGINEERING PHYSICS LAB**

L	T	P	Credits
0	0	2	1

**Course Code: BAI106**

14. To determine the stopping potential from the photocurrent versus applied potential graph.

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

**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 equipment's 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: FUNDAMENTAL OF COMPUTER AND  
INFORMATION TECHNOLOGY LAB**

**Course Code: BAI107**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**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: BASICS OF DOMESTIC APPLIANCES****Course Code: BAI108**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**Total hours: 30**

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

1. Acquire necessary skills/hand on experience/ working knowledge on multimeters, galvanometers, ammeters, voltmeters, ac/dc generators, motors, transformers, single phase and three phase connections, basics of electrical wiring with electrical protection devices.
2. Understand the working principles of different household domestic appliances.
3. Check the electrical connections at house-hold.
4. To learn the skills to repair the electrical appliances for the general troubleshooting and wiring faults.

**Course Content****UNIT-I****7 Hours**

Basics of House wiring, Principles of working, parts and servicing of Electric fan, Electric Iron box, Water heater; Induction heater, Microwave oven; Refrigerator, Concept of illumination, Electric bulbs, CFL, LED lights, Energy efficiency in electrical appliances.

**UNIT-II****8 Hours****Electric Iron:**

Type of Electric Iron – Ordinary type and automatic/Thermostat Control type/steam iron, Construction and working principle of electric irons; common defects, testing and repairs

**Electric Stove:**

Types of Electric Stoves- Coiled type, covered type, Hot Plate, Grill/Oven,

Cooking Range- Construction and working principle of electric stoves, common defects, testing and repairs; Induction heater; OTG and Microwave oven; Three phase heater, star and Delta connections.

**Electric Toasters:**

Types of Toasters - Ordinary and Automatic; Construction and working principles of electric toaster; common defects, testing and repairs.

**UNIT-III**

**7 Hours**

**Table Lamp and Tube Light:**

Construction, working principles and use of Table Lamp, Night Lamp and Tube Light; Common faults, their causes, testing and repair, LED Table lamp.

**Electric Fan:**

Type of Fans – ceiling fan, Pedestal fan, Bracket Fan, Exhaust Fan; Construction working principles, special characteristics and applications of Electric fans; Common faults, their causes, testing and repairs; Installation of Bracket Fan and Exhaust Fan.

**UNIT-IV**

**8 Hours**

**Electric Mixer, Grinder and Blender:**

Construction, working principles, special characteristics and applications of Electric Mixer, Grinder and Blender; Common Faults, their causes, testing and repairs; Servicing maintenance and overhauling of Electric Mixer, Grinder and Blender.

**Emergency Light and Stabilizer:**

Constructions and working principles of Emergency Light and Stabilizer; Common faults, their causes, testing and repairs.

**Transaction Modes**

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

### **Suggested Readings**

1. A Text book on Electrical Technology, B.L.Theraja, S.Chand& Co.,
2. A Text book on Electrical Technology, A.K.Theraja.
3. Performance and design of AC machines, M.G.Say, ELBSEdn.,
4. Handbook of Repair & Maintenance of domestic electronics appliances; BPB Publications.
5. Consumer Electronics, S.P.Bali, Pearson.
6. Domestic Appliances Servicing, K.P.Anwer, Scholar Institute Publications



**Course Title: BASICS OF DOMESTIC APPLIANCES LAB****Course Code: BAI109**

L	T	P	Credits
0	0	2	1

**Total hours: 15**

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

1. Acquire necessary skills/hand on experience/ working knowledge on multimeters, galvanometers, ammeters, voltmeters, ac/dc generators, motors, transformers, single phase and three phase connections, basics of electrical wiring with electrical protection devices.
2. Understand the working principles of different household domestic appliances.
3. Check the electrical connections at house-hold.
4. To learn the skills to repair the electrical appliances for the general troubleshooting and wiring faults.

### **Course Content**

#### **Co-curricular Activities (Hands on Exercises):**

1. Identifying Phase, Neutral and Earth on power sockets.
3. Identifying primary and secondary windings and measuring primary and secondary voltages in various types of transformers.
4. Observing the working of transformer under no-load and full load conditions.
5. Observing the connections of elements and identify current flow and voltage drops.
6. Studying electrical circuit protection using MCBs, ELCBs.
7. Dismantling and reassemble of reflector type room Heater.
8. Dismantling and reassembling of Electric Iron (i) Ordinary type (ii) Automatic/Thermostat control type.
9. Testing and repair of Electric Iron (i) Ordinary type (ii) Automatic/Thermostat control type.

10. Dismantling and reassembling of Electric Stove (i) Coiled type (ii) Covered type  
(a) Hot plate (b) Grill (iii) Induction Heater (iv) Microwave oven, (v) Three phase heater star and delta connection
11. Connection of Fluorescent tube light (FTL) circuit.
12. Testing and repair of (i) Table Lamp (ii) Night Lamp and (ii) Tube Light (iv) LED table lamp
13. Testing fault finding, repair and overhauling of electric fans.
14. Testing fault finding, repair and overhauling of (i) electric mixer (ii) grinder (iii) blender.
15. Testing fault finding, repair and overhauling of emergency light
16. Testing fault finding, repair and overhauling of voltage stabilizer (manual and automatic)

### **Transaction Modes**

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

### **Suggested Readings**

1. A Text book on Electrical Technology, B.L.Theraja, S.Chand& Co.,
2. A Text book on Electrical Technology, A.K.Theraja.
3. Performance and design of AC machines, M.G.Say, ELBSEdn.,
4. Handbook of Repair & Maintenance of domestic electronics appliances; BPB Publications.
5. Consumer Electronics, S.P.Bali, Pearson.
6. Domestic Appliances Servicing, K.P.Anwer, Scholar Institute Publications

**SEMESTER-II****Course Title: ENGINEERING CHEMISTRY****Course Code: BAI201**

L	T	P	Credits
3	0	0	3

**Total Hours: 45****Learning Outcomes:** After completion of this course, the learner will be able to:

1. Demonstrate Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and Nano particles,
2. Evaluate band structure of solids and the role of doping on band structures.
3. Distinguish the ranges of Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging
4. Rationalize periodic properties such as ionization potential, electro-negativity, Oxidation states and electro-negativity.

**Course Content****UNIT1****15 Hours**

**Atomic and molecular structure:** Schrodinger equation, Particle in a box solution and their applications for conjugated molecules and Nanoparticles, Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations, Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

**UNIT II****10 Hours**

**Spectroscopic techniques and applications:** Principles of spectroscopy and selection rules, electronic spectroscopy, Fluorescence and its applications in medicine, Vibrational and rotational spectroscopy of diatomic molecules, Applications, Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, Diffraction and scattering.

Ionic, Dipolar and Vander Waals interactions, Equations of state of real gases and Critical phenomena. Potential energy surfaces of H<sub>3</sub>, H<sub>2</sub>F and HCN and trajectories on these surfaces.

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibriums, Water chemistry, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

**UNIT III****10 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, hard soft acids and bases, molecular 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 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.

**Transaction Modes**

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 Spectroscop. 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
3	1	0	4

**Course Code: BAI202****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.

**Transaction Modes**

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: PROGRAMMING FOR PROBLEM SOLVING**

**Course Code: BAI203**

L	T	P	Credits
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 root finding of function, differentiation of function and simple integration
4. Implement conditional branching, iteration and recursion.

### **Course Content**

#### **UNIT I**

**15 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**

**8 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**

**7 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 Modes**

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-Hill.*



**Course Title: COMMUNICATION SKILLS**

**Course Code: BAI204**

L	T	P	Credits
3	0	0	3

**Total Hours: 45**

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

1. Develop vocabulary and improve the accuracy in Grammar.
2. Apply the concepts of accurate English while writing and become equally ease at using good vocabulary and language skills.
3. Develop and Expand writing skills through Controlled and guided activities.
4. Compose articles and compositions in English.

### **Course Content**

#### **UNIT I**

**16 Hours**

**Vocabulary Building:** The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

#### **UNIT II**

**14 Hours**

**Basic Writing Skills:** Sentence Structures, use of phrases and clauses in sentences, Importance of proper punctuation, creating coherence, organizing principles of paragraphs in documents, Techniques for writing precisely.

#### **UNIT III**

**8 Hours**

**Identifying Common Errors in Writing:** Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Cliché

#### **UNIT IV**

**7 Hours**

**Nature and Style of sensible Writing:** Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion

**Writing Practices:** Comprehension, Précis Writing, Essay Writing.

### **Transaction Modes**

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

### **Suggested Readings**

- Swan, Michael. (1995). *Practical English*. OUP.
- Wood, F.T. (2007). *Remedial English Grammar*. Macmillan.
- Zinsser, W. (2001). *On Writing Well*. Harper Resource Book.
- Lyons, L. H. & Heasley, B. (2006). *Study Writing*. Cambridge University Press.

- *Kumar, S &Lata, P. (2011). Communication Skills. Oxford University Press.*
- *CIEFL, Hyderabad. Exercises in Spoken English. Parts. I-III. Oxford University Press.*

**Course Title: MANUFACTURING PRACTICES**

**Course Code: BAI205**

L	T	P	Credits
1	0	4	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**

**8 Hours**

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

**UNIT II**

**6 Hours**

CNC machining, Additive manufacturing, Fitting operations & power tools

**UNIT III**

**6 Hours**

Electrical & Electronics Carpentry, Plastic moulding, 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 Modes**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion,

**Course Title: ENGINEERING CHEMISTRY LAB**

L	T	P	Credits
0	0	2	1

**Course Code: BAI206**

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.

**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. Potentiometry - 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 viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

**Course Title: PROGRAMMING FOR PROBLEM SOLVING LAB****Course Code: BAI207**

L	T	P	Credits
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 root 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

**Suggested Readings**

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

**Course Title: COMMUNICATION SKILLS LAB**

**Course Code: BAI208**

L	T	P	Credits
0	0	2	1

**Total Hours: 15**

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

1. Illustrate the importance of pronunciation and apply the same day to day conversation.
2. Apply verbal and non-verbal communication techniques in the Professional Environment.
3. Develop coherence, cohesion and competence in Oral discourse.
4. Evaluate the interview process confidently.

### **Course Content**

#### **Oral Communication**

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

**Course Title: Indian Constitution****Course Code: BAI209**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
2	0	0	NC

**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, 42<sup>nd</sup>, 44<sup>th</sup>, 74<sup>th</sup>, 76<sup>th</sup>, 86<sup>th</sup> & 91<sup>st</sup> 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.

**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*



*Gupta: The Constitution of India Bare Act with Short Notes-Useful for Competitive Examinations. Prabhat Prakashan.*

- *Ghosh, P. K. (1966). Constitution of India (Prabhat Prakashan): How it Has Been Framed. Prabhat Prakashan.*

**SEMESTER-III****Course Title: OBJECT ORIENTED PROGRAMMING USING C++****Course Code: BAI301**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 ios class functions and flags, formatting using manipulators.

**Classes and Objects:** Specifying a class, creating class objects, accessing class members, access specifiers, 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**

**9Hours**

**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 Modes**

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.*
- *Bjarne Stroustrup. (1985). The C++ Programming Language. AddisonWesley.*
- *Herbert Schildt. (1994). The Complete Reference to C++ Language. McGrawHill-Osborne.*
- *Lippman F. B. (1997). C++ Primer. AddisonWesley*

**Course Title: DATA STRUCTURE & ALGORITHMS**

**Course Code: BAI302**

L	T	P	Credits
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 Modes**

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: DIGITAL ELECTRONICS**

**Course code: BAI303**

L	T	P	Credits
3	0	0	3

**Total Hours: 45**

**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**

**15 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, si gned binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lcs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

**UNIT II**

**10 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, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

**UNIT III**

**10 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

**Digital to analog converters:** weighted resistor/converter, R-2R Ladder D/A converter, Specifications for D/A converters, examples of D/A converter lcs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converters

#### **UNIT IV**

**10 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 Modes**

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: NUMERICAL METHODS AND ANALYSIS**

**Course Code: BAI304**

L	T	P	Credits
3	0	0	3

**Total Hours-45**

**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**

**10 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**

**10 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**

**10 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 Modes**

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: OBJECT ORIENTED PROGRAMMING USING  
C++ LAB**

**Course Code: BAI305**

L	T	P	Credits
0	0	4	2

**Total Hours-30**

**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 use of 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 & ALGORITHM LAB****Course Code: BAI306**

L	T	P	Credits
0	0	4	2

**Total Hours-30****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: DIGITAL ELECTRONICS LAB**

**Course Code: BAI307**

L	T	P	Credits
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: HUMAN ETHICS & ITS VALUES.**

**Course Code: BAI308**

L	T	P	Credits
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
5. Formulate moral responsibility and could themselves as good professionals

## **Course Content**

### **UNIT I**

**10Hours**

**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 Modes**

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

**Suggested Readings**

1. "**Ethics in Engineering**", Mike Martin and Roland Schinzinger, McGraw-Hill, New York, 1996.
2. "**Engineering Ethics**", Govinda rajan M, Natarajan S, Senthil Kumar V. S, Prentice Hall of India, New Delhi, 2004.

**SEMESTER-IV****Course Title: DISCRETE MATHEMATICS****Course Code: BAI401**

L	T	P	Credits
3	1	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 Modes**

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: OPERATING SYSTEM****Course Code: BAI402**

L	T	P	Credits
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 root 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, Dining 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.

#### **Transaction Modes**

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*. 2<sup>nd</sup> Edition Wesley.
- Maurice Bach, Prentice-Hall of India (1986). *Design of the Unix Operation Systems*. 8<sup>th</sup> 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.coursera.org/courses?query=operating%20system)
- <https://www.cse.iitb.ac.in/~mythili-operating-system>
- [https://computer.howstuffworks.com/web-operating-system.htm- operating-system-](https://computer.howstuffworks.com/web-operating-system.htm)

**Course Title: DESIGN & ANALYSIS OF ALGORITHMS**

**Course Code: BAI403**

L	T	P	Credits
3	0	0	3

**Total Hours: 45**

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

1. Describe the greedy paradigm and develop the greedy algorithms.
2. Implement and examine the divide-and-conquer paradigm.
3. Develop the dynamic programming algorithms and evaluate their computational complexity.
4. Analysis the graphs to find shortest path.

### **Course Content**

#### **UNIT I**

**10 Hours**

**Introduction:** Algorithm and its importance, Mathematical foundations- Growth functions, Complexity analysis of algorithms.

**Divide and Conquer:** Basic technique and its application on Binary Search, Finding Maximum and Minimum and on sorting techniques such as Merge Sort, Quick Sort.

#### **UNIT II**

**15 Hours**

**Greedy Algorithms:** General method, using greedy algorithm to solve Knapsack problem, Minimum-Cost spanning trees problem, Single source shortest path problem and Travelling salesperson problem.

**Dynamic Programming:** Introduction to dynamic programming and application of the algorithm to solve multistage graphs, all pair's shortest path problem and Knapsack problem.

#### **UNIT III**

**10 Hours**

**Backtracking:** General backtracking algorithm, Application of backtracking to 8 Queens' problem, Sum of subsets, Graph coloring, Hamiltonian cycles and Knapsack problem.

**String Matching Algorithms:** Introduction, Brute Force algorithm, Rabin-Karp algorithm, KMP algorithm, and Boyer-Moore algorithm.

#### **UNIT IV**

**10 Hours**

**NP-completeness and Approximation Algorithms:** Introduction to P, NP, NP-hard and Complete problems, Examples of NP-complete problems, Introduction to approximation algorithms, Absolute approximations, E-approximations.

**Approximation algorithms using linear programming, randomization, and specialized techniques.**

**Transaction Modes**

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

### **Suggested Readings**

- *Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms" Galgotia Publications (Year 2002).*
- *Thomas H. Cormen, Charles E. Leiserson, Ronald Rivest, and Clifford Stein, "Introduction to Algorithms", MIT Press Year 1990.*
- *Sanjoy Dasgupta, Christos Papadimitriou, and Umesh Vazirani, "Algorithms", McGraw-Hill Education 2006.*
- *Michael T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", Wiley (Year 2002).*
- *Alfred V. Aho, John E. Hopcroft, and Jeffrey. D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education 1974. 6. John Kleinberg and Eva Tardos, "Algorithm Design", Pearson Education 2005.*
- *T. H. CORMEN, C. E. LEISERSON, R. L. RIVEST, AND C. STEIN. Introduction to Algorithms, MIT Press, New York, 3rd edition, 2009.*
- *S. DASGUPTA, C. PAPADIMITRIOU, AND U. VAZIRANI. Algorithms, McGraw-Hill, New York, 2008*

### **Web Links**

- <https://www.classcentral.com/course/swayam-Design-and-analysis-of-algorithms->
- [https://vssut.ac.in/lecture\\_notes/lecture1428551222](https://vssut.ac.in/lecture_notes/lecture1428551222). Design-and-analysis-of-algorithms-
- [https://sites.northwestern.edu/hartline/eecs-336-Design-analysis-of-algorithms.](https://sites.northwestern.edu/hartline/eecs-336-Design-analysis-of-algorithms)

**Course Title: Computer Organization & Architecture****Course Code: BAI404**

L	T	P	Credits
3	0	0	3

**Total Hours-45****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, RTL interpretation 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****10 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****10 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**

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

**Course Title: OPERATING SYSTEM LAB**

**Course Code: BAI405**

L	T	P	Credits
0	0	4	2

**Total Hours-30**

**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.

3. **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: DESIGN & ANALYSIS OF ALGORITHMS LAB****Course Code: BAI406**

L	T	P	Credits
0	0	4	2

**Total Hours-30****Learning Outcomes:** After completion of this course, the learner will be able to:

1. Examine randomized algorithms.
2. Analyze the performance of algorithms.
3. Describe and implement the dynamic-programming paradigm.
4. Examine and recognize the greedy paradigm.

**Course Content**

1. Write a program to implement bubble sort algorithm by comparing its complexity.
2. Write a program to implement linear search algorithm by comparing its complexity.
3. Write a program to implement binary search algorithm by comparing its complexity.
4. Write a program to implement PUSH operation in stacks.
5. Write a program to implement POP operation in stacks.
6. Write a program to implement Queues.
7. Write a program to insert an element in the beginning of the link list.
8. Write a program to delete an element from the middle of the link list.
9. Write a program to implement the concept of queen's problem.

**Course Title: ORGANISATIONAL BEHAVIOR****Course Code: BAI407**

L	T	P	Credits
3	0	0	3

**Total Hours-****45****Learning Outcomes:** After completion of this course, the learner will be able to:

1. Discuss usability goals and user experience goals for designing an interactive product.
2. Identify suitable methods for evaluating interactive technologies.
3. Analyze the suitable methods for establishing requirements.
4. Learn the conceptual, practical, and ethical issues involved in evaluation.

**Course Content****COURSE CONTENTS:****UNIT I****12****Hours**

Organizational Behavior: What managers do, Definition of OB, contributing disciplines to OB, challenges and opportunities for OB. Foundations of Individual behavior- biographical characteristics, ability, and learning. Values, Attitudes, Personality and Emotions, Perception

**UNIT II****12****Hours**

Motivation: Concept, Theories of Maslow, Herzberg, McClelland, Porter & Lawler Model, Application of Motivation Concept. Job Satisfaction Foundations of Group Behaviour: Group formation, development and structure, Group Processes, Group Decision- making Techniques, Work Teams.

**UNIT III****11Hours**

Interpersonal Skill-Transactional analysis, Life Positions, Johari Window. Leadership: Concept, theories, styles and their application. Power and Politics in Organization

**UNIT IV****10****Hours**

Conflict Management, Stress Management, Crisis Management, Organizational Change & Development, Innovation, Creating a learning Organization, Organizational Culture, Organizational Effectiveness.

**Transaction Modes**

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

**Suggested Readings:**

- Nelson, Debra L and James C Quick, "Organisational Behavior", Thomson Learning
- Pareek, Udai, "Understanding Organisational Behaviour", Oxford University Press, New Delhi
- Robbins, S.P., "Organisational Behaviour", Prentice Hall of India, New Delhi
- Hellgiegel, D & J.W. Slocum, "Organisational Behaviour", Thomson Learning
- Mcschane, "Organization Behaviour", TMH, New Delhi
- Luthans, Fred, "Organisational Behaviour", mcgrawHill, New York
- New Storm and Keith Davis, "Organization Behaviour", TMH, New Delhi

**Course Title: Environmental Science****Course Code: BAI408**

L	T	P	Credits
2	0	0	NC

**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
5. Describe threats to global biodiversity, their implications and potential solutions

**Course Content**

**UNIT I  
Hours**

**6**

**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** **Hours**

**10**

**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** **Hours**

**8**

**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.

### **Transaction 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. &Datta, A.K.(2008).Waste Water Treatment. Oxford & IBH Publ. Co. Pvt.Ltd*

**SEMESTER-V****Course Title: SOFTWARE ENGINEERING****Course Code: BAI501**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total Hours-45**

**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.

**Difference between classical and advanced concepts****Kind of problems which are candidate for using advanced feature 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****10****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

10

#### 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

10Hours

**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.
- Pfleddger 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.
- stephens, Rod (2015) *Beginning Software Engineering*, Wrox.
- Tsui, Frank , Orlando Karam and Barbara Bernal (2013) *Essentials of Software Engineering*, Jones & Bartlett Learning , Sudbury, MA.



**Course Title: JAVA PROGRAMMING****Course Code: BAI502**

L	T	P	Credits
3	1	0	4

**Total Hours: 60****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****15 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****15Hours****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****15 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**

**15Hours**

**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 Microservices, Contract Testing, Monolithic, SOA, and Micro Services Architecture, Docker, DC, Bounded Context

#### **Transaction Modes**

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

#### **Suggested Readings**

- McGraw-Hill. (1999). *Java 2 Computer Reference*. Tata McGraw Hill.
- Horstmann. (2018). *Core Java-I*. Addison Wesley.
- E Balagurusami. (2006). *Programming with JAVA*. Tata McGraw-Hill Education.
- Ken Arnold, James Gosling and David Holmes, "The Java Programming Language", 4th ed, 2005.
- Bruce Eckel, "Thinking in Java", 4th ed, 2007.

#### **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](https://www.tradepub.com/free-offer/advanced-java-tutorial/w_java34?sr=hicat&t=hicat:827)- Java Programming.

**Course Title: RELATIONAL DATABASE MANAGEMENT  
SYSTEM**

**Course Code: BAI503**

L	T	P	Credits
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 Modes**

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

**Suggested Readings**

- *J. D. Ullman, Computer Science Press. (2016). Principles of Database and Knowledge-Base Systems. Vol1*
- *R. Elmasri and S. Navathe, Pearson Education.(1905). Fundamentals of Database System.5th Edition*
- *Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley. (1995). Foundations of Databases Reprint.*
- *Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning-Course Technology, Seventh Edition, 2007.*
- *Shio Kumar Singh, Database Systems Concepts, Designs and Application, Pearson Education, Second Edition, 2011.*

**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: WEB DESIGNING & DEVELOPMENT****Course Code: BAI504**

L	T	P	Credits
4	0	0	4

**Total Hours-60**

**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****15 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****15 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**

**15 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 Modes**

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

#### **Suggested Readings**

- *WILEY Dreamtech. (2010). Web Programming, building internet applications. Chris Bates 2nd edition.*
- *Hans Bergsten. (2000). Java Server Pages. SPDO' Reilly.*
- *Dietel and Nieto. (2001). Internet and World Wide Web. PHI/Pearson Education Asia.*
- *Joglekar. (2009). Web Warriar 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: RELATIONAL DATABASE MANAGEMENT  
SYSTEM LAB**

**Course Code: BAI505**

L	T	P	Credits
0	0	4	2

**Total Hours: 30**

**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 LAB****Course Code: BAI506**

L	T	P	Credits
0	0	4	2

**Total Hours-30**

**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.
5. Create a web page to show use tables and div tags.
6. Create a web page using class, id and inline styles.
7. Create a web page to create a form.
8. Create a web page to show an alert using java script.
9. Show the use of get Element by Id in java script.
10. Create a web page using variables, loop and Conditions in java script.
11. Create a web page using Switch in java script.
12. Create a web page to show use of j query.
13. Create a web page to implement get & post in Ajax.
14. Create a web page to print your name using PHP.
15. Create a web page to show use of all data types in PHP
16. Create a web page to show use loops &Conditional Statement.
17. Create a web page to show use arrays in PHP.



**Course Title: JAVA PROGRAMMING LAB**

**Course Code: BAI507**

L	T	P	Credits
0	0	4	2

**Total Hours: 30**

**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: Numerical Aptitude and Reasoning Ability**

**Course Code: BAI508**

L	T	P	Credits
2	0	0	2

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

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

1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning Ability
5. Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

### **UNIT I**

Numerical problem- Percentages (*like profit & loss %, marks, shares etc.*), Time & Work, Speed & Distance problems, Fraction, Ratios, Average & Volume, Factoring (*LCM, HCF*), Mensuration formulas, Simple interest & Compound interest .

### **UNIT II**

**Logical Reasoning-** Statements & Assumption, Syllogism, Puzzles, Constraint-Based Reasoning, Proposition Testing, Course of Action, Assertion and Reason, Input Output Relations, Conclusion Estimation from Passages, Cause and Effect Reasoning, Theme Detection etc.

### **UNIT III**

**Verbal Reasoning:** Analogy, Series Completion, Blood Relations, Venn Diagrams, Sequential Output Tracing, Ranking & Time Sequence Test, Alphabet Test, Logical Sequence of Words, Inserting the Missing Character, Data

Sufficiency, Arithmetical Reasoning Questions, Coding-Decoding, Puzzle Test, Eligibility Test, Situation Reaction Test, Assertion & Reason, etc.

#### **UNIT IV**

**Non-Verbal Reasoning:** Mirror Images, Reverse Images, Spotting Embedded Figures, Figure Matrix, Paper Folding, Cubes & Dice, Construction of Squares & Triangles, Grouping of Identical Figures, Paper Cutting, Rule Detection, Dot Situation, Figure Formation & Analysis, Series, Classification, Analogy etc.

**Course Title: Basics of Management**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>NC</b>

**Course Code: BAI509**

**Total Hours:30**

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

1. Evaluate the global context for taking managerial actions of planning, organizing and controlling.
2. Assess global situation, including opportunities and threats that will impact management of an organization.
3. Integrate management principles into management practices.
4. Assess managerial practices and choices relative to ethical principles and standards.
5. Specify how the managerial tasks of planning, organizing, and controlling can be executed in a variety of circumstances.

#### **Course Content**

##### **UNIT-I**

**15 Hours**

**Principles of Management:** Introduction, definition and importance of management, Functions of Management, Planning, Organizing, Staffing, Coordinating, Directing, Motivating and Controlling. Concept and Structure of an Organization Types of industrial organization: Line organization, Functional organization, Line and Functional organization. Hierarchical Management

Structure: Top, middle and lower level management, Departmentalization Introduction and its advantages.

**Work Culture:** Introduction and importance of Healthy Work Culture in organization, Components of Culture, Importance of attitude, values and behavior, Behavioral Science – Individual and group behavior, Professional ethics – Concept and need of Professional Ethics.

## **UNIT-II**

**15 Hours**

**Leadership and Motivation:** Leadership: Definition and Need of Leadership, Qualities of a good leader, Manager vs. leader, Motivation: Definition and characteristics of motivation, Factors affecting motivation, Maslow's Need Hierarchy Theory of Motivation, Job Satisfaction.

**Legal Aspects of Business:** Introduction and Need, Labour Welfare Schemes: Wage payment: Definition and types, Incentives: Definition, need and types, Factory Act 1948, Minimum Wages Act 1948.

## **UNIT-III**

**15 Hours**

**Management Scope in different Areas:** Human Resource Development: Introduction and objective, Manpower Planning, recruitment and selection, Performance appraisal methods. Material and Store Management: Introduction, functions and objectives of material management, Purchasing: definition and procedure, Just in time (JIT). Marketing and Sales: Introduction, importance and its functions, Difference between marketing and selling, Advertisement- print media and electronic media, Market-Survey and Sales promotion. Financial Management – Introduction: Concept of NPV, IRR, Cost-benefit analysis, Elementary knowledge of Income Tax, Sale Tax, Excise duty, Custom duty, Provident Fund, Maintenance Management, Concept , Preventive Maintenance.

## **UNIT-IV**

**15**

**Hours**

**Miscellaneous Topics:** Customer Relationship Management (CRM): Definition and Need, Types of CRM, Customer satisfaction. Total Quality Management (TQM): Inspection and Quality Control, Concept of Quality Assurance, TQM. Intellectual Property Rights (IPR): Introduction, definition and its importance, Infringements related to patents, copyright, trade mark.

### **Suggested Readings**

1. Principles of Management by Philip Kotler TEE Publication
2. Principles and Practice of Management by ShyamalBannerjee: Oxford and IBM Publishing Co, New Delhi.
3. Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co., 7, West Patel Nagar , New Delhi.
4. Modern Management Techniques by SL Goel: Deep and Deep Publications PvtLimited Rajouri Garden, New Delhi.
5. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.
6. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill Book Company, New Delhi.
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by DD Sharma, Sultan Chand and Sons, New Delhi.
9. Intellectual Property Rights and the Law by Dr. GB Reddy.
10. Service Quality Standards, Sales & Marketing Department, MarutiUdyog Ltd.
11. Customer Relationship Management: A step-by-step approach, Mohamed &Sagadevan Oscar Publication, Delhi
12. Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi.

**SEMESTER-VI****Course Title: FORMAL LANGUAGE & AUTOMATA THEORY**

L	T	P	Credits
3	1	0	4

**Course Code: BAI601****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 N DFA, 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 Modes**

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://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://www.udemy.com/course/formal-languages-and-automata-theory-e/-Formal-Language-&Automata-Theory)
- [https://eecs.wsu.edu/~ananth/CptS317- Formal Language & Automata Theory](https://eecs.wsu.edu/~ananth/CptS317-Formal-Language-&Automata-Theory)

**Course Title: Artificial Intelligence****Course Code: BAI602**

L	T	P	Credits
3	0	0	3

**Total Hours: 45****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. Understand the concept of expert system using Machine Learning.
4. Create an 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: Propositional 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: PYTHON WITH DATA STRUCTURE FOR ML**

**Course Code: BAI603**

L	T	P	Credits
4	0	0	4

**Total Hours-60**

**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**

**R-Programming:** R Basics Basic operations in R, Math operations in R, Vector, working with null values, Import & Export files in R, Data-frame, Joins, One-way and Two-way tables, Vectors, Matrices, R Basics  
Installing R and RStudio. Getting started with RMarkdown. Getting started with R: installing libraries, variables and data types, logical and arithmetic operations, functions and methods, loops, the %>% operator.

**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**

**15Hours**

**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*. MIT Press
- 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 WITH DATA STRUCTURE FOR ML  
LAB**

**Course Code: BAI604**

L	T	P	Credits
0	0	4	2

**Total Hours-30**

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

1. Apply the basic principles of python programming. And extend the functionality of R by using add-on packages.
2. Extract data from files and other sources and perform various data manipulation tasks on them.
3. Understand the code statistical functions in R and create applications using python programming
4. Use of R Graphics and Tables to visualize results of various statistical operations on data and looping functions; use Web Services using python programming and apply the knowledge of R gained to data Analytics for real life applications and manipulate python programs by utilizing the data structures like lists.

### Course Content

#### List of Programs:

Introduction: Installing R on personal machines. Installing R and RStudio.

1. The basic functionality of R will be demonstrated, Variable types in R. Numeric variables, strings and factors.
2. Accessing the help system. Retrieving R packages.
  - a) Basic data types and operations: numbers, characters and composites.
  - b) Data entry and exporting data 02 LO 1, LO 2, LO 3
3. R as a programming language:
  - a) Grouping, loops and conditional execution, Functions Exploratory data analysis
  - b) Range, summary, mean, variance, median, standard deviation, histogram, box plot, scatterplot 04 LO 1, LO 4
4. Graphics in R
  - a) Graphics and tables
  - b) Working with larger datasets
  - c) Building tables with aggregate
  - d) Introduction to ggplot2 graphics 06 LO 3
5. Regression and correlation
  - a) Simple regression and correlation, Multiple regression
  - b) Tabular data and analysis of Categorical data 02 LO 4

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton 's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

*SOFTWARE requirements:*

- The R statistical software program. Available from: <https://www.r-project.org/>
- RStudio an Integrated Development Environment (IDE) for R. Available from: <https://www.rstudio.com/>

**Course Title: PROJECT -I**

**Course Code: BAI605**

L	T	P	Credits
0	0	4	2

**Total Hours: 30**

**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: NETWORK SECURITY**

**Course Code: BAI606**

L	T	P	Credits
3	0	0	3

**Total Hours: 45**

**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 Contents**

**UNIT I**

**10**

**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**

**8**

**Hours**

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

**UNIT III**

**15**

**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**

**12**

**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 Modes**

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.*

**Course Title: MOBILE APPLICATION DEVELOPMENT**

**Course Code: BAI607**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total Hours-45**

**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**

**10 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**

**10 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**

**10 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 Modes**

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 for Dummies. John Wiley & Sons.*
- Henry Lee, Eugene Chuvyrov. (2012). *Beginning Windows Phone App Development. Apress.*

**Course Title: Internet of Things**

**Course Code: BAI608**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total Hours: 45**

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

1. Understand the application areas of IOT.
2. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3. Building blocks of Internet of Things and characteristics.
4. Use IOT in real world applications.

**Course Content**

**UNIT-1**

**10 Hours**

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

**UNIT-II**

**12 Hours**

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

**UNIT-III**

**13 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**

**10 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 Madiseti, 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 Kellmerit, "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: Soft Computing****Course Code: BAI609**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total Hours: 45**

**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**

**15Hours**

**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: Cyber Law and Ethics in Computer Vision**

**Course Code: BAI610**

L	T	P	Credits
3	0	0	3

**Total Hours:45**

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

1. Analyse the concept of cybercrimes.
2. Learn about the regulation of cyber space at national and international level.
3. Learn the international legal regime related to cybercrimes.
4. Discuss the offences and penalties under it act 2000.
5. Discuss the scope of consumer protection in e-commerce.

### **Course Content**

#### **UNIT – I**

**15 Hours**

**General introduction and Cyber space regulations:** Cyber Space-Meaning and characteristics Need for regulation of cyber space, Cyber-libertarianism, Cyber-paternalism, Lessing’s model of regulation, Regulators in cyberspace, Introduction to Internet, ACLU v Reno, Digitization and Society, Legal Challenges of the Information Society, Information Technology Act, 2000

#### **UNIT – II**

**10Hours**

**Cyber law and IPR issues:** Digital Copyrights, Open Source, Linking and caching, Digital Rights Management, DMCA, - Patents, Software Patents Trademarks and domain names, Brand identities, search engines and secondary market, ICANN, Database Right

#### **UNIT- III**

**10Hours**

**Cyber law and privacy and taxations issues:** Digitization, personal data and data industry, Data protection principles, Conditions for processing of personal

data, CCTV, RFID tracking, Data retention and identity - Taxation issues of e-commerce

#### UNIT – IV

**10Hours**

**Cyber Crimes:** Computer misuse - identity theft, grooming and harassment, Hacking, Viruses, criminal damage and mail bombing, Denial of service attack, Obscenity, child abuse, Stalking. Morphing, web jacking, phishing etc., Cyber terrorism, Bandwidth theft, Convention on cyber crime

#### Transactional Modes

- Video based Teaching, Collaborative Teaching, Cooperative Teaching, Case based Teaching, Case Analysis, Group Discussion

#### Suggested Readings

- Senthil, Surya and Devi Lakshmi (2010). *Manual of Cyber Laws*. New Delhi: Aditya Book Company.
- Singh, Ranbir and Singh Ghanshyam (2004). *Cyber Space and the Law: Issues and Challenges*, Hyderabad: Nalsar University.

**Course Title: Machine Vision**

**Course Code: BAI611**

L	T	P	Credits
3	0	0	3

**Total**

#### Hours-45

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

1. Understand the basics of how an image is processed
2. Enhance, Analyze and segment the image using algorithms
3. To interpret the image and transform it using the mathematical knowledge
4. Extract the features from the image and represent using morphological operations
5. Apply the concept in understanding the scene and process the background part of the image.

#### Course Content

**UNIT I****15****Hours**

Basics of Image Processing: Image Formation Physics, Image Digitization – Sampling and Quantization, Digital Image Properties, Color Image, Color spaces/ conversions, Cameras

Preprocessing and Image Enhancement:

Image enhancement methods: Contrast Adjustment-Histogram Manipulation-Image Smoothing-Image Sharpening;

Image Enhancement using Linear Filters – Ideal Low Pass Filter - Gaussian Filter – Ideal Noise Reduction using non linear filters-Geometric Rectification using Bilinear Interpolation-Suppression of in homogeneities using Homomorphic Filtering.

**UNIT II****10****Hours**

Image Analysis and Segmentation: Thresholding - Edge detection- Edge Based Segmentation – Region Based Segmentation- Active Contour Models – Graph Based segmentation - Image Analysis- invariant feature - Image transforms.

**UNIT III****10****Hours**

Mathematical Morphology and Texture Description Image Invariant feature: Skeletons and object marking – Morphological Segmentation – Statistical Texture Description – Co-occurrence matrices – Local Binary Patterns – Syntactic Texture.

Description Methods - Object Measurement - Counting -Visual inspection tasks regarding textures

**UNIT IV****10****Hours**

Wavelet Transform and Multi-resolution Analysis/image transforms: Image transforms - Frequency domain transformations - FFT's – Haar Wavelet - Multiresolution analysis - Scale-invariant features.

Motion Analysis: Optical Flow – Detection and Correspondence of Interest Points - Detection of Motion

Patterns – Video Tracking – Motion Models to aid tracking: Kalman Filters - stereo mapping- image fusion

**Text Books/Suggested References:**

1. Intelligent Autonomous Systems Foundations and Applications by Pratihari, Dilip Kumar, Springer, 2010



2. The Autonomous System: A Foundational Synthesis of the Sciences of the Mind Szabolcs Michael de Gyurky, Mark A. Tarbell, Wiley, 2013
3. Creating Autonomous Vehicle Systems by Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc Gaudiot, Morgan & Claypool Publishers , 2018

**SEMESTER-VI****Course Title: MACHINE LEARNING****Course Code: BAI701**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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: Deep Learning****Course Code: BAI702**

L	T	P	Credits
3	0	0	3

**Total Hours-45**

**Learning Outcomes:** After completion of this course, the learner will be able to:  
 To introduce the fundamentals of deep learning and the main research activities in this field. To learn architectures and optimization methods for deep neural network training

**Course Contents:****UNIT I****10****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****10****Hours**

Module 2: 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****10****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

**Suggested Readings**

1. Deep Learning, Ian Goodfellow Yoshua Bengio Aaron Courville, MIT Press, 2017
2. Neural Networks and Deep Learning, Michael Nielsen,, Determination Press

**Reference Books**

1. Deep Lear
2. ning Step by Step with Python, N D Lewis, 2016

**Course Title: Data and Visual analytics in AI**

**Course Code: BAI703**

L	T	P	Credits
3	0	0	3

**Total**

**Hours-45**

**Learning Outcomes:**

1. Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc
2. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning
3. Design and implement various machine learning algorithms in a range of real-world applications

**Course Content**

**UNIT I**

**15**

**Hours**

Introduction

Data for Graphics, Design principles, Value for visualization, Categorical, time series, and statistical data graphics, Introduction to Visualization Tools

Graphics Pipeline and Aesthetics and Perception

Introduction, Primitives: vertices, edges, triangles, Model transforms: translations, rotations, scaling, View transform, Perspective transform, window

transform, Graphical Perception Theory, Experimentation, and the Application, Graphical Integrity, Layering and Separation, Color and Information, Using Space

**UNIT II**

**10**

**Hours**

Graphics Pipeline and Aesthetics and Perception

Introduction, Primitives: vertices, edges, triangles, Model transforms: translations, rotations, scaling, View transform, Perspective transform, window transform, Graphical Perception Theory, Experimentation, and the Application, Graphical Integrity, Layering and Separation, Color and Information, Using Space

**UNIT III**

**10 Hours**

Visualization Design

Visual Display of Quantitative Information, Data-Ink Maximization, Graphical Design, Exploratory Data Analysis, Heat Map

Collaboration

Graph Visualization and Navigation, Online Social Networks, Social Data Analysis, Collaborative Visual Analytics, Text, Map, Geospatial data

**UNIT IV**

**10 Hours**

Multidimensional Data and Interaction : Query, Analysis and Visualization of Multi-Dimensional Relational Databases, Interactive Exploration, tSNE, Interactive Dynamics for Visual Analysis, Visual Queries, Finding Patterns in Time Series Data, Trend visualization, Animation, Dashboard, Visual Storytelling

**Text Books/Suggested References:**

1. The Visual Display of Quantitative Information by E. Tufte, Graphics Press, 2nd Edition, 2001
2. Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, Khanna Publishing 2019.
3. Data Visualization Handbook by J. Koponen, J. Hildén, CRC Press, 2019
4. The Book of Trees: Visualizing Branches of Knowledge by M. Lima, Princeton Architectural Press, 2014
5. Handbook of Graph Drawing and Visualization by R. Tamassia, CRC Press, 2013
6. Interactive Data Visualization for the Web by S. Murray O'Reilly Press, 2nd Edition, 2017.

**Course Title: Introduction to Robotics****Course Code: BAI704**

L	T	P	Credits
3	0	0	3

**Total Hours: 45****Course Objective:****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 Contents:

**UNIT I****10 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****15 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****10 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

Suggested References:

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

**Course Title: PROJECT -II**

**Course Code: BAI705**

L	T	P	Credits
0	0	4	2

**Total Hours: 30**

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

5. Use latest multimedia devices and programming software.
6. Design and construct a hardware and software system, component or process to meet desired needs.
7. Classify the multidisciplinary Problems of project.
8. 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**

Project should include following phases: System Analysis and Design

Coding - Implementation Testing

It should be a working project Must have a future perspective

The Domain of project can be from:

Databases

Application software

System software

Multimedia

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: Industrial Training**

L	T	P	Cr
0	0	0	4

**Course Code: BAI706****Total Hours:60****Course Learning Outcome: On successful completion of this course, the students 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 Title: BLOCK CHAIN ARCHITECTURE DESIGN****Course Code: BAI707**

L	T	P	Credits
3	0	0	3

**Total Hours: 45****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****10 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**

**10Hours**

**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**

**10 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.

**Course Title: DIGITAL FORENSICS**

**Course Code: BAI708**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total Hours: 45**

**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**

**10 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**

**10 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**

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

**Course Title: Data ware Housing & Data Mining**  
**Course Code: OEC087**

L	T	P	Cr
3	0	0	3

**Total Hours: 45**

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

1. Design and deploy appropriate classification techniques
2. Cluster the high dimensional data for better organization of the data
3. Discover the knowledge imbued in the high dimensional system
4. Evolve Multidimensional Intelligent model from typical system
5. Evaluate various mining techniques on complex data objects

## **Course Content**

### **UNIT-1**

**10 Hours**

Need for strategic information, difference between operational and Informational data stores Data warehouse definition, characteristics, Data warehouse role and structure, OLAP Operations, Data71 mart, Different between data mart and data warehouse, Approaches to build a data warehouse, Building a data warehouse, Metadata & its types.

### **UNIT-II**

**15 Hours**

**Data Pre-processing:** Need, Data Summarization, Methods. De-normalization, Multidimensional data model, Schemas for multidimensional data (Star schema, Snowflake Schema, Fact Constellation Schema, Difference between different schemas. Data warehouse architecture, OLAP servers, Indexing OLAP Data, OLAP query processing, Data cube computation

### **UNIT-III**

**10 Hours**

**Data Mining:** Definition, Data Mining process, Data mining methodology, Data mining tasks, Mining various Data types & issues. Attribute-Oriented Induction, Association rule mining, Frequent itemset mining, The Apriori Algorithm, Mining multilevel association rules.

**UNIT-IV****10 Hours**

Overview of classification, Classification process, Decision tree, Decision Tree Induction, Attribute Selection Measures. Overview of classifier's accuracy, Evaluating classifier's accuracy, Techniques for accuracy estimation, increasing the accuracy of classifier. Introduction to Clustering, Types of clusters, Clustering methods, Data visualization & various data visualization tools.

**Suggested Readings**

1. Data Warehousing, Data Mining & Olap by Berson, Tata McGraw- Hill.
2. Han J., Kamber M. and Pei J., Data mining concepts and techniques, Morgan Kaufmann Publishers (2011) 3rd ed.
3. Pudi V., Krishana P.R., Data Mining, Oxford University press, (2009) 1st ed.
4. Adriaans P., Zantinge D., Data mining, Pearson education press (1996), 1st Ed.
5. Pooniah P., Data Warehousing Fundamentals, Willey interscience Publication, (2001)

**Course Title: Big Data****Course Code: OEC088**

L	T	P	Cr
3	0	0	3

**Total Hours: 45**

**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**

**10Hours**

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**

**12Hours**

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**

**13Hours**

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**

**10Hours**



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.

### SEMESTER-VIII

**Course Title: PROJECT -III**

**Course Code: BAI801**

L	T	P	Credits
0	0	10	5

**Total Hours: 75**

**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. Do work on multidisciplinary Problems.
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

Project should include following phases: System Analysis and Design  
Coding - Implementation Testing

It should be a working project Must have a future perspective

The Domain of project can be from:

Databases

Application software

System software

Multimedia

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

The reports will be assessed by teacher in-charge of the training. The student has to appear in Viva-voce examination.

### **SEMESTER-VIII**

**Course Title: Entrepreneurship Development**

**Course Code: BAI802**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>NC</b>

**Total Hours:30**

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

1. Assess the commercial viability of new technologies, business opportunities and existing companies
2. Plan, organize, and execute a project or new venture with the goal of bringing new products and service to the market
3. Carry out scientific research in the field of entrepreneurship
4. Improved your interpersonal and collaborative skills
5. Write scientific reports and communicate the results in a professional manner

### **UNIT-I**

**10Hours**

**Introduction to Generic Skills:** Importance of Generic Skill Development (GSD), Global and Local Scenario of GSD, Life Long Learning (LLL) and associated importance of GSD.

**Managing Self:** Knowing Self for Self Development- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc., Managing Self – Physical- Personal grooming, Health, Hygiene, Time Management, Managing Self – Intellectual development - Information Search: Sources of information, Reading: Purpose of reading, different styles of reading, techniques of systematic reading, Note Taking: Importance of note taking, techniques of note taking, Writing: Writing a rough draft, review and final draft. Managing Self – Psychological, Stress, Emotions, Anxiety-concepts and significance, Techniques to manage the above.

## **UNIT-II**

**5Hours**

**Managing in Team:** Team - definition, hierarchy, team dynamics, Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background, Communication in group - conversation and listening skills.

## **UNIT-III**

**5Hours**

**Task Management:** Task Initiation, Task Planning, Task execution, Task close out, Exercises/case studies on task planning towards development of skills for task management

**Problem Solving:** Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving, Different approaches for problem solving. Steps followed in problem solving. Exercises/case studies on problem solving.

## **UNIT-IV**

**5Hours**

**Entrepreneurship:** Introduction, Concept/Meaning and its need, Competencies/qualities of an entrepreneur, Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level. Market Survey and Opportunity Identification (Business Planning)- How to start a small scale industry, Procedures for registration of small-scale industry, List of items reserved for exclusive manufacture in small-scale industry, Assessment of

demand and supply in potential areas of growth, understanding business opportunity, Considerations in product selection, Data collection for setting up small ventures. Project Report Preparation- Preliminary Project Report, Techno-Economic Feasibility Report, Exercises regarding “Project Report Writing” for small projects

### **SEMESTER-VIII**

**Course Title: Neural Network**

**Course Code: BAI802**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Cr</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total Hours:45**

**Course Outcomes:**

1. Understand the concepts of computational intelligence like machine learning
2. Ability to get the skill to apply machine learning techniques to address the real time problems
3. in different areas
4. Understand the Neural Networks and its usage in machine learning application.

**Course Content**

**UNIT – I 15 Hours**

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find- S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias. Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

**UNIT – II 10 Hours**

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm. Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face

recognition, advanced topics in artificial neural networks. Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

**UNIT – III 10 Hours**

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm. Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning. Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

**UNIT- IV 10 Hours**

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms. sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution. Reinforcement Learning – Introduction, the learning task, Q-learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

**TEXT BOOK:**

**1. Machine Learning – Tom M. Mitchell, - MGH**

**REFERENCE BOOK:**

**2. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.**

**Course Title: Autonomous Drones**

**Course Code: BAI804**

<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Total**

**Hours-45**

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

1. Complete understanding of autonomous systems.
2. Create a model of basic autonomous vehicle.
3. Understand, design and implement an autonomous robot.
4. Understand, design and implement an autonomous drone.

**Course Content**

**UNIT I**

**10**

**Hours**

Introduction: What are autonomous systems? AI in autonomous systems, Autonomous systems vs robots

Functional architecture: Major functions in an autonomous vehicle system, Motion Modelling - Coordinate frames and transforms, point mass model

**UNIT II**

**10**

**Hours**

Modelling in autonomous systems: Vehicle modelling (kinematic and dynamic bicycle model - two-track models), Sensor Modelling - encoders, inertial sensors, GPS.

**UNIT III**

**10**

**Hours**

SLAM

Localization and mapping fundamentals, LIDAR and visual SLAM, Navigation - Global path planning, Local path planning, Vehicle control - Control structures, PID control, Linear quadratic regulator, Sample controllers.

**UNIT IV**

**15**

**Hours**

Drones

overview, definition, applications, components platforms, propulsion, on-board flight control, payloads, communications, concepts of flight, regulatory norms

and regulations, Machine learning and deep learning for autonomous driving, Case study.

**Text Books/Suggested References:**

1. Intelligent Autonomous Systems Foundations and Applications by Pratihari, Dilip Kumar, Springer, 2010
2. The Autonomous System: A Foundational Synthesis of the Sciences of the Mind Szabolcs Michael de Gyurky, Mark A. Tarbell, Wiley, 2013
3. Creating Autonomous Vehicle Systems by Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc Gaudiot, Morgan & Claypool Publishers , 2018

**Course Title: ADHOC & SENSOR NETWORK****Course Code: OEC089**

L	T	P	Credits
3	0	0	3

**Total Hours-45****Learning Outcomes:** After completion of this course, the learner will be able to:

1. Identify the major issues associated with ad-hoc/sensor networks.
2. Explore current ad-hoc/sensor technologies by researching key areas such as algorithms, protocols, hardware, and applications.
3. Examine the experience through real-world programming projects on ad-hoc/sensor hardware.
4. Implement or develop algorithms involved in ad-hoc/sensor systems.

**Course Content****UNIT I****10****Hours**

**Introduction to Ad Hoc Wireless Networks:** Characteristics of MANETs, Applications of MANETs, Challenges, And Routing in MANETs: Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols.

**UNIT II****15****Hours**

**Data Transmission in MANETs:** The Broadcast Storm, Multicasting, And Geocaching TCP over Ad Hoc Networks: TCP Protocol overview, TOP and MANETs, Solutions for TOP over Ad Hoc. Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing-

**UNIT III****10****Hours**

**Basics of Wireless Sensors and Applications:** The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications. Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

**UNIT IV****10****Hours**

**Data Retrieval in Sensor Networks:** Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic



nature of WSNs.

### Transaction Modes

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

### Suggested Readings

- *C Siva Ram Murthy, B.S.Murthy. (2004). Adhoc Wireless Networks Architectures and Protocols. Pearson Education.*
- *Fei Hu, XiaojunCao, AnAuerbach book, CRC Press. (2010). Wireless Sensor Networks — Principles and Practice. Taylor &Francis Group.*

**Course Title: DESIGN & DEVELOPMENT OF APPLICATIONS**

L	T	P	Credits
3	0	0	3

**Course Code: OEC090**

**Total Hours: 45**

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

1. Learn the basics of learning problems with hypothesis and version spaces
2. Understand the features of machine learning to apply on real world problems
3. Characterize the machine learning algorithms as supervised learning and unsupervised learning and apply and analyze the various algorithms of supervised and unsupervised learning
4. Analyze the concept of neural networks for learning linear and non-linear activation functions

### Course Content

#### UNIT1

**10**

#### Hours

**Introduction:** Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

#### UNIT II

**10**

#### Hours

**Basic Design:** Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch

events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability

### **UNIT III**

**15**

#### **Hours**

**Advanced Design:** Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

**Technology Android:** Introduction – Establishing the development environment Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server-side applications – Using Google Maps, GPS and Wi-Fi – Integration with social media applications.

### **UNIT IV**

**10**

#### **Hours**

**IOS:** Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wi-Fi - iPhone marketplace. Swift: Introduction to Swift, features of swift.

#### **Transaction Modes**

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

#### **Suggested Readings**

- *Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012*
- *AnubhavPradhan, Anil V Despande Composing Mobile Apps, Learn ,explore, apply*
- *James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012*
- *Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012*
- *David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6. Development: Exploring the iOS SDK”, Apress, 2013.*