

GURU KASHI UNIVERSITY



B. Tech Computer Science & Engineering (Single Major)

Session: 2025-26

Faculty of Engineering & Technology

Graduate Attributes of the Programme: -

Type of learning outcomes	The Learning Outcomes Descriptors
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/interdisciplinary areas of learning	The programme focuses to design and develop computer programs in the areas related to algorithm, networking, web design and cloud computing to understand, analyze, develop and efficiently solve problems related to computer-based systems.
Generic learning outcomes	The generic learning outcomes for graduates typically include: Problem Analysis, Design and Development, Modern Tool Usage, Lifelong Learning
	1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. 2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. 3. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. 4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. 5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. 6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. 7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. 8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. 9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

	10.Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. 11.Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. 12.Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
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Programme Learning outcomes: An Undergraduate Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 4.5:

Element of the Descriptor	Programme learning outcomes relating to Undergraduate Certificate programme
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
	Understand about engineering applications and its importance in society.
	Understand programming Skills to solve simple numerical method problems.
	Identify, formulate and analysis of mathematics, natural sciences, and engineering sciences.
General, technical and professional skills required to perform and accomplish tasks	Design experiments and acquires data in order to explore physical principles, effectively communicate results, and evaluate related scientific studies.
Application of knowledge and skills	Development of tools for job-ready skills, and entrepreneurship skills.
Generic learning outcomes	Understanding of global change and sustainability while placing the development of physics.
Constitutional, humanistic, ethical, and moral values	Development of physics in its historical and cultural context.

Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Design new instruments for entrepreneurship skills with practical knowledge. Acquire necessary skills/hand on experience/ working knowledge on live projects and experiments.
Credit requirements	48
Entry requirements	A candidate who has passed Senior Secondary Certificate Examination (Class XII level) of the Board of School Education, Punjab; or any other examination recognized as equivalent thereto with minimum passing marks in aggregate, shall be eligible to join First Semester of the Undergraduate (UG) Programme.

Semester: 1st									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int.	Ext.	Total Marks
BCS1100	Engineering Physics	Major Core Course	3	0	0	3	30	70	100
BCS1101	Engineering Mathematics-I	Major Core Course	3	1	0	4	30	70	100
BCS1102	Engineering Physics Lab	Major Core Course	0	0	2	1	30	70	100
BCS1103	Engineering Graphics & Drawing	DSEC	4	0	0	4	30	70	100
BCS1104	Communication Skills-I	Ability Enhancement Course	2	0	0	2	30	70	100
VAC0001	Environment Education	VAC	2	0	0	2	30	70	100
BCS1105	Principle of Economics	Multidisciplinary Course	3	0	0	3	30	70	100
BCS1106	Basic Electrical Engineering	Minor Course	3	0	0	3	30	70	100
BCS1107	Basic Electrical Engineering Lab	Minor Course	0	0	2	1	30	70	100
BCS1108	Computer Proficiency	Skill Enhancement Course	2	0	0	2	30	70	100
BCS1109	Computer Proficiency Lab	Skill Enhancement Course	0	0	2	1	30	70	100
BCS1110	Entrepreneurship Setup & Launch	Skill Enhancement Course	0	0	4	2	30	70	100
Total			22	1	08	27	330	770	1100

Semester: 2nd

Course Code	Course Title	Type of Course	L	T	P	No of Credits	Int	Ext	Total Marks
BCS2150	Engineering Chemistry	Major Core Course	3	0	0	3	30	70	100
BCS2151	Engineering Mathematics-II	Major Core Course	3	1	0	4	30	70	100
BCS2152	Engineering Chemistry Lab	Major Core Course	0	0	2	1	30	70	100
BCS2153	Communication Skills-II	Ability Enhancement Course	2	0	0	2	30	70	100
BCS2154	Manufacturing Practices	Skill Enhancement Course	0	0	6	3	30	70	100
BCS2155	Indian Constitution	Multidisciplinary	3	0	0	3	30	70	100
VAC0002	Human Values and Professional Ethics	VAC	2	0	0	2	30	70	100
BCS2156	Programming for Problem Solving	Minor Course	3	0	0	3	30	70	100
BCS2157	Programming for Problem Solving Lab	Minor Course	0	0	2	1	30	70	100
Total			16	1	10	22	240	560	800

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

Element of the Descriptor	Programme learning outcomes relating to Undergraduate Diploma programme
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Understand the advanced and latest manufacturing techniques being used in engineering industry.
	Apply knowledge of reading & writing language skills.
	Identify, formulate and analysis of mathematics, natural sciences, and engineering sciences.
General, technical and professional skills required to perform and accomplish tasks	Ability to analyze situations and propose logical solutions.
	Reading & Writing reports, presenting ideas, and articulating thoughts clearly. Keeping up with new concepts and changes in technology or business practice.
	Ability to find credible sources, analyze data, and synthesize information.
Application of knowledge and skills	Develop knowledge of applications of algorithms for the creation, insertion, deletion, searching and sorting of each data structure problem. Develop solutions for a range of problems using objects and classes.
Generic learning outcomes	Ability to describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.
Constitutional, humanistic, ethical, and moral values	Construct the ability to face difficult situations in life boldly and resolve them confidently.
Employability and job-ready skills, and	Analyze and design various combinational and sequential circuits.

entrepreneurship skills and capabilities/qualities and mindset	
Credit requirements	94
Entry requirements	A student can re-enter into second year of a programme if she/he has taken an exit option after first year(UG DIPLOMA in CSE).

Semester: 3rd									
Course Code	Course Title	Type of Course	L	T	P	No of Credits	Int.	Ext.	Total Marks
BCS3200	Object Oriented Programming Using C++	Major Core Course	3	0	0	3	30	70	100
BCS3201	Object Oriented Programming Using C++ Lab	Major Core Course	0	0	2	1	30	70	100
BCS3202	Data Structure & Algorithms	Minor Core Course	3	0	0	3	30	70	100
BCS3203	Data Structure & Algorithms Lab	Minor Core Course	0	0	2	1	30	70	100
BCS3204	Digital Electronics	Skill Enhancement Course	2	0	0	2	30	70	100
BCS3205	Professional Communication	Ability Enhancement Course	2	0	0	2	30	70	100
BCS3206	Numerical Methods and Analysis	DSEC	4	0	0	4	30	70	100
BCS3207	Digital Electronics Lab	Skill Enhancement Course	0	0	2	1	30	70	100
IKS0006	Indian Health Sciences	VAC	2	0	0	2	30	70	100
BCS3208	Sustainable Development	Multidisciplinary Course	3	0	0	3	30	70	100
Total			19	0	06	22	300	700	1000

Semester: 4th									
Course Code	Course Title	Type of Course	L	T	P	No of Credits	Int.	Ext.	Total Marks
BCS4250	Discrete Mathematics	Major Core Course	4	0	0	4	30	70	100
BCS4251	Operating System	Major Core Course	3	0	0	3	30	70	100
BCS4252	Operating System Lab	Major Core Course	0	0	2	1	30	70	100
BCS4253	Design & Analysis of Algorithms	Major Core Course	3	0	0	3	30	70	100
BCS4254	Design & Analysis of Algorithms Lab	Major Core Course	0	0	2	1	30	70	100
BCS4255	Computer Organization & Architecture	Vocational Course	4	0	0	4	30	70	100
BCS4256	Report Writing	Ability Enhancement Course	2	0	0	2	30	70	100
IKS0009	Indian Agriculture	VAC	2	0	0	2	30	70	100
Discipline Specific Elective Course -1(Any one of the following)									
BCS4257	Network Security	Discipline Specific Elective	4	0	0	4	30	70	100
BCS4258	E-Commerce								
Total			22	0	04	24	270	630	900

Programme learning outcomes: An Bachelor of Vocational in CSE awarded to students who have demonstrated the achievement of the outcomes located at level 5.5:

Element of the Descriptor	Programme learning outcomes relating to 3year UG Degree programme
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	An understanding of and apply current theories, models, programming and techniques that provide a basis for the software lifecycle Development & Training.
	Discuss the basic concepts of open source platform to understand programming skills.
	Identify, formulate and analysis of mathematics, natural sciences, and engineering sciences.
General, technical and professional skills required to perform and accomplish tasks	Develop the logic ability in order to master your programming skills Software Product, Software crisis, Handling complexity through Abstraction and Decomposition.
Application of knowledge and skills	Develop solutions for a range of problems using different computers based experimentation and analyze, interpret data.
Generic learning outcomes	Design & develop different applications software of different programming language on different platforms. Organize web media objects using editing software. Problem-Solving & Analytical Thinking. Develop an entrepreneurial mindset by identifying market problems and creating tech solutions.
Constitutional, humanistic, ethical, and moral values	Construct the ability to face difficult situations in life boldly and resolve them confidently.

Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Ability to have Technical Skills (Hard Skills) in different fields like cybersecurity, Web Development, App Development: Android. Software Development Life Cycle (SDLC) & Agile Methodologies. Hands-on experience with real-world projects.
Credit requirements	142
Entry requirements	A student can re-enter into third year of a programme if she/he has taken an exit option after 2 nd year(U.G Diploma in CSE).

Semester: 5th									
Course Code	Course Title	Type of Course	L	T	P	Credits	Int.	Ext.	Total Marks
BCS5300	Java Programming	Major Core Course	3	0	0	3	30	70	100
BCS5301	Java Programming Lab	Major Core Course	0	0	2	1	30	70	100
BCS5302	Relational Database Management System	Major Core Course	3	0	0	3	30	70	100
BCS5303	Relational Database Management System Lab	Major Core Course	0	0	2	1	30	70	100
BCS5304	Web Designing & Development	Vocational Course	3	0	0	3	30	70	100
BCS5305	Web Designing & Development Lab	Vocational Course	0	0	2	1	30	70	100
BCS5306	Design & Development of Applications	Major Core Course	4	0	0	4	30	70	100
Discipline Specific Elective Course -II(Any one of the following)									
BCS5307	Cyber Law & Ethics in Computer Vision	Discipline Elective Course	4	0	0	4	30	70	100
BCS5308	Multimedia and Application								
Discipline Specific Elective Course -III (Any one of the following)									
BCS5309	Software Engineering	Discipline Elective Course	4	0	0	4	30	70	100
BCS5310	Security Engineering								
Total			21	0	06	24	270	630	900

Semester: 6th									
Course Code	Course Title	Type of Course	L	T	P	Credits	Int.	Ext.	Total Marks
BCS6350	Formal Language & Automata Theory	Major Core Course	4	0	0	4	30	70	100
BCS6351	Computer Networks	Major Core Course	4	0	0	4	30	70	100
BCS6352	Big Data	Major Core Course	4	0	0	4	30	70	100
BCS6353	Python with R-Programming	Vocational Course	3	0	0	3	30	70	100
BCS6354	Python with R-Programming-Lab	Vocational Course	0	0	2	1	30	70	100
Discipline Specific Elective Course -IV (Any one the Following)									
BCS6355	Deep Learning	Discipline Elective	4	0	0	4	30	70	100
BCS6356	Mobile Application Development								
Discipline Specific Elective Course -V (Any one of the Following)									
BCS6357	Natural Language Processing	Discipline Elective	4	0	0	4	30	70	100
BCS6358	Soft Computing								
Total			23	0	2	24	210	490	700

Programme learning outcomes: The Bachelor's degree in B.Tech CSE is awarded to students who have demonstrated the achievement of the outcomes located at level 6:

Element of the Descriptor	Programme learning outcomes relating to Bachelor's Degree (Honors)
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Understanding of advanced computer science concepts, industry trends, and research-oriented knowledge.
	focuses on specialization, innovation, and career preparation.
General, technical and professional skills required to perform and accomplish tasks	Advanced technical expertise, professional skills, and general competencies that prepare them for jobs, research, and entrepreneurship.
Application of knowledge and skills	Apply their theoretical knowledge and technical skills to real-world projects, industry-oriented tasks, research, and innovation.
Generic learning outcomes	Students will be Advanced Technical Proficiency. Project Management and Team Collaboration skill. Recognizing the rapid evolution of technology, students should be prepared for continuous learning and professional development throughout their careers.
Constitutional, humanistic, ethical, and moral values	Construct the ability to face difficult situations in life boldly and resolve them confidently.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Ability to have Technical Skills (Hard Skills) in different fields like cybersecurity, Web Development, App Development: Android. Software Development Life Cycle (SDLC) & Agile Methodologies. Hands-on experience with real-world projects.

Credit requirements	186
Entry requirements	A student can re-enter into fourth year of a programme if she/he has taken an exit option after 3 rd year(B.Voc in CSE).

Semester: 7th									
Course Code	Course Title	Type of Course	L	T	P	No of Credits	Int.	Ext.	Total Marks
BCS7400	Machine Learning	Major Core Course	4	0	0	4	30	70	100
BCS7401	Internet of things	Major Core Course	4	0	0	4	30	70	100
BCS7402	Artificial Intelligence	Major Core Course	4	0	0	4	30	70	100
BCS7403	Introduction to Robotics	Minor	4	0	0	4	30	70	100
BCS7404	Project-I(Literature & problem formulation)	Minor Course	0	0	8	4	30	70	100
Discipline Specific Elective Course -VI(Any one of the following)									
BCS7405	Block chain Architecture Design	Discipline Elective	4	0	0	4	30	70	100
BCS7406	Digital Forensics								
Total			20	0	08	24	180	420	600

Semester: 8th									
Course Code	Course Title	Type of Course	L	T	P	No of Credits	Int.	Ext.	Total Marks
BCS8450	Internship	Internship	0	0	0	20	30	70	100
Total			0	0	0	20	30	70	100
Grand Total			143	2	46	188	1495	3230	4700

SEMESTER-1st

Course Title: ENGINEERING PHYSICS	L	T	P	Credits
Course Code: BCS1100	3	0	0	3

Total Hours: 45

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

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

Course Content

Unit-I

8 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

7 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.

Transactional Mode:

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

Suggested Readings:

- Griffith, D. J., & Ruppener, G. (1981). *Introduction to electrodynamics*.
- Saslow, W. M. (2002). *Electricity, magnetism, and light*. Elsevier.
- Subrahmanyam, N. (2012). *A textbook of optics*. S. Chand Publishing.
- Murugesan, R., & Sivaprasath, K. (2016). *Modern physics*. S. Chand Publishing.
- Avadhanulu, M. N., & Murthy, T. A. (2008). *Engineering Physics*. S. Chand Publishing.
- Beiser, A. (2003). *Concepts of modern physics*.

Course Title: Engineering Mathematics-I	L	T	P	Credits
Course Code: BCS1101	3	1	0	4

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.

Transactional Mode:

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 LTTC. 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 Physics Lab	L	T	P	Credits
Course Code: BCS1102	0	0	2	1

Total Hours: 15

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

1. Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.
2. Understand the Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuits.

3. Analysis of Single-Phase AC Circuits, the representation of alternating

Course Title: Engineering Graphics & Drawing	L	T	P	Credits
Course Code: BCS1103	4	0	0	4

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.

Total Hours: 60

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

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

Course Content

Unit- I**15****Hours**

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and 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**15****Hours**

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

Unit- III**15****Hours**

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

Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, shares, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Customization& CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, setting up of Unit--s and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Unit-IV**15****Hours**

Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to Credits ate drawings, Credits ate, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of

composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerance techniques; dimensioning and scale multi views of dwelling; Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: Creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerance; Use of solid-modeling software for Credits eating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).

Transactional Mode:

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.

Course Title: Communication Skills-I	L	T	P	Credits
Course Code: BCS1104	2	0	0	2

Total Hours: 30

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

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

Course Content

Basics of Communication

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

Unit-II

8

Hours

Written Communication Skills

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

Unit-III

7

Hours

Verbal and Presentation Skills

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

Unit-IV

8

Hours

Advanced Communication and Professional Skills

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

Transactional Mode:

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

Suggested Readings:

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

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

Total Hours:30

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

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

Course Content

Unit- 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

10

Hours

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

Unit-III

8 Hours

Disaster Management: Floods, earthquake, cyclone and landslides.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness.

Unit-IV

6

Hours

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

Transactional Mode:

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

Suggested Readings:

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

Course Title: Principle of Economics	L	T	P	Credits
Course Code: BCS1105	3	0	0	3

Total Hours: 45

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

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

Course Content

Unit-I **10**
Hours

Introduction to economics

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

Unit-II **15**
Hours

Demand, Supply, Elasticities, and Market Efficiency

The economic problem of scarcity, choice, and opportunity cost, Demand, supply, and market equilibrium, Demand and supply applications, Consumer surplus and producer's surplus, Market efficiency and their applications, Elasticity: its various

forms and estimation methods, elasticity, and total revenue, Elasticity applications in the field of energy and environment, Utility, Preferences and Choice, Budget constraints, determination of optimal choices using indifference curve analysis and its applications, Behavioral economics as an alternative framework of consumer choice

Unit-III

10

Hours

Production and Cost

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

Unit-IV

10

Hours

Market structure and regulation

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

National Income Accounting

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

Transactional Mode:

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

Suggested Readings:

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

Course Title: Basic Electrical Engineering	L	T	P	Credits
Course Code: BCS1106	3	0	0	3

Total Hours:45

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

1. Understand the DC and AC electrical circuit elements with RLC.
2. Analysis of simple circuits with dc excitation. Superposition, 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 **10** **Hours**

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

Unit-II **13** **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 **12** **Hours**

Electrical Machines: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic, Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor, Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Unit-IV **10 Hours**

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit-- (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries,

Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Transactional Mode:

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

Suggested Readings:

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

Course Title: Basic Electrical Engineering Lab	L	T	P	Credits
Course Code: BCS1107	0	0	2	1

Total Hours:15

Course Title: Computer Proficiency	L	T	P	Credits
Course Code: BCS1108	2	0	0	2

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

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

Course Content

List of experiments

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

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

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

Total Hours:30

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

1. Understand the concept of input and output devices of Computers
2. Study to use the Internet safely, legally, and responsibly.
3. discuss an operating system and its working, and solve common problems related to operating systems

4. Learn basic word processing, Spreadsheet and Presentation Graphics Software skills

Course Content

UNIT I

8 Hours

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

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

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

UNIT II

7 Hours

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

File Management Basics: Physical structure of disk

UNIT III

7 Hours

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

UNIT IV

8 Hours

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

Introduction to ASCII and Unicode standards

Transaction Modes

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

Suggested Readings

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

Course Title: Computer Proficiency Lab	L	T	P	Credits
Course Code: BCS1109	0	0	2	1

Total Hours:15

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

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

Course Content

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

Course Code: BCS110	L	T	P	Cr.
Course Title: Entrepreneurship Setup & Launch	0	0	04	02

Introduction:

This semester lays the foundation for the learner to understand what entrepreneurship is, beyond just starting a business. It introduces key ideas like problem-solving, value creation, and self-awareness. The learner will begin exploring basic business concepts while discovering their own interests and strengths.

Learners Objective:

1. Understand the core concepts of entrepreneurship through relatable, real-life examples.
2. Begin to see themselves as problem-solvers and creators.
3. Learn about business paths and choose one to try based on interest or local fit.

4. Launch a micro-hustle (online or offline) to earn their first income.
5. Build confidence and self-belief by doing.

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

Guiding Principles/Approach:

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

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

Semester Syllabus:

Format: 12 weeks, 4 hours/week | 2 credits

Revenue Target: ₹10,000

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

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

Weekly Component:

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

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

Evaluation Criteria

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

SEMESTER-2nd

Course Title: Engineering Chemistry	L	T	P	Credits
Course Code: BCS2150	3	0	0	3

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

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

Course Content**Unit-1****12 Hours**

Periodic properties: Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

Unit-II**11 Hours**

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

Unit-III**12 Hours**

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

Ionic, Dipolar and Vander Waals interactions, Equations of state of real gases and Critical phenomena.

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

Unit-IV**10 Hours**

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

Transactional Mode:

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

Suggested Readings:

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

Course Title: Engineering Mathematics –II	L	T	P	Credits
Course Code: BCS2151	3	1	0	4

Total Hours: 60

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

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

Course Content

Unit-I

14 Hours

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

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

Unit-II

15 Hours

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

Unit-III

15

Hours

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

Unit-IV

16 Hours

Transform Calculus: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions.

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

Transactional Mode:

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

Suggested Readings:

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

Course Title: Engineering Chemistry Lab	L	T	P	Credits
Course Code: BCS2152	0	0	2	1

Total Hours: 15

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

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

Course Content

List of Experiments

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

Course Title: Communication Skills -II	L	T	P	Credits
Course Code: BCS2153	2	0	0	2

Total Hours: 30

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

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

Course Content**Unit-I****5 Hours****Fundamentals of Inter-Personal Communication and Building Vocabulary:**

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

Unit-II**10 Hours**

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

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

Unit-III**8 Hours**

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

Unit-IV**7 Hours**

Group Discussion and Interview Skills: Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization

of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

Transaction Mode:

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

Suggested Readings:

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

Course Title: Manufacturing Practices	L	T	P	Credits
Course Code: BCS2154	0	0	6	3

Total Hours: 45

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

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

Course Content

Unit-I **15 Hours**
 Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.

Unit-II **10 Hours**
 CNC machining, Additive manufacturing, Fitting operations & power tools

Unit-III **10 Hours**
 Electrical & Electronics Carpentry, Plastic molding, glass cutting

Unit-IV **10 Hours**
 Metal casting, welding (arc welding & gas welding), brazing [More hours can be given to Welding for Civil Engineering students as they may have to deal with Steel structures fabrication and erection; 3D Printing is an evolving manufacturing technology and merits some lectures and hands-on training.]

Workshop Practice:

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Indian Constitution	L	T	P	Credits
Course Code: BCS2155	3	0	0	3

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

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

Course Content**Unit-I****5 Hours**

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

Unit-II**10 Hours**

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

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

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

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

Unit-III**10 Hours**

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

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

Unit-IV**5 Hours**

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

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

Transaction Mode:

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

Suggested Readings:

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

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

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

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

Course Content**Unit-I****10 Hours**

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

Unit-II**5 Hours**

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

Unit-III**10 Hours**

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

Unit-IV**5 Hours**

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Programming For Problem Solving	L	T	P	Credits
Course Code: BCS2156	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

10 Hours

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

Unit-II

15 Hours

Arithmetic expressions and precedence: Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching
Iteration and loops

Arrays: Arrays (1-D, 2-D), Character arrays and Strings

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of Equations, notion of order of complexity through example programs (no formal definition requirement).

Unit-III

10 Hours

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Recursion: Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit-IV

10 Hours

Structure: Structures, Defining structures and Array of Structures

Pointers: Idea of pointers, defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

File handling (only if time is available, otherwise should be done as part of the lab.)

Transaction Mode:

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

Suggested Readings:

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

Course Title: Programming For Problem Solving Lab	L	T	P	Credits
Course Code: BCS2157	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

SEMESTER-3rd

Course Title: Object Oriented Programming Using C++	L	T	P	Credits
Course Code: BCS3200	3	0	0	3

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

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

Course Content**Unit-I****10 Hours**

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

Unit-II**15 Hours**

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

9 Hours

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Object Oriented Programming Using C++ Lab	L	T	P	Credits
Course Code: BCS3201	0	0	2	1

Total Hours-15**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 & Algorithms	L	T	P	Credits
Course Code: BCS3202	3	0	0	3

Total Hours: 45

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

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

Course Content

Unit-I

8 Hours

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

Unit-II

12 Hours

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

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

Unit-III

10 Hours

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree, definitions, algorithms and analysis.

Unit-IV**15 Hours**

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Data Structure & Algorithm Lab	L	T	P	Credits
Course Code: BCS3203	0	0	2	1

Total Hours-15

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

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

Course Content

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

Course Title: Digital Electronics	L	T	P	Credits
Course Code: BCS3204	2	0	0	2

Total Hours: 30

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

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

Course Content

Unit-I

7 Hours

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

Unit-II

7 Hours

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

Unit-III

8 Hours

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

Unit-IV

8 Hours

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

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Professional Communication	L	T	P	Credits
Course Code: BCS3205	2	0	0	2

Total Hours-30

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

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

Course Content

Unit-I

10 Hours

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

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

Unit-II

10 Hours

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

Unit-III

5 Hours

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

Unit-IV

5 Hours

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

Transaction Mode:

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

Suggested Readings:

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

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

Course Title: Numerical Methods And Analysis	L	T	P	Credits
Course Code: BCS3206	4	0	0	4

Total Hours-60

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

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

Course Content

Unit-I

15 Hours

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

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

Unit-II

15 Hours

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

Unit-III

15 Hours

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

Unit-IV

15 Hours

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

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

Transaction Mode:

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

Suggested Readings:

- *Gerald, C. F. (2004). Applied numerical analysis. Pearson Education India.*
- *Jain, M. K. (2003). Numerical methods for scientific and engineering computation. New Age International.*
- *Mathews, J. H. (1992). Numerical methods for mathematics, science and engineering (Vol. 10). Prentice-Hall International.*
- *Burden, R. L., Faires, J. D., & Burden, A. M. (2015). Numerical analysis. Cengage learning*

Course Title: Digital Electronics Lab	L	T	P	Credits
Course Code: BCS3207	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: Indian Health Sciences	L	T	P	Credits
Course Code: IKS0006	2	0	0	2

Total Hours-30

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

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

Course Content

Unit-I

7 Hours

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

Unit-II

8 Hours

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

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

Unit-III

8 Hours

Dinacharya or daily regimen for the maintenance of good health. Ritucharya or seasonal regimen. Important Texts of Ayurveda. Selected extracts from *Astāngahrdaya* (selections from *Sūtrasthāna*) and *Suśruta-Samhitā* (sections on plastic surgery, cataract surgery and anal fistula). The large pharmacopeia of Ayurveda.

Unit-IV

7 Hours

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

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

Transactional Mode:

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

Suggested Readings:

- Park, K. (2005). Park's textbook of preventive and social medicine. *Preventive Medicine in Obstet, Paediatrics and Geriatrics*.
- Lad, V. (1984). *Ayurveda: The science of self-healing: A practical guide*. Lotus press.
- Bali, A. S., & Ramesh, M. (2021). Governing healthcare in India: A policy capacity perspective. *International Review of Administrative Sciences*, 87(2), 275-293.
- Teitelbaum, J., & Wilensky, S. (2009). *Essential readings in health policy and law* (Vol. 3). Jones & Bartlett Publishers.

Course Title: Sustainable Development	L	T	P	Credits
Course Code: BCS3208	3	0	0	3

Total Hours-45

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

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

Course Content

Unit-I

10 Hours

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

Unit-II

10 Hours

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

Unit-III

10 Hours

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

Unit-IV

10 Hours

Challenges in Sustainable Development-Diversity and Social Exclusion: Concept and implications, human development of the sociocultural and other ethnic groups of the society; Contemporary Issues of Development – Bottom of the pyramid

approach; Understanding the importance of social capital, social mobilization, social security, and population stabilization.

Transaction Mode:

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

Suggested Readings:

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

SEMESTER-4th

Course Title: Discrete Mathematics	L	T	P	Credits
Course Code: BCS4250	4	0	0	4

Total Hours-60**Learning Outcomes:** After completion of this course, the learner will be able to:

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

Course Content**Unit-I****15 Hours**

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

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

Total Hours: 60**Unit-II****15 Hours**

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination. Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Unit-III**15 Hours**

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

Unit-IV**15 Hours**

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Operating System	L	T	P	Credits
Course Code: BCS4251	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.

Transactional Mode:

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

Suggested Readings:

- Charles Crowley. (1996). *Operating System; A Design-oriented Approach*. 1st Edition, Irwin Publishing.
- Gary J.
- Nutt, Addison. (2002). *Operating Systems: A Modern Perspective*. 2nd Edition Wesley.
- Maurice Bach, Prentice-Hall of India (1986). *Design of the Unix Operation Systems*. 8th Edition.
- Daniel P. Bovet, Marco Cesati, O'Reilly and Associates. (2005). *Understanding the Linux Kernel*. 3rd Edition
- Waddington, D. G., and D. Hutchison. (1999): "Resource partitioning in general purpose operating systems." *ACM SIGOPS Operating Systems Review* 33, no. 4
- Abraham Silberschatz,(2021) Peter Baer Galvin, Greg Gagne, "Operating System Principles", 10th edition.

Web Links

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

Course Title: Operating System Lab	L	T	P	Credits
Course Code: BCS4252	0	0	2	1

Total Hours-15

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

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

Course Content

Installation Process of various operating systems

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

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

Course Title: Design & Analysis Of Algorithms	L	T	P	Credits
Course Code: BCS4253	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.

Transactional Mode:

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

Suggested Readings:

- Horowitz, E., Sahni, S., & Rajasekaran, S. (1997). *Computer algorithms C++: C++ and pseudocode versions*. Macmillan.
- Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2022). *Introduction to algorithms*. MIT press.
- Dietzfelbinger, M. (2008). Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, *Algorithms*, McGraw Hill, Boston (2007), p. x+ 320, Paperback \$33.75, ISBN: 978-007352340-8 Jon Kleinberg, Éva Tardos, *Algorithm Design*, Pearson/Addison Wesley, Boston (2006), p. xxiii+ 838, Hardcover \$103, ISBN: 978-032129535-4.
- Goodrich, M. T., & Tamassia, R. (2001). *Algorithm design: foundations, analysis, and internet examples*. John Wiley & Sons.
- Aho, A. V., & Hopcroft, J. E. (1974). *The design and analysis of computer algorithms*. Pearson Education India.
- Kleinberg, J., & Tardos, É. (2005). *Algorithm Design*, chapter Basics of Algorithm Analysis.
- Dasgupta, S., Meirovitch, Y., Zheng, X., Bush, I., Lichtman, J. W., & Navlakha, S. (2024). A neural algorithm for computing bipartite matchings. *Proceedings of the National Academy of Sciences*, 121(37), e2321032121.

Web Links

- <https://www.classcentral.com/course/swayam-Design-and-analysis-of-algorithms->
- https://vssut.ac.in/lecture_notes/lecture1428551222. *Design-and-analysis-of-algorithms-*
- <https://sites.northwestern.edu/hartline/eecs-336-Design-analysis-of-algorithms.>

Course Title: Design & Analysis Of Algorithms Lab	L	T	P	Credits
Course Code: BCS4254	0	0	2	1

Total Hours-15

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: Computer Organization & Architecture	L	T	P	Credits
Course Code: BCS4255	4	0	0	4

Total Hours-60

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

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

Course Content

Unit-I

18 Hours

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

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

Unit-II

15 Hours

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

12 Hours

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

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

Memory and cache coherency.

Unit-IV

15 Hours

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Report Writing	L	T	P	Credits
Course Code: BCS4256	2	0	0	2

Total Hours-30

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

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

Course Content

Unit-I

10 Hours

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a seminar/technical report, Minutes of meeting writing.

Unit-II

12 Hours

Drafting report and design issues: The use of drafts, Illustrations and graphics.

Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit-III

13 Hours

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

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

Unit-IV

10 Hours

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

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

Transaction Mode:

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

Suggested Readings:

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

Web Links

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

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

Total Hours-30

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

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

Course Content

Unit-I

7 Hours

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

Unit-II

7 Hours

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

Unit-III

8 Hours

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

Unit-IV

8 Hours

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

Transactional Mode:

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

Suggested Readings:

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

Course Title: Network Security	L	T	P	Credits
Course Code: BCS4257	4	0	0	4

Total Hours: 60

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

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

Course Content

Unit-I

16 Hours

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

Unit-II

10 Hours

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

Unit-III

17 Hours

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

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

Unit-IV

17 Hours

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: E-Commerce	L	T	P	Credits
Course Code: BCS4258	4	0	0	4

Total Hours-60

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

1. Identify the component parts of e-commerce
2. Identify the benefits of selling online
3. Know how to optimize and stay safe when selling online
4. Have an outline strategy for e-Commerce for your business?

Course Content

Unit-I

15 Hours

Introduction to E-Commerce: Definition, Scope of E-Commerce, Hardware requirements, Ecommerce and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce.

Unit-II

12 Hours

Business to Business E-Commerce: Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter-Organizational E-commerce.

Unit-III

15 Hours

Legal issues: Risks: Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, Service provider liability, Enforceable online contract.

Unit-IV

18 Hours

Security Issues: Security Solutions: Symmetric and Asymmetric Cryptosystems, RSA, DES, and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic Cash over internet, Internet Security.

Business to Consumer E-Commerce: Consumer trade transaction, Internet, Page on the Web, Elements of E-Commerce with VB, ASP, SQL.

E-business: Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E- Diversity, Case studies through internet.

Transactional Mode:

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

Suggested Readings:

- Qin, Z., Chang, Y., Li, S., & Li, F. (2014). *E-commerce strategy*. Springer.
- Kamlesh, B., & Debjani, N. (1999). *E-commerce: the cutting edge of business*.
- Reynolds, M. (2000). *Beginning Ecommerce: With VB, ASP, ADO and MTS*.
- Westland, J. C., & Clark, T. H. (2001). *Global electronic commerce theory and case studies*. Universities Press.
- Reynolds, M. (2000). *Beginning Ecommerce: With VB, ASP, ADO and MTS*.

SEMESTER-5th

Course Title: Java Programming	L	T	P	Credits
Course Code: BCS5300	3	0	0	3

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

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

Course Content**Unit-I****10 Hours****An overview of Java:** Object oriented programming, Two paradigms, abstraction, the OOP principles, Java class libraries**Date types, variables and arrays:** Integers, floating-point types, characters, Boolean, Iterates, Variable, Data types and casting, array operators.**Operators:** Arithmetic operators, bit wise operators, relational operators, Boolean logical operators, assignment operators, operator precedence**Control Statement:** Java's selection Statement, iteration Statement, jumps Statement.**Introduction to classes:** Class fundamentals, declaring object reference variable, introducing methods, constructors, the keywords, garbage collection, the finalize () method.**Methods and Classes:** Overloading methods, using objects as parameters, recursion.**Unit-II****10 Hours****Inheritance:** Inheritance basics, using super, method overriding, dynamic method dispatch, using abstract Classes, using final with inheritance, Package and Interfaces, Package protection, importing packages**Exception handling:** Exception handling fundamentals, Exception types, Uncaught Exceptions, using try and catch, multiple catch clauses, nested try Statement throw, and finally Java built in exception creating your own exception, sub classes, using exceptions**Unit-III****10 Hours**

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

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

Unit-IV

15 Hours

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

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

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

Transaction Mode:

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

Suggested Readings:

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

Web Links

- <https://www.codementor.io/@sureshatta/11-websites-that-help-Java-Programming>
- <https://www3.ntu.edu.sg/home/ehchua/programming/howto/References.html-Java-Programming>
- https://www.tradepub.com/free-offer/advanced-java-tutorial/w_java34?sr=hicat&t=hicat:827-Java-Programming

Course Title: Java Programming Lab	L	T	P	Credits
Course Code: BCS5301	0	0	2	1

Total Hours: 15**Learning Outcomes:** After completion of this course, the learner will be able to:

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

Course Content**List of Programs:**

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

Course Title: Relational Database Management System	L	T	P	Credits
Course Code: BCS5302	3	0	0	3

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

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

Course Content**Unit-I****15 Hours**

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

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

Unit-II**10 Hours**

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

Unit-III**10 Hours**

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

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

Unit-IV**10 Hours**

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

SQL Server: Introduction to SQL Server and Oracle Server, Indexes, Views, Cursors, Packages, Triggers, Stored Procedures.

No SQL: Introduction to NoSQL, Key Features, Advantages and Disadvantages of NoSQL, Types of NoSQL database.

Non-relational data and NoSQL: Document data stores, columnar data stores, Key/value data stores, Graph data stores, Object data stores, External index data stores, typical requirements.

Transaction Mode:

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

Suggested Readings:

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

Web Links

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

Course Title: Relational Database Management System Lab	L	T	P	Credits
Course Code: BCS5303	0	0	2	1

Total Hours: 15**Learning Outcomes:** After completion of this course, the learner will be able to:

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

Course Content**List of Experiments:**

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

Course Title: Web Designing & Development	L	T	P	Credits
Course Code: BCS5304	3	0	0	3

Total Hours-45

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

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

Course Content

Unit-I

10 Hours

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

Unit-II

15 Hours

Java Beans: Introduction to Java Beans, Advantages of Java Beans, JDK 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, The javax.servlet Package, Reading Servlet parameters, and Reading Initialization parameters. The javax. servlet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues

Unit-III

10 Hours

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

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

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

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

Unit-IV

10 Hours

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

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

Transaction Mode:

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

Suggested Readings:

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

Web Links

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

Course Title: Web Designing & Development Lab	L	T	P	Credits
Course Code: BCS5305	0	0	2	1

Total Hours-15

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

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

Course Content

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

Course Title: Design & Development of Applications	L	T	P	Credits
Course Code: BCS5306	4	0	0	4

Total Hours-60

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

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

Course Content

Unit-I

15 Hours

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

Unit-II

15 Hours

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

Unit-III

15 Hours

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

Unit-IV

15 Hours

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

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Cyber Law & Ethics In Computer Vision	L	T	P	Credits
Course Code: BCS5307	4	0	0	4

Total Hours-60

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

1. Analyze 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 scope of consumer protection in e-commerce. and offences and penalties under it act 2000.

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

15 Hours

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

15 Hours

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

15 Hours

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 Mode:

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

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: Multimedia and Applications	L	T	P	Credits
Course Code: BCS5308	4	0	0	4

Total Hours-60

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

1. Describe technical characteristics and performance of multimedia system and terminals.
2. Design creative approach in application of multimedia devices, equipment and systems
3. Interpret and analyze measurement results obtained on the multimedia system and components,
4. Describe the development process and applications of the multimedia systems

Course Content**Unit-I****15 Hours**

Introduction to Multimedia Technology - computers, communication and entertainment framework for multimedia system, features of multimedia system, Multimedia Hardware devices& software development tools, M/M devices, presentation devices and the user interface, M/M presentation and authoring.

Unit-II**15 Hours**

Digital Representation of Sound and Image:-Digital representation of sound and transmission, Basics of Video, Types of Video Signals, Analog Video, Digital Video, brief survey of speech recognition and generation, digital video and image compression, JPEG image compression standard, MPEG motion video compression, DVI technology, timbered media representation and delivery.

Unit-III**15 Hours**

M/M Software: -M/M software environments, limitations of workstation operating systems, M/M system services, OS support for continuous media applications, media stream protocol, M/M file system and information representation system, and data models for M/M and hypermedia information.

Application of M/M: -Application of M/M, intelligent M/M system.

Unit-IV**15 Hours**

Virtual Reality System: Desktop VR, virtual reality OS, distributed virtual environment system, virtual environmental displays and orientation tracking, visually coupled systems requirements, intelligent VR software systems.

Multimedia Communication: Building Communication network, Application Subsystem, Transport Subsystem, QOS, Resource Management, Distributed Multimedia Systems.

Uses: Applications of environments in various fields such as medical entertainment, manufacturing, business, education etc.

Transactional Mode:

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

Suggested Readings:

- *Stephen McGloughlin, "Multimedia on the Web", PHI.*
- *Villamil-Casanova & Nolina, "Multimedia production, planning & Delivery", PHI.*
- *Lozano, "Multimedia sound & video", PHI.*
- *J. Jeefcoate, "Multimedia in Practice Tech & application".*

Course Title: Software Engineering	L	T	P	Credits
Course Code: BCS5309	4	0	0	4

Total Hours:60

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

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

Course Content

Unit-I

15 Hours

Introduction: The software engineering, Discipline-Evolution and impact, why study software Engineering? Emergence of software Engineering. Difference between classical and advanced concepts.

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

Unit-II

15 Hours

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

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

Unit-III

15 Hours

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

Coding and Testing: Code review, Verification and validation, Unit-- testing, Black Box Testing, Integration and System Testing. Verification and validation, Integration

testing, Validation testing, alpha and beta testing, System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, process debugging approaches. Software re-engineering: Reverse engineering, restructuring, forward engineering.

Unit-IV

15 Hours

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 Mode:

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 Mandrioli D. (1991). *Fundamentals of Software Engineering*. Prentice Hall, N. J.
- Pfleedger S. L. (1991). *Software Engineering: The Production of Quality software*. Second Edition, Macmillan Publishing Company.
- Boehm 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: Security Engineering	L	T	P	Credits
Course Code: BCS5310	4	0	0	4

Total Hours-60

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

1. Use of various concepts related to engineering secure systems by keeping various threats in mind.
2. Understand the principles related to use of authentication mechanism, their form, security analysis, overhead, use of security standards related to cryptography and physical security.
3. Examine the building systems using passwords, biometrics, CAPTCHA's, secure programming techniques, trusted computing, Crypto APIs and physical security.
4. Understand a variety of security attacks, their sophistication, and defense mechanisms

Course Content

Unit-I

15 Hours

Introduction to Security Engineering: Passwords and their limitations, attacks on passwords, CAPTCHA, Biometrics. Access Control, ACL, sandboxing, virtualization, trusted computing. Multi-level and multi-lateral security.

Unit-II

15 Hours

Securing services: Security in Metered Services, pre-payment meters, secure printing and seals. Tamper resistance mechanisms. Secure systems: hardware, software and communication systems – design issues and analysis.

Unit-III

15 Hours

Secure software architecture: Models and principles, hardware design related security – smart cards and other security solutions, communication protocols and application systems associated with security.

Unit-IV

15 Hours

Attacks and defenses: Phishing, social networking attacks, Denial of service, API attacks, network attacks and countermeasures, side-channel attack, advanced persistent Threats (APTs), copyright and DRM.

Transaction Mode:

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

Suggested Readings:

- *Ramesh s. Gaonkar. (2013) Microprocessor Architecture, Programming and Application with 8085, Penram International publishing India Pvt. Ltd.*
- *Douglas. V Hall. (2006). Microprocessor and interfacing, Tata Mc-GrawHill Publication.*

SEMESTER-6th

Course Title: Formal Language & Automata Theory	L	T	P	Credits
Course Code: BCS6350	4	0	0	4

Total Hours: 60

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

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

Course Content**Unit-I****15 Hours**

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

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

Unit-II**12 Hours**

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

Unit-III**18 Hours**

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

Unit-IV**15 Hours**

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

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

Transaction Mode:

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

Suggested Readings:

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

Web Links

- [https://stackoverflow.com/questions/17252374/what-are-the-best-sites-to-learn-about-Formal Language & Automata Theory](https://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: Computer Networks	L	T	P	Credits
Course Code: BCS6351	4	0	0	4

Total Hours-60

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

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

Course Content

Unit-I

15 Hours

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

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

Unit-II

15 Hours

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

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

Unit-III

15 Hours

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

Unit-IV

15 Hours

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

Transaction Mode:

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

Suggested Readings:

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

Course Title: Big Data	L	T	P	Credits
Course Code: BCS6352	4	0	0	4

Total Hours: 60

Learning 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 and 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.
4. Write a server side java application called Servlet to update and delete operations on DBMS table

Course Content

Unit-I

15 Hours

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

Unit-II

15 Hours

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

Unit-III

15 Hours

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

Unit-IV

15 Hours

Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig Hive services, Hive-QL, Querying Data in Hive, Fundamentals of H-Base and Zookeeper, Visualizations: Visual data analysis techniques, interaction techniques. Systems and applications

Transaction Mode:

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

Suggested Readings:

- *Michael Berthold, David J. Hand. (2007). Intelligent Data Analysis. Springer.*
- *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.*
- *AnandRajaraman and Jeffrey David Ullman.(2012). Mining of Massive Datasets. Cambridge UniversityPress.*
- *Bill Franks. (2012). Taming the Big Data Tidal Wave: Finding Opportunit-iesin Huge Data Streams with Advanced B Analytics. JohnWiley&sons.*

Course Title: Python With R-Programming	L	T	P	Credits
Course Code: BCS6353	3	0	0	3

Total Hours-45

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

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

Course Content

Unit-I

15 Hours

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

10 Hours

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

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

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

Unit-III

15 Hours

Python File Operation: Reading config files in python, Writing log files in python, Understanding read functions, read (), readline () and readlines (), Understanding write functions, write () and write lines(), 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

10 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 Mode:

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

Suggested Readings:

- John V Guttag. (2013). *Introduction to Computation and Programming Using Python Revised and expanded Edition*. MITPress

- Robert Sedgewick, Kevin Wayne, Robert Dondero. (2016). *Introduction to Programming in Python: An Inter-disciplinary Approach*. Pearson India Education Services Pvt.Ltd.
- Timothy A. Budd. (2015). *Exploring Python.*, Mc-Graw Hill Education (India)PrivateLtd.
- Kenneth A. Lambert. (2012). *Fundamentals of Python First Programs.*”, CENGAGE Learning.
- Charles Dvierbach. (2013). *Introduction to Computer Science using Python. A ComputationalProblem-Solving Focus*. Wiley IndiaEdition.
- Paul Gries, Jennifer Campbell and Jason Montojo. (2013). *Practical Programming: An Introduction to Computer Science using Python 3*. Second edition, Pragmatic Programs, LLC.
- Dave Brueck and Stephen Tanner “*Python Programming* 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 R-Programming Lab	L	T	P	Credits
Course Code: BCS6354	0	0	2	1

Total Hours-15

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 Studio.

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
6. Compute the GCD of two numbers.
 7. Find the square root of a number (Newton 's method)
 8. Exponentiation (power of a number)
 9. Find the maximum of a list of numbers
 10. Linear search and Binary search
 11. Selection sort, Insertion sort
 12. Merge sort
 13. First n prime numbers
 14. Multiply matrices
 15. Programs that take command line arguments (word count)
 16. Find the most frequent words in a text read from a file
 17. Simulate elliptical orbits in Pygame
 18. 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: Deep Learning	L	T	P	Credits
Course Code: BCS6355	4	0	0	4

Total Hours: 60

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

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

Course Content

Unit-I

15 Hours

Introduction: History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptron's (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation

Unit-II

15 Hours

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

Unit-III

15 Hours

Auto-encoders & Regularization: Auto encoders and relation to PCA, Regularization in auto encoders, DE noising 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.

Transaction Mode:

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

Suggested Readings:

- *Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016 .*
- *Michael A. Nielsen, Neural Networks and Deep Learning, Determination Press, 2015*
- *Yoshua Bengio, Learning Deep Architectures for AI, now Publishers Inc., 2009*
- *Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017 .*
- *Sujit Pal "Deep Learning with Keras" Pact Publishers, 2017 3 Francois Chollet "Deep Learning with Python", Manning Publications, 2017.*

Course Title: Mobile Application Development	L	T	P	Credits
Course Code: BCS6356	4	0	0	4

Total Hours: 60

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

1. Identify various concepts of mobile programming that make it unique from programming for other platforms.
2. Critique mobile applications on their design pros and cons and deploy applications to the Android marketplace for distribution.
3. Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
4. Program mobile applications for the Android operating system that use basic and advanced phone features.

Course Content

Unit-I

15 Hours

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

Unit-II

15 Hours

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

Unit-III

15 Hours

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

Unit-IV

15 Hours

Using Common Android APIs: Using Android Data and Storage APIs, managing data

using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World. MLR Institute of Technology- UG - Autonomous-Regulations & Syllabus – MLR - 17 Page | 106 Department of Computer Science and Engineering.

Transaction Mode:

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

Suggested Readings:

- T1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011)
- Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd
- Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd.
- Android Application Development All in one for Dummies by Barry Burd, Edition:

Course Title: Natural Language Processing	L	T	P	Credits
Course Code: BCS6357	4	0	0	4

Total Hours: 60

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

1. Apply the computational knowledge for Natural Language Processing to understand the properties of natural languages, its algorithms for processing linguistic information in various tasks such as Machine translation, Information extraction and retrieval, and Speech Technology.
2. Understand the concepts of linguistic foundations that underlie natural language processing, which would provide the knowledge for building components of NLP systems.
3. Discover the capabilities, analyze them and explore the limitations of current natural language technologies, and some of the algorithms and techniques that underline these technologies to take up various research challenges in the field.
4. Recognize the significance of research in natural language processing for common NLP tasks such as text classification, spam filtering, spell checking, machine learning, etc. to engage in lifelong learning.

Course Content

Unit-1

15 Hours

Introduction: Basic concepts of Natural Language Processing, evolution of NLP, issues and challenges in NLP, basic concepts of phases of natural language processing morphological analysis, syntactic analysis, semantic analysis, pragmatic analysis, tools and techniques used for performing these analysis, ambiguities, Types of ambiguities

Unit-II

15 Hours

Syntactic analysis: Concept of Grammars, Chomsky hierarchy of grammars, concept of parsing, top-down parsing, bottom-up parsing, bidirectional parsing, generating parse tree, data structures and algorithms used for parsing, tokenize Case study of parsers of NLP systems like ELIZA, LUNAR

Unit-III

15 Hours

Semantic Analysis: understanding meaning, CASE grammars, transformational gram-mars used for performing semantic analysis. Resolving ambiguities to generate correct meaning, Word Sense Disambiguation Case study of Toolkit of word sense disambiguation used in WORDNET

Dialog flow: Basics of Dialogflow, Features , Use Cases, Components, Advantages of Dialogflow, Dialog flow Agent, , Parameters, Entities, Custom Intent, fallback intent, Knowledge Base in Dialogflow, Training in Dialogflow, Intent Matching with Follow-up Intent, Integration with an Integration, How to Build Resume Chabot for Google Assistant, How to Build an Appointment Scheduler with Dialog flow

Unit-IV

15 Hours

Software tools for Performing NLP: English WORDNET, components of WordNet understanding NLTK tool for using wordnet, HINDI wordnet, Indian Govt initiative for language analysis and machine translation.

Transaction Mode:

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

Suggested Readings:

- Allen, James, “*Natural Language Understanding*”, Second Edition, Benjamin/Cum-ming, 1995.
- Jurafsky, Dan and Martin, James, “*Speech and Language Processing*”, Second Edition, Prentice Hall, 2008
- Ela Kumar, “*Natural Language Processing*”, IK international Publication, second edition 2014

Course Title: Soft Computing	L	T	P	Credits
Course Code: BCS6358	4	0	0	4

Total Hours: 60

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 and

Course Content

Unit-I

15 Hours

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

15 Hours

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

15 Hours

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

15 Hours

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.

Transaction Mode:

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

Suggested Readings:

- Allen, James, “*Natural Language Understanding*”, Second Edition, Benjamin/ Cummings, 1995.
- Jurafsky, Dan and Martin, James, “*Speech and Language Processing*”, Second Edition, Prentice Hall, 2008
- Ela Kumar, “*Natural Language Processing*”, IK international Publication, second edition 2014

SEMESTER-7th

Course Title: Machine Learning	L	T	P	Credits
Course Code: BCS7400	4	0	0	4

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

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

Transaction Mode:

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://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](https://www.quora.com/What-are-the-best-sites-to-learn-Python-using-R-Programming)

Course Title: Internet of Things	L	T	P	Credits
Course Code: BCS7401	4	0	0	4

Total Hours: 60**Learning Outcomes:** After completion of this course, the learner 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****15 Hours****Introduction & Concepts:** Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels.**Unit-II****17 Hours****Domain Specific IOTs:** Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.**Unit-III****18 Hours****M2M & System Management with NETCONF-YANG:** M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG.**Unit-IV****15 Hours****Developing Internet of Things & Logical Design using Python:** Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes, Python Packages.**IOT Physical Devices & Endpoints:** Introduction to IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, and Programming & IOT Devices.**Transactional Modes**

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

Suggested Readings:

- *Vijay Madisetti, Arshdeep Bahga, "Internet of Things A Hands-On-Approach", 2014, ISBN: 978 0996025515*
- *Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0*
- *Daniel Kellmireit, "The Silent Intelligence: The Internet of Things". 2013, ISBN 0989973700*
- *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: Artificial Intelligence	L	T	P	Credits
Course Code: BCS7402	4	0	0	4

Total Hours-60

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

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

Course Content

Unit-I

15 Hours

Introduction: What is AI, Importance of AI, Early work in AI, Applications of AI, Knowledge and its definition. Knowledge Representation: 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 Mode:

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. Addison Wesley.*

Course Title: Introduction to Robotics	L	T	P	Credits
Course Code: BCS7403	4	0	0	4

Total Hours: 60

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

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

Course Content

Unit-I

17 Hours

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

Unit-II

16 Hours

Need of AI in Robotics: History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents.
Game Playing: AI and game playing, plausible move generator, static evaluation move generator, game playing strategies, problems in game playing.

Unit-III

10 Hours

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

Unit-IV

17 Hours

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

Pneumatic and Electric system

Transaction Mode:

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

Suggested Readings:

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

Course Title: Project –I (Literature & Problem Formulation)	L	T	P	Credits
Course Code: BCS7404	0	0	8	4

Total Hours: 60

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

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

Course Content

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

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

Course Title: Block Chain Architecture Design	L	T	P	Credits
Course Code: BCS7405	4	0	0	4

Total Hours: 60

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

1. Describe 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

Unit-1

16 Hours

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

Unit-II

14 Hours

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

Unit-III

15 Hours

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

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

Unit-IV

15 Hours

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

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

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

Transaction Mode:

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.
- Josh Thompson, *‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’*, Create Space Independent Publishing Platform, 2017.
- Imran Bashir, *“Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained”*, Packt Publishing.
- Merunas Grincalaitis, *“Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols”*, Packt Publishing.

Course Title: Digital Forensics	L	T	P	Credits
Course Code: BCS7406	4	0	0	4

Total Hours:60**Learning Outcomes:** After completion of this course, the learner will be able to:

1. Contrast digital investigations that conform to accepted professional standards and are based on the investigative process: identification, preservation, examination, analysis, and reporting.
2. Understand Cite and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy.
3. Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards.
4. Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity.

Course Content**Unit-I****14 Hours****Introduction:** Understanding the need of Computer Forensics, Definitions**Computer Hardware:** Analysis of sources for digital evidence, Digital Media, Hard disk basics, mobile phones**Unit-II****16 Hours****Files and File Systems:** Windows file systems, Forensic file images, metadata, File signatures**Forensic software:** Different software packages, Basic search queries, ASCII, UNICODE, Regular expressions, viewing and managing keywords and cases, Encryption, password protection, Password recovery tools.**Unit-III****15 Hours****Physical evidence:** fingerprints or other evidence on machines, keyboards Forensic**Reports:** Proper report writing, ExDESplaining forensics to the uneducated Email analysis, IP tracking, Tracking and analysis of emails, Webmail, POP, IMAP**Unit-IV****15 Hours****File signature analysis:** File signatures, File extensions, Detecting file Manipulation**Hash Analysis:** Hashing files, Hash libraries

Window Artifacts: My documents, recycle bin, Installed programs, Windows XP vs. Windows 7

Transaction Mode:

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

Suggested Readings:

- *R. Boddington, Practical Digital Forensics, Packt Publishing, 2016.*
- *N. Jain, D. Kalbande, Digital Forensic: The Fascinating World of Digital Evidences, Wiley, 2016.*
- *M.J. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson, 2008.*
- *J. Marcella, G. Guilloso, Cyber Forensics: from data to digital intelligence, Wiley, 2012*

SEMESTER-8th

Course Title: Internship	L	T	P	Credits
Course Code: BCS8450	0	0	0	20

Total Hours: 20

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

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

Course Content

The industrial training will normally contain:

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