Course Structure & Syllabus

of

B. Tech. Programme

in

Computer Science and Engineering

Academic Year – 2019-20

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, ODISHA

Burla, Sambalpur-768018, Odisha

www.vssut.ac.in

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

VISION

To be a recognized leader by imparting quality technical education and there by facilitating the extensive research environment, equipping students with latest skills in the field of technology supplemented with practical orientation to face challenges in the fast morphing modern computing industry and academia for the betterment of the society.

MISSION

1. To produce best quality computer science professionals and researchers by providing state-of-the-art training, hands on experience and healthy research environment.
2. To collaborate with industry and academia around the globe for achieving quality technical education and excellence in research through active participation of all the stakeholders.
3. To promote academic growth by establishing Center of Excellences and offering inter-disciplinary postgraduate and doctoral programs.
4. To establish and maintain an effective operational environment and deliver quality, prompt cost effective and reliable technology services to the society as well as compliment the local and global economic goals..

Programme Educational Objectives (PEOs)

1. PEO-1: The graduates will be able to employ their expertise In Computer Engineering to resolve various industrial and technological problems
2. PEO-2: The graduates will be able to Impart professionalism, ethical attitude, and communication skills and maintain good teamwork spirit in their profession.
3. PEO-3: The graduates will be able to employ their competencies to succeed in pursuits of advanced degree and practical lifelong Independent learning.
4. PEO4: The graduates will be emerged as leaders in engineering, management, applied research and education.

	M1	**M2**	**M3**	**M4**
PEO1	**3**	**3**	**1**	**2**
PEO2	**2**	**1**	**1**	**3**
PEO3	**3**	**3**	**2**	**1**
PEO4	**2**	**2**	**1**	**3**

Program Outcomes of B.Tech (CSE)

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** 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.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** 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.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** 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.
PO11	**Project management and finance:** 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.
PO12	**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.

Program Specific Outcomes for B.Tech. (CSE)

PSO1	Apply the knowledge of electric circuits, control systems, electrical machines, power electronics and power systems to solve complex engineering problems in the discipline of Electrical Engineering
PSO2	Develop suitable techniques and cutting-edge engineering hardware and software tools in electrical engineering to solve practical problems.
PSO3	Aware of the impact of professional electrical engineering solutions on social, economic, environmental and technological sustainability.

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA

PROPOSED COURSE STRUCTURE FOR BACHELOR OF TECHNOLOGY
COURSES TO BE EFFECTIVE FROM JULY 2019- 2020

COURSE STRUCTURE FIRST SEMESTER **FIRST YEAR (THEORY)**				
Sl. No	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**Credits**
1	**BMA01001**	**Mathematics-I**	**3-1-0**	**4**
2	**BPH01001**	**Physics**	**3-0-0**	**3**
3	**BEE01001**	**Basic Electrical Engg.**	**3-0-0**	**3**
4	**BHU01001**	**English For Business Communication**	**3-0-0**	**3**
5	**BME01001**	**Engineering Mechanics**	**3-0-0**	**3**
SESSIONALS				
1	**BPH01002**	**Physics Laboratory**	**0-0-3**	**1.5**
2	**BEE01002**	**Basic Electrical Engg. Lab**	**0-0-3**	**1.5**
3	**BHU01002**	**Business Communication Skills**	**0-0-3**	**1.5**
4	**BME01002**	**Workshop & Manufacturing Practices**	**0-0-3**	**1.5**
NON-CREDIT				
1	**BNC01003**	**Induction Programme and participation in Clubs / Societies**	**0-0-0**	**0**
Total			**15-1-12**	**22**

COURSE STRUCTURE SECOND SEMESTER **FIRST YEAR (THEORY)**				
Sl.No	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**Credits**
1	**BMA02001**	**Mathematics - II**	**3-1-0**	**4**
2	**BCH02001**	**Chemistry**	**3-0-0**	**3**
3	**BEC02001**	**Basic Electronics**	**3-0-0**	**3**
4	**BIT02001**	**Programming for Problem Solving**	**3-0-0**	**3**
5	**BME02001**	**Basic Civil Engg.**	**3-0-0**	**3**
SESSIONALS				
1	**BCH02002**	**Chemistry Lab**	**0-0-3**	**1.5**
2	**BEC02002**	**Basic Electronics Lab**	**0-0-3**	**1.5**
3	**BIT02002**	**Programming Lab /**	**0-0-3**	**1.5**
4	**BCE02002**	**Engineering Graphics & Design**	**0-0-3**	**1.5**
NON-CREDIT				
1	**BNC02003**	**NSS/NCC/Yoga**	**0-0-0**	**0**
Total			**15-1-12**	**22**

COURSE STRUCTURE THIRD SEMESTER SECOND YEAR (THEORY)				
Sl. No.	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**Total Credits**
1	**BMA03001**	**Mathematics-III**	**3-1-0**	**4**
2	**BCS03001**	**Data Structures**	**3-0-0**	**3**
3	**BCS03002**	**Object Oriented Programming**	**3-0-0**	**3**
4	**BEC03001**	**Digital Electronics**	**3-0-0**	**3**
5	**BHU03001**	**Economics For Engineers**	**3-0-0**	**3**
SESSIONAL				
1	**BCS03002**	**Data Structures Lab.**	**0-0-3**	**1.5**
2	**BEC03002**	**Digital Electronics Lab.**	**0-0-3**	**1.5**
3	**BCS03003**	**Object Oriented Programming Lab.**	**0-0-3**	**1.5**
4	**BCS03004**	**Programming using MATLAB**	**0-0-3**	**1.5**
NON-CREDIT				
5	**BNC03001**	**Essence of Indian Traditional Knowledge/ Environmental Sciences**	**2-0-0***	**0**
TOTAL			**15-1-12**	**22**

* This contact hour is beyond the regular time table teaching

COURSE STRUCTURE FOURTH SEMESTER SECOND YEAR (THEORY)				
SI. No	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**Credit**
1	**BCS04001**	**Computer Organization**	**3-0-0**	**3**
2	**BCS04002**	**Theory of Computation**	**3-0-0**	**3**
3	**BCS04003**	**Design and Analysis of Algorithms**	**3-1-0**	**4**
4	**BMA04001**	**Graph Theory**	**3-0-0**	**3**
5	**BHU04001**	**Organisational Behaviour**	**3-0-0**	**3**
SESSIONALS				
8	**BCS04002**	**Computer Organization Lab**	**0-0-3**	**1.5**
10	**BCS04003**	**Design and Analysis of Algorithms Lab**	**0-0-3**	**1.5**
11	**BCS04004**	**Computing lab-I**	**0-0-3**	**1.5**
12	**BCS04005**	**Computing Lab -II**	**0-0-3**	**1.5**
NON-CREDIT				
1	**BNC04001**	**Environmental Sciences/ Essence of Indian Traditional Knowledge**	**2-0-0***	**0**
2	**BNC04002**	**Summer Internship/ Training**	**0-0-0**	**0**
Total			**15-0-12**	**22**

COURSE STRUCTURE THIRD YEAR	FIFTH SEMESTER (THEORY)

SI. No	Course Code	Subject	Contact Hrs. L-T-P	Credit
1	BCS05001	Operating Systems	3-0-0	3
2	BCS05002	Computer Architecture	3-0-0	3
3	BCS05003	Database Management System	3-0-0	3
4		Professional Elective -1	3-0-0	3
5		Open Elective -1	3-0-0	3
6		Professional Ethics, Professional Law &Human Values / Financial Management, Costing, Accounting, Balance Sheet & Ratio Analysis	2-0-0	2
SESSIONAL				
1	BCS05004	Operating Systems Lab	0-0-3	1.5
2		Professional Elective Lab-1	0-0-3	1.5
3	BCS05005	Database Management System Lab	0-0-3	1.5
Total			17-0-9	21.5

COURSE STRUCTURE THIRD YEAR	SIXTH SEMESTER (THEORY)

SI. No	Course Code	Subject	Contact Hrs. L-T-P	Credit
1	BCS06001	Computer Networks	3-0-0	3
2	BCS06002	Software Engineering	3-0-0	3
3		Professional Elective - II	3-0-0	3
4		Professional Elective – III	3-0-0	3
5		Open Elective – II	3-0-0	3
6		Financial Management Costing, Accounting, Balance Sheet & Ratio Analysis/ Professional Ethics, Professional Law &Human Values	2-0-0	2
SESSIONALS				
1	BCS06003	Computer Networks Lab	0-0-3	1.5
2	BCS06004	Software Engineering Lab	0-0-3	1.5
3		Professional Elective Lab – II	0-0-3	1.5
NON-CREDIT				
1	BNC06001	Summer Industry Internship/ Training/ Project	0-0-0	0
Total			17-0-9	21.5

COURSE STRUCTURE SEVENTH SEMESTER FOURTH YEAR (THEORY)				
SL NO	**Course Code**	**Subject**	**Contact hrs. L-T-P**	**Credit**
1	**BCS07001**	**Artificial Intelligence**	**3-0-0**	**3**
2	**BCS07002**	**Internet and Web Programming**	**3-0-0**	**3**
3		**Professional Elective – IV**	**3-0-0**	**3**
4		**Open Elective – III**	**3-0-0**	**3**
SESSIONALS				
1		**Project – I**	**0-0-6**	**3**
2	**BCS07003**	**Web Programming Lab**	**0-0-3**	**1.5**
3		**Seminar on internship**	**0-0-3**	**1.5**
TOTAL			**12-0-12**	**18**

COURSE STRUCTURE EIGHTH SEMESTER FOURTH YEAR (THEORY)				
SL NO	**Course Code**	**Subject**	**Contact hrs. L-T-P**	**Credit**
1		**Professional Elective - V**	**3-0-0**	**3**
2		**Professional Elective - VI**	**3-0-0**	**3**
3		**Open Elective - IV**	**3-0-0**	**3**
SESSIONALS				
1		**Project II**	**0-0-12**	**6**
2		**Seminar on Project**	**0-0-2**	**1**
TOTAL			**9-0-14**	**16**

Note: Each hour of practical /lab/sessional class = 0.5 credit

The students should undergo Summer Internship or Project in India or Abroad for a minimum period of 8 weeks either in 4^{th} & 6^{th} Semesters together or in one semester at a stretch.

Departments are required to create a basket of minimum 25 number of Professional Electives from which the students can exercise their option.

Suggested grouping of Professional elective subjects:

LIST OF PROFESSIONAL ELECTIVE				
Sl. No.	**Category**	**Course Code**	**Subject Name**	**Semester**
1	PE-I	BCSPE501	Computer Graphics	5th Semester
2		BCSPE502	Simulation and Modelling	
3		BCSPE503	Optimization Techniques	
4		BCSPE504	Introduction to Cryptography	
1	PE-II	BCSPE601	Compiler Design	6th Semester
2		BCSPE602	Software Testing and Reliability	
3		BCSPE603	Multimedia Systems	
4		BCSPE604	Wireless Sensor Networks	
1	PE-III	BCSPE605	Internet of Things (IOT)	
2		BCSPE606	Cyber Security	
3		BCSPE607	Microprocessors and Microcontrollers	
4		BCSPE608	Cloud Computing	
5		BCSPE609	Pattern Recognition	
1	PE-IV	BCSPE701	Image Processing	7th Semester
2		BCSPE702	Parallel and Distributed Computing	
3		BCSPE703	Data Mining	
4		BCSPE704	Computational Complexity	
1	PE-V	BCSPE801	Randomized Algorithms	
2		BCSPE802	Mobile Computing	
3		BCSPE803	Computer Vision	
4		BCSPE804	Bioinformatics	
1	PE-VI	BCSPE805	Real Time System	8th Semester
2		BCSPE806	Embedded System	
3		BCSPE807	Machine Learning	
4		BCSPE808	Natural Language Processing	

Suggested grouping of open elective subjects:

SL. NO.	CATEGORY	COURSE CODE	OPEN ELECTIVE SUBJECTS	TO BE OFFERED IN SEMESTER
1	OE-I	BCSOE501	Operating Systems	5th Semester
2		BCSOE502	Computer Architecture	
3		BCSOE503	Database Management System	
1	OE-II	BCSOE601	Computer Networks	6th Semester
2		BCSOE602	Software Engineering	
3		BCSOE603	Compiler Design	
1	OE-III	BCSOE701	Artificial Intelligence	7th Semester
2		BCSOE702	Internet and Web Programming	
3		BCSOE703	Data Mining	
1	OE-IV	BCSOE801	Machine Learning	8th Semester
2		BCSOE802	Mobile Computing	

1st Semester

B. Tech.: Mathematics-I (Calculus and Linear Algebra) (BMA 01001) [3-1-0]

Module 1: Calculus (8 Lectures)

Rolle's theorem, Mean value theorems (statements only) and applications. Introduction to improperintegrals. Beta and Gamma functions and their properties.

Module 2: Calculus (8 Lectures)

Convergence of sequence and series, tests of convergence. Fourier series, arbitrary period, even andodd function, half range series.

Module3: Calculus (8 Lectures)

Limit, continuity and partial derivatives (two variables), maxima and minima. Vector and scalar point functions and fields, gradient of a scalar field, directional derivative, divergence of a vector field, curl of a vector field and applications

Module 4: **Linear Algebra** ***(8 Lectures)***

Linear systems of equations, Gauss elimination, linear independence, rank of a matrix, Gauss-Jordan elimination. Vector Space; basis and dimension'

Module 5: **Linear Algebra** ***(8 Lectures)***

Eigenvalues, eigenvectors, some applications of eigenvalue problems, symmetric, skew-symmetric and orthogonal matrices, diagonalization, quadratic forms, complex matrices and forms.

Text Book:

1) Erwin Kreyszig, Advanced Engineering Mathematics (9th Edition), Wiley India Pvt. Ltd
2) S.C. Malik and S. Arora, Mathematical Analysis, New Age International

Reference Books:

1) George B. Thomas, Jr. and Ross L. Finney, Calculus and Analytic Geometry, Addison WesleyPublishing Company
2) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill
3) A. Stroud, Advanced Engineering Mathematics, Industrial Press
4) S.K. Paikray,Text book of Matrix Algebra, Kalyani Publisher

Course Outcomes:

Upon completion of the subject the students will be able to:

CO1	Recognize basic knowledge of differential calculus, improper integral, Beta and Gamma functions which are useful in various fields of engineering
CO2	Analyse periodic phenomenon and describe Fourier series expansion of periodic function
CO3	Demonstrate functions of several variables that is essential in most of the branches of engineering
CO4	Apply Gauss elimination method and rank of a matrix in solving linear equations
CO5	Implement knowledge of eigenvalues and eigenvectors in a comprehensive manner

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	2	1	-	-	-	1	1
CO2	3	3	2	2	1	2	1	-	-	-	1	1
CO3	3	3	2	2	1	2	1	-	-	-	1	1
CO4	3	3	2	2	1	2	1	-	-	-	1	1
CO5	3	3	2	2	1	2	1	-	-	-	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	3	3	2	2	1	2	1	-	-	-	1	1

ENGINEERING PHYSICS (BPH01001)

Course Objectives:

- To understand the concept of Elasticity
- To gain the knowledge of Oscillations and Resonance
- To obtain knowledge and concept of wave optics through Interference, Diffraction and Polarization
- To understand the fundamentals of Electromagnetism
- To gain the basic idea on Quantum Physics and Photonics

Syllabus

Module-I PROPERTIES OF MATTEER

Ideas of Elastic Constants (Y, K, η and σ), relation between elastic constants, torsion pendulum, determination of η, cantilever at one end.

Module-II OSCILLATION AND WAVES

Review of Simple Harmonic Oscillation and application to Compound pendulum, Damped Harmonic Oscillation, Forced Oscillation, Resonance, (Amplitude Resonance, Velocity Resonance, and Sharpness of Resonance).

Module-III OPTICS

Concept of Wave and wave equation, Superposition of Many harmonic waves, Interference, Concept of coherent sources (Division of wave front and division of amplitude), Interference in thin parallel film, Newton's ring (Theory, Application, Determination of Wavelength of Light, Refractive index of liquid), Concept of Diffraction (Huygen's Principle), Types of Diffraction, Fraunhofer Diffraction due to a single slit and diffraction Grating, Determination of Wavelength, Dispersive Power and Resolving Power of a Plane Diffraction Grating, Polarization, Double Refraction, Half wave Plate, Quarter wave Plate.

Module-IV ELECTROMAGNETISM

Vector Calculus, Gradient, Divergence, Curl (Mathematical Concept), Gauss' Divergence Theorem and Stoke's Theorem (Statement Only), Derivation of Maxwell's Electromagnetic Equations in Differential form and Integral form, Electromagnetic Wave equations for $\vec{E}$ and $\vec{B}$ in vacuum and in conducting medium, Transverse nature of EM waves.

Module-V QUANTUM MECHANICS AND PHOTONICS

Wave particle duality, Matter Wave (de-Broglie Hypothesis), Wave Functions, Observables as Operators, Eigen Functions and Eigen Values, Normalization, Expectation Values, Schrodinger equation (Time Dependent and Time Independent), Particle in a box. **Lasers:** Introduction and Characteristics of Lasers, Einstein's Coefficients and Relation between them, Lasing Action (Population Inversion, Three and Four level Pumping Schemes), Different types of Lasers (Ruby lasers, He-Ne Lasers).

Text Book:

1. Principle of Engg. Physics: Md. N. Khan and S. Panigrahi
2. Engg. Physics: H.K. Malik and A.K. Singh

Reference Books:

1. Oscillations and Waves: N. Subramanyam and Brij Lal
2. Optics: A. Ghatak
3. Electrodynamics: D.J. Griffith
4. Concept of Modern Physics: A. Beiser
5. Lasers: Theory and Applications: K. Thyagarajan and A.K. Ghatak

Course Outcomes:

Upon completion of the subject the students will be able to:

CO1	Explain the concepts of Stress, Strain, Elastic Modulus and Elastic Constant, Bending of Beams. Identify the importance Elastic properties in Engineering Applications
CO2	Understand simple harmonic Oscillator, Damped Harmonic and Forced Oscillators. Explain Quality factor and resonance with applications
CO3	Explain the link between Simple Harmonic Motion and Waves. Understand the principle of superposition, the need of coherent sources, analyze the difference between Interference and Diffraction and their applications. Illustrate the concept of Polarization of light and its applications.
CO4	Understand the basic mathematical concepts related to electromagnetic vector fields, Understand the concepts related to electromagnetic wave.
CO5	Understand and explain the differences between classical and quantum mechanics. Interpret the wave function, operators and Schrodinger equation to solve physical problems. Understand generation, outline and need for the laser

Course Articulation Matrix row for this Course

Table	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	POP11	PO12
CO1	3	3	2	2	1	-	-	1	-	1	-	1
CO2	3	3	3	2	1	-	-	1	-	1	-	2
CO3	3	3	3	3	1	-	-	1	-	1	-	2
CO4	3	3	3	2	1	-	-	1	-	1	-	2
CO5	3	3	2	3	2	-	-	2	-	2	-	2

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course	3	3	2	1	3	2	1	1	3	3	1	1

BASIC ELECTRICAL ENGINEERING (BEE 01001)

MODULE-I (8 HOURS)

D.C circuit analysis and network theorems: Concept of network, Active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, source transformation, Kirchoff's Law: loop and nodal methods of analysis, star delta transformation, network theorems: Thevenin's theorem, Norton's theorem, maximum power transfer theorem. Transients, in R-L, R-C and R-L-C circuits with DC Excitation.

MODULE-II (8 HOURS)

Single phase and three phase ac circuit: Sinusoidal, square and triangular waveforms-average and effective value, form the peak factors, concept of phasors, phasors representation of sinusoidally varying voltage and current, analysis of series-parallel RLC circuits. Apparent, active and reactive powers, power factor, power factor improvement, resonance in series and parallel circuits, bandwidth and quality factors, star and delta connections, balanced supply and balanced load, line and phase voltage/current relation, three phase power measurements.

MODULE-III (8 HOURS)

Magnet circuit & principle of electromechanical energy conversion: Analogy between electric and magnetic circuit, magnetic circuits with DC and AC excitation, magnetic leakage, BH curve, hysteresis and eddy current losses, magnetic circuit calculation, mutual coupling. Principles of dc motor & generator, types, emf equation of DC machine, torque equation of motor, Speed control of dc motor. characteristics and applications of DC motors.

MODULE-IV (8 HOURS)

AC MACHINES: Single Phase Transformer: Principle of operation, construction, emf equation, equivalent circuit, power losses, efficiency, Introduction to auto transformers. Three Phase Induction Motor: Type, principle of operation, slip-torque Characteristics, applications. Single Phase Induction Motor: Principle of operation and introduction to methods of starting, applications. Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor, emf equation, voltage regulation, applications.

MODULE-V (7 HOURS)

Measurement Instruments & Introduction to Power System: Types of instruments: construction and working principle of PMMC and MI type voltmeter and ammeters, single phase dynamometer type wattmeter and induction type energy meter, use of shunts and multipliers: general layout of electrical power system and function of its elements, concept of grid, Introduction to power converters.

TEXT BOOKS

[1]. Edward Hughes (revised by Ian McKenzie Smith), "Electrical & Electronics Technology", Pearson Education Limited. Indian Reprint 2002, 10th Edition.
[2]. D.Kulshreshtha, "Basic Electrical Engineering" TMH, 1st Edition.

REFERENCE BOOKS

[1]. C.L. Wadhwa, “Electrical Engineering”, New Age International Publishers, 2nd Edition.

[2]. S. Parker Smith, “Problems in Electrical Engineering”, Asia Publications, 10th Edition.

Course Outcomes:

Upon completion of the subject the students will demonstrate the ability to:

CO1	Implement principles of DC network, theorems and transients.
CO2	Analyze the concept of Single phase and three phase AC circuits.
CO3	Express the concept of magnetic circuit and DC machines.
CO4	Apply basic principles of AC machines and their working.
CO5	Demonstrate basic principles of measuring instruments and power system.

Course Articulation Matrix

	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**
CO	3	3	2	1	1	2	1	-	-	-	-	1
CO	3	3	2	1	1	2	1	-	-	-	-	1
CO	3	3	2	1	1	2	1	-	-	-	-	1
CO	3	3	2	1	1	2	1	-	-	-	-	1
CO	3	3	2	1	1	2	1	-	-	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**
Cours	3	3	2	1	1	2	1	-	-	-	-	1

ENGLISH FOR BUSINESS COMMUNICATION (BHU01001)

Course Description

The course is designed to give students a comprehensive view of communication, its scope and importance in business, and to build the proficiency needed to succeed in today's technologically enhanced workplace. Effective communication is an integral part of life. This course focuses on improving the LSRW skills, i.e. listening, speaking, reading and writing of the students. Students will learn how to communicate effectively though the prescribed syllabus followed by an intensive practice in the language lab. This integrated approach of theory and language lab sessions will help students to communicate clearly with an impact, by improving their verbal and non-verbal communication style, as well as enhancing their competency in grammar and pronunciation. This course further tries to conversant students with the correct practices and strategies in drafting effective business correspondence.

Syllabus

Module 1: Fundamentals of Communication (6 Hours)

- Process of Communication, Types of Communication (Verbal & Non Verbal)
- Channels of Business Communication
- Barriers to Communication.
- Plain English
- Bias free language
- Cross Cultural Communication

Module 2: Communicative Grammar (6 Hours)

- Time and Tense
- Aspects (Perfective & Progressive)
- Verbs of State and Event
- Passive and Active Voice
- Conditionals

Module 3: Sounds of English (06 Hours)

- The Speech Mechanism and Organs of Speech
- Consonant Sounds of English
- Vowel Sounds of English
- Stress Pattern: Syllable, Stress and Intonation.
- Problem sounds for Indian Speakers

Module 4: Business Writing (06 Hours)

- Paragraph writing
- Sentence Linker
- Business Letters
- Report Writing
- Proposal writing

Module 5: Professional Writing (06 Hours)

- Notice, Circular and Memo writing
- Agenda & Minute writing
- Writing Cover letter
- Résumé (CV) Writing

Reference Books

1. Effective Technical Communication by M Ashraf Rizvi (Tata McGraw Hill)
2. Business Communication by Hory Sanker Mukerjee (Oxford University Press)
3. Better English Pronunciations by J. D.O Conner (Cambridge University Press)
4. A Communicative Grammar of English by G.N. Leech and Jan Svartik (OUP)
5. Business communication by Ramachandran, Lakshmi and Krishna (Macmillan)

Programme Outcomes of BTech Programme

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: 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.
PO5	Modern tool usage: 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.
PO6	The engineer and society: 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.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: 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.
PO11	Project management and finance: 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.
PO12	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.

Course Outcomes

Upon completion of the course the students will demonstrate the ability to:

CO1	Analyse various components of human communication and to identify key elements and principles of organizational communication.
CO2	Apply correct usage of English grammar in writing and speaking.
CO3	Evaluate students' ability to articulate English key sounds as well as its basic rhythm, stress and intonation patterns correctly.
CO4	Compile, plan and structure various forms of business writing in a professional manner.
CO5	Write various business documents appropriate for different business and employment situations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	1	-	1	-	-	1	3	-	-
CO2	-	-	-	1	-	1	-	-	1	3	-	-
CO3	-	-	-	1	-	1	-	-	1	3	-	-
CO4	-	-	-	1	-	1	-	-	1	3	-	-
CO5	-	-	-	1	-	1	-	-	1	3	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	-	-	-	-	-	-	-	-	1	3	1	-

ENGINEERING MECHANICS (BME 01001)

Course Contents

Module - I (8 Hours)

Concurrent forces on a plane: Composition, resolution and equilibrium of concurrent coplanar forces, method of moment.General case of forces on a plane: Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections, plane frame, equilibrium of ideal systems.

Module-II (8 Hours)

Friction: Problems involving dry friction, Ladder, WedgesPrinciple of virtual work.

Module - III (8 Hours)

Parallel forces on a plane: General case of parallel forces, center of parallel forces and center of gravity, centroid of composite plane figure and curves, Theorems of Pappus.

Moments of inertia: Plane figure with respect to an axis in its plane and perpendicular to the plane, Polar moment of inertia, parallel axis theorem

Module – IV (8 Hours)

Rectilinear translation: Kinematics, principle of dynamics, D Alembert's Principle,

Principle of work and energy for a particle and a rigid body in plane motion, Conservation of energy, Principle of impulse and momentum for a particle and a rigid bodies in plane motion, Conservation of momentum, System of rigid bodies, Impact, direct and central impact, coefficient of restitution.

Module – V (8 Hours)

Curvilinear translation: Kinematics, equation of motion, projectile, D Alembert's principle of curvilinear motion. Kinematics of rotation of rigid body.

Text Book:

1. Engineering Mechanics: S Timoshenko & Young; 4th Edition (International edition) McGraw Hill.

Reference Books:

1. Fundamental of Engineering mechanics (2nd Edition): S Rajesekharan& G ShankaraSubramanium; Vikas Pub. House Pvt ltd.
2. Engineering mechanics: K. L. Kumar; Tata MC Graw Hill.

Upon completion of the subject the students will be able to:

CO1	Draw free body diagrams and determine the resultant of forces and/or moments.
CO2	Solve the problems involving dry friction.
CO3	Determine the centroid and second moment of area of sections.
CO4	Apply Newton's laws and conservation laws to elastic collisions and motion of rigid bodies.
CO5	Determine the various parameters in projectile motion.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	2	-	-	-	3	1	-	1
CO2	3	3	2	1	2	-	-	-	3	1	-	1
CO3	3	3	2	1	2	-	-	-	3	1	-	1
CO4	3	3	2	1	2	-	-	-	3	1	-	1
CO5	3	3	2	1	2	-	-	-	3	1	-	1

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	3	2	1	2	-	-	-	3	1	-	1

PHYSICS LABORATORY (BPH01002)

List of Experiments

1. Determination of acceleration due to gravity by using Bar pendulum
2. Determination of surface tension of water by capillary rise method
3. To draw the characteristics of a bipolar junction transistor
4. To determine the rigidity modulus of the material of a wire by using Barton's apparatus.
5. Determination of wave length of monochromatic light with the help of Newton's ring apparatus.
6. Determination of grating element of a diffraction grating using spectrometer.

Course Outcomes

Upon completion of the subject the students will demonstrate the ability to:

CO1	Express the idea of calculation of acceleration due to gravity at any place using the concept of oscillatory system and simple harmonic motion.
CO2	Demonstrate the working and operational technique to calculate the mechanical properties of fluid and other materials.
CO3	Evaluate the voltage, current, power and characteristics behaviour of the electronic devices.
CO4	Analyze the mechanical properties of any material with the idea of elasticity and its various applications.
CO5	Implement the measurement of different characteristic properties and related calculations of optical devices.

Course Articulation Matrix

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
CO	3	3	2	1	3	2	1	1	3	3	1	1
CO	3	3	2	1	3	2	1	1	3	3	1	1
CO	3	3	2	1	3	2	1	1	3	3	1	1
CO	3	3	2	1	3	2	1	1	3	3	1	1
CO	3	3	2	1	3	2	1	1	3	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	3	3	2	1	3	2	1	1	3	3	1	1

BASIC ELECTRICAL ENGINEERING LABORATORY (BEE01002)

List of Experiments

1. Preliminary: Preparation of symbol chart for various systems & components as per ISS, to study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat, Study of safety rules as per ISS
2. Measurement of the armature & field resistance of D.C. Machine by volt-amp method. & Starting and speed control of a D.C. shunt motor
3. Study of BH Curve
4. Determination of open circuit characteristics (O.C.C) of D.C shunt generator when separately excited at different speeds.
5. Measurement of earth resistance and insulation resistance.
6. Starting of Induction motor and measurement of three phase power & power factor by 2- wattmeter method.
7. Callibration of a single phase Energy Meter by directed loading & Phantom loading.
8. Obtaining the voltage, current, power and power factor of fluorescent lamp.
9. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
10. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform

Course Outcomes

Upon completion of the subject the students will demonstrate the ability to:

CO1	Express the safety rules as per ISS and symbols of different electrical components and the use of various electrical instruments in laboratory.
CO2	Demonstrate the working and operational characteristics of dc motor and dc generator.
CO3	Evaluate the voltage, current, power and power factor of fluorescent lamp.
CO4	Implement the measurement of earth resistance and insulation resistance and demonstrate the internal structure of different machines.
CO5	Analyze the connection and calibration of single phase energy meter, three phase power and power factor by two wattmeter method and basic idea about converters.

Course Articulation Matrix

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
CO	3	3	2	1	3	2	1	1	3	3	1	1
CO	3	3	2	1	3	2	1	1	3	3	1	1
CO	3	3	2	1	3	2	1	1	3	3	1	1
CO	3	3	2	1	3	2	1	1	3	3	1	1
CO	3	3	2	1	3	2	1	1	3	3	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
Cours	3	3	2	1	3	2	1	1	3	3	1	1

BUSINESS COMMUNICATION AND PRESENTATION SKILLS LAB (BHU 01002)

Course Description

Good communication skills are indispensable for the success of any professional. The English language, in particular, has become essential in the lives of young engineers who aspire to build their careers anywhere in the world. In this regard the language laboratory plays an important role in developing the students' basic proficiency in English. Since a large number of engineering students completed their education from vernacular medium schools, they lack the basic English language proficiency which is a detrimental factor during recruitment drives in engineering colleges. In this context the language laboratory is very helpful in practicing and assessing students' speech in different communication environments. It provides them facilities to learn pronunciation, accent, stress and rudimentary communicative English grammar along with various practice sessions like presentations, group discussions, debates, case studies which are the part and parcel of corporate life.

Syllabus (Assignments)

1. Functional English grammar: Practice and exercises
2. Practice of English phonemes
3. Reading comprehension
4. Drafting business correspondence
5. Understanding the importance of body language
6. Oral presentations (Self Introduction, Extempore, Formal Presentation, power point presentations etc.)
7. Group discussion
8. Preparation for appearing an interview
9. Situational conversation practice

Reference Books

1. Effective Technical Communication by M Ashraf Rizvi (Tata McGraw Hill)
2. Business Communication by Hory Sanker Mukerjee (Oxford University Press)
3. Better English Pronunciations by J. D.O Conner (Cambridge University Press)
4. A Communicative Grammar of English by G.N. Leech and Jan Svartik (OUP)
5. Business communication by Ramachandran, Lakshmi and Krishna (Macmillan)

Programme Outcomes of BTech Programme

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4	Conduct investigations of complex problems: 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.
PO5	Modern tool usage: 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.
PO6	The engineer and society: 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.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: 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.
PO11	Project management and finance: 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.
PO12	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.

Course Outcomes

Upon completion of the sessional the students will demonstrate the ability to:

CO1	Analyse various components of effective human communication and to apply them during various practice sessions.
CO2	Apply correct usage of English grammar in writing and speaking.
CO3	Articulate English key sounds as well as its basic rhythm, stress and intonation patterns correctly.
CO4	Compile, plan and structure various forms of business writing in a professional manner.
CO5	Confidently face various recruitment drives and qualify them.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	-	-	1	3	-	-
CO2	-	-	-	-	-	1	-	-	1	3	-	-
CO3	-	-	-	-	-	1	-	-	1	3	-	-
CO4	-	-	-	-	-	1	-	-	1	3	-	-
CO5	-	-	-	-	-	1	-	-	1	3	-	-

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	-	-	-	-	-	-	-	-	1	3	1	-

WORKSHOP & MANUFACTURING PRACTICES (BME01002)

Course content

1. **Carpentry Section**:

Study of different Hand tools, measuring instruments and equipments used in Carpentry work. Safety precautions.

Preparation of Job:

Wooden rack/bench/chair/stool (any one)

Includes the operations:

Measuring, Marking, Sawing, Planing, Chiseling, Mortesing, Tenoning, making Half-lap joint, Mortese&Tenon joint and Nail joint.

2. **Fitting Section**:

Study of different Hand tools, measuring instruments and equipments used in Fitting work. Safety precautions. Study of Drilling Machine and Grinding Machine.

Preparation of Job:

Paper Wt. / Square or Rectangular joint (male-female joint) (any one)

Includes the operations:

Measuring, Marking, Filing, Sawing, Drilling, Tapping, Dieing and Punching.

3. **Black Smith Section**:

Study of different Hand tools, equipments, Open hearth furnace and Induction furnaces used in Blacksmith work. Different types of heat treatment processes. Safety precautions.

Preparation of Job:

Weeding hook/Hexagonal headed bolt/Chisel (any one)

Includes the operations:

Measuring, Marking, Cutting, Upsetting, Drawing down, Bending, Fullering and Quenching.

Course Outcomes:

Upon completion of the subject the students will be able to:

CO1	Acquire knowledge on different types of hand tool, measuring instruments and machine tools are used in Fitting, Carpentry and Smithy work.
CO2	Know about different types of operations and joints performed in different shops i.e. in Fitting and Carpentry.
CO3	Know about the forging temperature of different types of ferrous metals and different types of operation (e.g. upsetting, edging, flattening and bending etc.) carried out on hot metals to prepare jobs.
CO4	Acquire skills for the preparation of different types of jobs Carpentry/fitting/smithy shops by using different types of hand tools and machine tools.
CO5	Understand the importance of safety precaution in different shops.

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	2	2	1	1	3	1	2	1
CO2	-	-	1	-	2	2	1	1	3	1	2	1
CO3	-	-	-	-	1	2	1	2	3	1	2	1
CO4	-	-	-	-	3	2	1	1	3	1	2	1
CO5	-	-	-	-	-	-	-	1	2	1	1	1

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	-	-	1	-	2	2	1	1	3	1	2	1

2nd Semester

Mathematics-II (Differential Equations and Complex Variables) [3-1-0]

BMA 02001

Module 1: Differential Equations *(8 Lectures)*

Exact ODEs, integrating factors, linear ODEs, Bernoulli equation, homogeneous linear odes of second order, homogeneous linear ODEs with constant coefficients, Euler-Cauchy equations, non-homogeneous ODEs, Applications of ODEs to electric circuits

Module 2: Power Series Solution of Differential Equations *(8 Lectures)*

Series solution of differential equation (excluding Frobenius method), Legendre's equation, Legendrepolynomials. Bessel's Equation, properties of Bessel's functions, Bessel Functions of the first and Second Kind. ***Module 3:*** **Complex Variables *(8 Lectures)***

Complex valued function, differentiation, analytic function, Cauchy-Riemann equations, harmonic and conjugate harmonic functions, exponential function, trigonometric and hyperbolic functions, logarithm, general power

Module 4: Complex Variables *(8 Lectures)*

Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, power series, radiusof convergence, Taylor and Maclaurin series, singularities and zeros, Laurent series, Cauchy residue theorem (statement only) and applications.

Module 5: Elementary Numerical Methods *(8 Lectures)*

Solution of algebraic and transcendental equations by Newton-Raphson and secant method.

Interpolation: Lagrange's method, divided difference method, Newton's forward and backward method. Numerical Integration: Trapezoidal and Simpson's Rule. Numerical solutions of differential equations: Euler's method and improved Euler's method.

Text Book:

1) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd, 9th edition.

Reference Books:

1) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press
2) Milton Abramowitz and Irene A. Stegun, *Handbook of Mathematical Functions*, National Bureau ofStandards, Applied Mathematics Series - 55
3) J. Sinha Roy and S. Padhy, Ordinary and Partial Differential Equation, Kalyani Publisher.
4) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill

Course Outcomes:

Upon completion of the subject the students will be able to:

CO1	Develop adequate knowledge of the effective mathematical tools for the solutions of differentialequations that models various physical processes
CO2	Describe power series solution of differential equations
CO3	Demonstrate analytic functions and applications of Cauchy-Riemann equations
CO4	Evaluate integration of complex valued functions, and apply Taylor and Laurent series expansionsof functions in various fields of engineering problems
CO5	Compute roots of algebraic and transcendental equations, and also evaluate the integralsby Trapezoidal and Simson's rules

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1	2	1	-	-	-	1	1
CO2	3	3	2	2	1	2	1	-	-	-	1	1
CO3	3	3	2	2	1	2	1	-	-	-	1	1
CO4	3	3	2	2	1	2	1	-	-	-	1	1
CO5	3	3	2	2	1	2	1	-	-	-	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course	3	3	2	2	1	2	1	-	-	-	1	1

Code: Subject: Chemistry Credits: 4 [3-1-0] (BCH 02001)

Module–I (9 Hours)

Schrodinger Wave equations (not to be derived), Application to particle in ID box.
Molecular rotational (microwave) spectroscopy: Basic principle and application to diatomic molecules, selection rules.
Molecular vibrational (IR) spectroscopy: Basic principle, types of vibrations and vibrational frequency, application to Harmonic and anharmonic oscillators, selection rules, modes of vibration.
Electronic (UV-Visible) spectroscopy: Basis principle, types of electronic transitions, The Franck - Condon principle, and Jablonski diagram.

Module – II (9 Hours)
Thermodynamics of Chemical Processes:

Concept of Entropy and free energy, Chemical Potential, Equilibrium Conditions.

Phase equilibria:

Phase, Components, Degree of Freedom, Phase Rule Equation.
Phase Diagrams: One Component Systems – Water and Sulphur, Basic idea of (a) Peritectic system, (b) Eutectoid system, (c) Binary phase diagrams of Pb-Ag & Fe-C system.

Module–III (9 Hours)
Electrochemistry:

Electrode Potentials and its Relevance to Oxidation and Reduction, Types of electrodes, Galvanic cell, Measurement of EMF and application of EMF measurements, Types of reference electrodes (Hydrogen, Glass, Quinhydrone Electrodes,) Determination of pH, Electrochemical energy systems its types (Dry Cells, lead acid cell and Fuel Cells: Construction, reaction, advantages and applications).

Corrosion: Concept, types of corrosion, dry or chemical and wet or Galvanic/electrochemical Corrosion, Factors affecting corrosion.

Module–IV (9 Hours)

Kinetics of complex Chemical Reactions: Reversible, Consecutive and Parallel Reactions, Steady State Approximation, Chain reaction.

Module-V (9 Hours)

Chemistry of engineering materials:

Nanomaterials: Applications of nanomaterials.
Organometallics: Application of organometallics
Books Recommended:
1) P. W. Atkins, Elements of Physical Chemistry, 4th Edition, Oxford University Press
2) C. N. Banwell and E. M. MacCash, Fundamentals of Molecular Spectroscopy, 5th Edition,
3) P. K. Kar, S. Dash and B. Mishra, B.Tech. Chemistry Vol. I, Kalyani Publications

Course Outcomes:

CO1: Apply the basic concept of classical mechanics and quantum chemistry to real life applications & to understand the basic concept of electromagnetic radiation, spectroscopic techniques and their applications.

CO2: Should perceive the spontaneity/feasibility of a process applying thermodynamics concepts and to keep up with the idea of phase equilibria, phase rule and its application to one and two component system.

CO3: Define the application of electrochemistry to commercial electrochemical cell and corrosion.

CO4: Able to apply the basic concept of kinetics of a reaction to complex reactions.

CO5: To demonstrate the properties and applications of organometallics and nanomaterials.

Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	3	3	1	-	-	-	1	-	-	1	1	1
CO 2	3	3	1	-	-	-	1	-	-	1	1	1
CO 3	3	3	1	-	-	-	1	-	-	1	1	1
CO 4	3	3	1	-	-	-	1	-	-	1	1	1
CO 4	3	3	1	-	-	-	1	-	-	1	1	1

Program Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
C O	3	3	1	-	-	-	1	-	-	1	1	1

BASIC ELECTRONICS (BEC 02001)

MODULE	CONTENT	HOURS
MODULE 1	Introduction to Electronics: - Signals, Frequency Spectrum of Signals, Analog and DigitalSignals, Linear Wave Shaping Circuits: - RC LPF, Integrator, RC HPF, Differentiator. Properties of Semiconductors: - Intrinsic, Extrinsic Semiconductors, Current Flow in Semiconductors, Diodes: - p-n junction theory, Current-Voltage characteristics, Analysis of Diode circuits, Rectifiers, Clippers, Clampers, Special diodes- LED, Photo diode, Zener Diode.	**12**
MODULE 2	Bipolar junction Transistor (BJTs):- Device Structure and Operation, Current-Voltage Characteristics, BJT as an Amplifier and as a Switch. Introduction to Power Amplifiers: - A,B and Ctypes. JFET:- Physical Structure, Operation and Characteristics	**10**
MODULE 3	Feedback Amplifiers: - General Feedback Structure, Properties of Negative Feedback, Four Basic Feedback Topologies (block diagram only), Practical feedback circuit. Operational Amplifiers (OP-AMPs): - The Ideal OP-AMP, Inverting Configuration, Non-Inverting Configuration. OP-AMP Applications (Adder, Subtractor, Integrator, Differentiator).	**08**
MODULE 4	Digital Fundamentals:- Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-to-Decimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, RS Flip Flop	**06**
MODULE 5	Introduction to Electronic Instruments: - CRO: CRT, Waveform Display, Applications of CRO, Electronic Multimeter, Audio Signal Generator: - Block diagram, Front Panel Controls. Principles of Communication:- Fundamentals of AM & FM, Block diagram of Transmitters	**06**
TEXT BOOK	**1.** Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford UniversityPress. Selected portions from chapters 1 to 3, 5, 8,13. **2.** Electronics Fundamentals and Applications, D Chattopadhyay and P.C. Rakshit, New Age International Publications. Selected portions fromchapters 4 to 12, 14, 16 to 18,20,21.	
REFERENCE BOOK	1. Integrated Electronics, Millman and Halkias, TMHPublications. 2. Electronic Devices & Circuit Theory, R.L Boylestad and L.Nashelsky, PearsonEducation.	

Course Outcomes:

Upon completion of the subject the students will demonstrate the ability to:

CO1	Implement different types of signals and its application to semiconductor devices and circuits.
CO2	Analyze the concept of different BJTs and its operation.
CO3	Express the concept of the Feedback Amplifiers and Operational Amplifiers.
CO4	Apply fundamentals of different Digital arithmetic operations and Digital circuits.
CO5	Demonstrate basic principles of important Electronic Instruments and Communication systems.

Relationship of Course Outcomes (CO) to Program Outcomes (PO) 1 – Low 2 – Moderate 3 – High												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	1	2	-	-	-	-	1
CO2	3	2	2	3	2	1	1	-	-	-	-	1
CO3	3	2	3	3	2	1	2	-	-	-	-	1
CO4	3	3	3	3	3	1	1	-	-	-	-	1
CO5	3	3	3	3	2	1	3	-	-	-	-	1

Program Articulation Matrix row for this Course

	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**
C	3	2	3	3	2	1	2	-	-	-	-	1

PROGRAMMING FOR PROBLEM SOLVING (BIT 02001)

L-T-P: 3-0-0 **Cr.-3**

Module I: **(8 Lectures)**

Introduction to computing- Block architecture of a computer, fundamental units of storage: bit, bytes, nibbles, word size. Introduction to problem solving- Basic concepts of an algorithm, program design methods, flowcharts. Level of programming Languages, structure of C program, Compiling and Executing C program

Module II: **(8 Lectures)**

C Language Fundamentals- Character set, Identifiers, Keywords, Data Types, Constant and Variables, Statements. Input &Output - Input & Output Assignments, Formatted Outputs. Operators and Expressions-Operators, Precedence of operators. Decision Control Structure, Loop Control Structure and Case Control Structure.

Module III: **(8 Lectures)**

Functions: Monolithic vs Modular programs, User defined vs standard functions, formal vs Actual arguments, Functions category, function prototypes, parameter passing, Recursion.Arrays1D Array, 2D Array & Multi-Dimensional Array. Strings- Declaration & Initialization, String Handling Functions.

Module IV: **(8 Lectures)**

Pointer variable and its importance, Pointer Arithmetic, Passing parameters, pointer to pointer, pointer to function. Dynamic Memory Allocation. Structure, Nested Structure, Array of Structures, Pointer to Structure, Structure & Functions, Union, Array of Union Variables, Union inside Structure, Bit Fields. Storage Class.

Module V: **(8 Lectures)**

Preprocessor Directives- Types, Pragma Directives, Conditional Directives. typedef, Enumerated Data Type. Files- Reading data from Files, Reading data from Files, Writing data to Files, Error Handling during File Operations. Advanced Issues in Input & Output – using argc&argv.

Text Books:

1. Programming in ANSI C, E Balaguruswamy
2. Computer Fundamentals &Programming in C: ReemaThareja, Oxford University Press.

Reference Books:

1. Let us C- Y.Kanetkar, BPB Publications.
2. Programming with ANSI and Turbo C- Kamthane, A.N. Pearson Education
3. C How to Program- Deitel and Deitel, Pearson Education.
4. The C Programming Language- Brian W. Kernighan and Dennis M. Ritchie, PrenticeHall.

Course Outcomes:
Upon completion of the subject the students will demonstrate the ability to:

1. grasp the fundamentals of Computer and problem solving.
2. conceptualize fundamentals of C Programming along with control structures.
3. Implement different problems on functions and arrays.
4. Apply pointers structures and unions for problem solving.
5. Gain knowledge of pre-processor directives and file operations.

Course Articulation Matrix

	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**
CO	3	3	3	3	2	-	-	-	2	-	-	3
CO	3	3	3	3	2	-	-	-	2	-	-	3
CO	3	3	3	3	2	-	-	-	2	-	-	3
CO	3	3	3	3	2	-	-	-	2	-	-	3
CO	3	3	3	3	2	-	-	-	2	-	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**
Cours	3	3	3	3	2	-	-	-	2	-	-	3

Basic of Civil Engineering BCE 02001

Module-II

Introduction to Civil Engineering – Various disciplines of Civil engineering, Importance of Civil engineering in infrastructure development of the country.

Introduction to types of buildings as per NBC, Selection of site for buildings, Components of a residential building and their functions, Introduction to Industrial buildings and types.

Building Planning – Basic requirements, elements, introduction to various building area terms, computation of plinth area, carpet area.

Module-II

Surveying – Principle and objectives, Instruments used, Horizontal measurements, Ranging (direct ranging only), Instruments used for ranging, Leveling – Definition, Principles, Instruments, Preparation of level book, problems on leveling, Modern surveying instruments – EDM, Total station, GPS (Brief discussion)

Building Materials – Bricks, properties and specifications, Cement – Types, properties, grades, other types of cement and uses, Cement mortar – Constituents, Preparation, Concrete – PCC and RCC, Grades, Steel – Use of steel in buildings, types.

Module-III

Building Construction – Foundations, Classification, Bearing Capacity of Soil and related terms (definition only), Masonry Works – classifications, definition of different technical terms, Brick masonry – types, bonds, general principle, Roofs – functional requirements, basic technical terms, roof covering material, Floors – function, types, flooring materials(brief discussion), Plastering and Painting – objectives, types, preparation and procedure of application.

Module-IV

Basic Infrastructure services – air conditioning & purpose, fire protection & materials, Ventilation, necessity & functional requirements, Lifts, Escalators.

Introduction to planning and design aspects of transportation engineering, Transportation modes, Highway engineering – historical development, highway planning, classification of highway, Railway Engineering – cross section of rail track, basic terminology, geometric design parameter(brief discussion only).

Module-V

Airport engineering – development, types, definition, characteristics of aircraft, basic terminology, Traffic engineering – traffic characteristics, traffic studies, traffic operations (signals, signs, markings), Urban engineering – classification of urban road.

Irrigation & Water Supply Engineering – Introduction, Types of Irrigation, different types of hydraulic structures, dam and weirs, types of dam, purpose and functions.

Text Books:

- Basic Civil engineering, Gopi, S., Pearson Publication
- Basic Civil Engineering, Bhavikatti, S. S., New Age.

Reference Books:

- Construction Technology, Chudley, R., Longman Group, England
- Basic Civil and Environmental Engineering, C.P. Kausik, New Age.
- American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application

Course Outcomes:

- Analyze the fundamental aspect of building planning.
- Summarize general aspect of building material and surveying.
- Explain about building constructions.
- Judge transportation modes and planning.
- Describe about Airport & Irrigation Structures.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**3**	**1**	**1**	**-**						
CO2	**3**	**2**	**1**	**1**	**1**							
CO3	**2**	**1**			**3**							
CO4	**3**	**2**	**1**	**2**	**1**	**3**						
CO5	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**1**	**2**	**2**	**2**	**3**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	2	2	2	1	2	3	1	2	2	2	3

B Tech Chemistry Lab: (BCH 02002)

List of Experiments to be done (Any ten Experiments)

1. Determination of amount of sodium hydroxide and sodium carbonate in a Mixture.
2. Determination of Total hardness of water by EDTA method.
3. Estimation of calcium present in the limestone.
4. Standardization of KMnO4 using sodium oxalate.
5. Determination of ferrous iron in Mohr's salt by potassium permanganate.
6. Determination of Rate constant of acid catalyzed hydrolysis of ester.
7. Determination of dissolved oxygen in a sample of water.
8. Conductometric titration of strong acid and strong base
9. Determination of Viscosity of lubricating oil by red wood Viscometer.
10. Determination of Flash point of given oil by Pensky Marten's Flash Point Apparatus.
11. Determination of available chlorine in bleaching powder.
12. Preparation of acidic and basic buffer solution and measurement of PH using PH meter

Book Recommended:

B. Tech Practical Chemistry- .

Course Outcomes:

CO1: Develop knowledge of concepts and applications of chemistry, important laboratory analytical techniques, and instrumentation.

CO2: Apply fundamental principles for environmental analytical methods.
CO3: Identify suitable analytical techniques for analysing a specific compound in a sample and ensure quality control.
CO4: Implement suitable techniques for sampling and handling of environmental and chemical samples.
CO5: Hands on training on using different laboratory apparatus and equipments including data analysis and conclusions.

Course Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	3	1	2	-	1	-	2	-	1	-	1	-
CO 2	3	1	2	-	1	-	2	-	1	-	1	-
CO 3	3	1	2	-	1	-	2	-	1	-	1	-
CO 4	3	1	2	-	1	-	2	-	1	-	1	-
CO 4	3	1	2	-	1	-	2	-	1	-	1	-

Program Articulation Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 -	PO1 1	PO1 2
CO	3	1	2	-	1	-	2	-	1	-	1	-

BASIC ELECTRONICS LAB **(BEC 02002)**

Experiment No.	CONTENT
1	Familiarity with electronic components and devices(Testing of semiconductor diode, Transistor, IC Pins connection) Digital Multimeter should be used.
2	Study and use of CRO to view waveforms and measure its Amplitude and Frequency.
3	Frequency response of LPF and HPF.
4	V-I Characteristics of a Semiconductor Diode. Determining DC and AC resistance.
5	Clipper Circuit.
6	Clamper Circuit.
7	Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.
8	V-I (Output) Characteristics of N-P-N/P-N-P Transistor in CE Configuration.
9	OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.
10	Verification of Truth table of Logic gates (AND, OR,NOT, NAND, NOR, EX-OR)
SUPPLEMENTARY BOOK	1. Integrated Electronics, Millman and Halkias, TMHPublications. 2. Electronic Devices & Circuit Theory, R.L Boylestad andL. Nashelsky, PearsonEducation.

Course Outcomes:

Upon completion of the subject the students will demonstrate the ability to:

CO1	Implement Acquire basic knowledge on electronic devices and components
CO2	Analyze different electronics circuits using semiconductor diodes.
CO3	Analyze and develop the characteristics of BJT and FET Circuits.
CO4	Apply fundamentals Operational amplifier circuits.
CO5	Implement knowledge on basic digital logic gates

Relationship of Course Outcomes (CO) to Program Outcomes (PO)

1 – Low **2 – Moderate** **3 – High**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	1	2	-	-	-	-	1
CO2	3	2	2	3	2	1	1	-	-	-	-	1
CO3	3	2	3	3	2	1	2	-	-	-	-	1
CO4	3	3	3	3	3	1	1	-	-	-	-	1
CO5	3	3	3	3	2	1	3	-	-	-	-	1

Program Articulation Matrix row for this Course

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
C	3	2	3	3	2	1	2	-	-	-	-	1

PROGRAMMING FOR PROBLEM SOLVING LAB (BIT 02002)

L-T-P: 0-0-3 **Cr.-1.5**

Topics to be covered:

1. Programs using Input – Output functions.
2. Programs on variable declaration, assignments, operators and typecasting.
3. Program on selection & iterative constructs.
4. Programs on functions.
5. Programs on arrays.
6. Programs on string manipulation.
7. Programs on pointers.
8. Programs on structure & union.
9. Programs on file handling.
10. A mini-project to be designed by students using features of C.

Course Outcomes

Upon completion of the subject the students will demonstrate the ability to:

CO1: Implement the basicsof C programming.

CO 2: Exercise conditional and iterative statements to develop programs.

CO 3: Exercise user defined functions to solve real time problems.

CO 4: Demonstrate the concept of pointers to access arrays, strings and functions.

CO 5: Create C programs on file manipulations.

Course Articulation Matrix

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
CO	3	3	3	3	2	-	-	2	3	-	-	3
CO	3	3	3	3	2	-	-	2	3	-	-	3
CO	3	3	3	3	2	-	-	2	3	-	-	3
CO	3	3	3	3	2	-	-	2	3	-	-	3
CO	3	3	3	3	2	-	-	2	3	-	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	3	3	3	3	2	-	-	2	3	-	-	3

Engineering Graphics & Design (BCE02002)

Course Content

Module-I

Introduction to Engineering Drawing: Drawing instruments, lines, lettering and dimensioning.

Scales: Plain, Diagonal and Vernier Scales.

Module-II

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Module-III

Orthographic Projections: Concepts, Orthographic projections of points, Lines, Planes and Solids. Sections of solids; Development of surfaces

Module-IV

Isometric Projections: Principles, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simpleand compound Solids.

Module-V

Introduction to Auto-Cad:

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute

Reference Books:

1 Engineering drawing by N.D. Bhatt and V.M Panchal, Charotar Publishing House, Anand.

Engineering Drawing by Venugopal, New Age publisher.

Course Outcomes:

1. Revise basics of engineering drawings and curves.
2. Use Orthographic projections of Lines, Planes, and Solids.
3. Apply Sectioning of various Solids and their representation.
4. Change Pictorial views to Orthographic Projections
5. Construct Isometric Scale, Isometric Projections and Views.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**3**	**1**	**1**							
CO2	**3**	**2**	**1**	**1**	**1**							
CO3	**2**	**1**			**2**							
CO4	**3**	**2**	**1**	**2**	**1**	**1**						
CO5	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**1**	**2**	**2**	**2**	**2**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	**3**	**2**	2	2	**1**	**1**	**3**	**1**	**2**	**2**	**2**	**2**

3RD SEMESTER

MATHEMATICS-III (BMA 03001)

(Transforms, Probability and Statistics and Multi variate Analysis) [3-1-0]

Module 1: **Laplace Transforms** ***(10 Lectures)***

Laplace transforms, inverse transforms, linearity, shifting, transforms of derivatives and integrals, solution of ODEs, unit step function, Dirac's delta function, differentiation and integration of transforms, convolution, integral equations.

Module 2: **Fourier Transforms** ***(8 Lectures)***

Basic concept of Fourier integral, Fourier sine and cosine integral, condition of convergence, Fourier transformation, Fourier sine transform, Fourier cosine transform, properties.

Module 3: **Probability** ***(6 Lectures)***

Random variables, probability distributions, mean and variance, Binomial, Poisson and hyper-geometric distributions, Normal distribution.

Module 4: **Statistics** ***(8 Lectures)***

Random sampling, point estimation of parameters, maximum likelihood estimation, confidence intervals, testing of hypotheses for mean and variance, correlation and regression.

Module 5: **Multi-variate Analysis** ***(8 Lectures)***

Line integrals, double integrals, change of order, Green's theorem (statements only), surface integrals, triple integrals, Divergence theorem of Gauss (statements only), Stoke's theorem (statements only) and applications.

Text Book:

Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd, 9th edition

Reference Books:

1) B.V. Ramana, Higher Engineering Mathematics, McGraw Hill
2) K.A. Stroud, Advanced Engineering Mathematics, Industrial Press

Course Outcomes:

Upon completion of the subject the students will be able to:

CO1	Develop adequate knowledge of Laplace and Fourier transforms, and apply this idea to solve differential equations
CO2	Describe unit step function and Dirac's delta function which are useful in engineering problems
CO3	Apply Binomial, Poisson and Normal distributions in probabilistic models
CO4	Demonstrate random sampling and estimation of parameters
CO5	Evaluate multiple integrals and with various applications

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	2	1	-	-	-	1	1
CO2	3	3	2	2	1	2	1	-	-	-	1	1
CO3	3	3	2	2	1	2	1	-	-	-	1	1
CO4	3	3	2	2	1	2	1	-	-	-	1	1
CO5	3	3	2	2	1	2	1	-	-	-	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	3	3	2	2	1	2	1	-	-	-	1	1

DATA STRUCURES AND ALGORITHMS (BCS03001)

Course Objective:

The objective of the course is to interpret and compute asymptotic notations of an algorithm to analyze the consumption of resources (time/space), exemplify and implement stack, queue and list ADT to manage the memory using static and dynamic allocations, implement binary search tree to design applications, identify, model, solve and develop code for real life problems like shortest path and MST using graph theory.

Module I

Introduction to Data Structures: Introduction to Data Structures and Algorithms, Analysis of Algorithms, Asymptotic notations, Time and space trade-off, ADT. Arrays and Lists, Strings, Row/Column major representation of Arrays, Sparse matrix.

Module II

Linear Data Structures: Linked List: Singly linked list, circular linked list, doubly linked list, operations on linked list. Stack: Push; Pop, stack representation using array and linked list, Applications of Stack, Recursion.Queue: Representation using array and linked list, Insertion and deletion operations, circular queue, Dequeue, priority queue.

Module III

Non-Linear Data Structures: Tree : General tree; Binary tree - definitions and properties; binary tree traversal algorithms with and without recursion. Binary Search Tree - creation, insertion and deletion operations, Threaded tree (One way and Two way); AVL tree balancing; B-tree; Application of trees, Heaps.

Graph : Representation, Traversals-BFS and DFS, Minimum Spanning Tree – Kruskal and Prim's Algorithms , Shortest Path, All pairs Shortest Path, Dijkshtra Algorithm, Transitive Closure.

Module IV

Sorting, Searching: Internal sorting algorithms and Complexities: Insertion, Selection, Bubble, Quick, Heap sort, Radix, Multi way merge sort, External sorting, Searching : Linear, Binary Search, Search trees traversal, Digital Search trees, Tries.

Module V

Hashing techniques, Hash function, Address calculation techniques- common hashing functions. Collision resolution, Linear probing, quadratic probing, Double hashing, Bucket addressing. Rehashing.

Text Books :

1. Data Structures Using C – A.M. Tenenbaum (PHI)
2. Introduction to Data Structures with Applications by J. Tremblay and P. G. Sorenson (TMH)

Reference Books :

Data Structures and algorithm Analysis in C – M. A. Weiss (Pearson Education)

Data Structures using C++ - E. Horowich, S. Sahni

Course Outcome:

CO1: Interpret and compute asymptotic notations of an algorithm toanalyze the consumption of resources (time/space).

CO2: Exemplify and implement stack, queue and list ADT to managethe memory using static and dynamic allocations

CO3: Implement binary search tree to design applications likeexpression trees

CO4: Identify, model, solve and develop code for real life problems likeshortest path and MST using graph theory.

CO5: Develop and compare the comparison-based search algorithms andsorting algorithms.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	3	2	-	-	-	-	-	-	3
CO2	3	3	3	3	2	2	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	2	2
CO4	3	3	3	2	1	1	-	-	-	-	1	2
CO5	3	3	3	3	2	1	-	-	-	-	1	2

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	3	3	3	3	2	1	-	-	-	-	1	2

OBJECT ORIENTED PROGRAMMING (BCS03002)

Course Objective:

The objective of the course is to map real world problems into the Programming language, solve the problems in systematic way, and efficiently implement linear, nonlinear data structures and various searching and sorting techniques.

.**Module I**

Introduction to object oriented programming, Evolution of C++,Object oriented technology, Disadvantages of conventional programming, Programming paradigms, Key concept of object oriented programming, Advantages of OOP, Object oriented Languages, Uses of OOP. INPUT AND OUTPUT IN C++: Introduction, streams in C++, Pre-defined streams, Buffering, Stream classes, Formatted and unformatted data, Unformatted console I/O operations, C++ DECLARATIONS: Parts of C++ declarations, Types of Tokens, Keywords, Identifiers, Dynamic Initialization, Data types in C++, Basic data types, Derived data type, User defined data type, Type modifiers, Type casting, Constants, Constant pointers, Scope access operator, CONTROL STRUCTURES: Decision –Making Statements, The if-else Statement, The nested if-else statement, The jump statement, The goto Statement, The break Statement, The continue Statement, The switch case statement, Loop in C/C++, FUNCTIONS IN C++:The main() function in C++, Parts of function, Passing Arguments, Return by Reference, Returning more values by Reference, Default Arguments, The constant argument, Inline Functions, Function Overloading.

Module – II

CLASSES AND OBJECTS:Structures in C++, Classes in C++, Declaring objects, The Public keyword, The Private keyword, The Protect keyword, Defining Member Functions, Characteristics of Member functions, Outside Member function Inline, Rules for Inline functions, Classes, Objects and memory, Static member variables and functions, static object, Array of objects, Friend function, The constant member function, Recursive member function, Local classes, CONSTRUCTORS AND DESTRUCTORS: Constructors and destructors ,Characteristicsof Constructors and Destructors, Application with constructors, Constructors with Arguments, Overloading Constructors, Constructors with Default Arguments, Copy constructors, Destructors, Calling constructors and destructors, Anonymous objects, Dynamic Initialization using constructors.

Module – III

OPERATER OVERLOADING AND TYPE CONVERSION:The keyword operator, Overloading unary operator, Operator return type, Constant on Increment and Decrement Operators, Overloading Binary operators, Overloading with friend function, Type conversion, Rules for Overloading operators. INHERITANCE: Access specifiers, Types of Inheritances, Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Multipath Inheritance, Virtual base classes, Constructors, Destructors and inheritance, Object as a class member, Abstract Classes.

Module -IV

POINTER AND ARRAYS: Pointer declaration, Void pointer, Wild pointer, Pointer to class, Pointer to object, The this pointer, Pointer to derived classes and base classes, pointer to members, Accessing private members with pointers, Direct Access to private members, Arrays, Characteristics of Arrays, Initialization of Arrays using functions, Arrays of classes. C++ AND MEMORY: The new and delete operator, Overloading new and delete operators. BINDING, POLYMORPHISHM AND VIRTUAL FUNCTIONS:Binding in C++, Pointer to

derived class objects, Virtual functions, Rules for virtual functions, Array of pointers, pure virtual functions, Abstract classes, Object slicing. APPLICATION WITH FILES:Introduction, File stream classes, Steps of file operations.

Module – V

EXCEPTION HANDLING: Introduction,Principles of Exception handling, The keyword try, throw and catch, Exception handling mechanism, multiple catch statements, Catch multiple Exceptions, Rethrowing Exception. GENERIC PROGRAMMING WITH TEMPLATES: Introduction, Need of template,Definition of class template ,Normal function template, Working of function templates, Class template with more parameters, Function template with more Arguments, Overloading of template function, Member function template. Working With strings:Introduction, Moving from C string to C++ string, Declaration and initializing string objects, handling string objects.

Text Books:

1. Ashok N. Kamthane- Object oriented programming with ANSI & Turbo C ++.,Pearson Education.
2. E. BalguruSwamy – C ++, TMH publication.

Reference Books:

1. Programming with ANSI C++, 2/e, Bhushan Trivedi, Oxford University Press
2. H. Schildt – C++, The Complete Reference, TMH.
3. RobortLafore-Object-oriented programming in Microsoft C ++
4. The C++ Programming Language (4th Edition), BjarneStroustrup, Addison-Wesley Publications.
5. Object-Oriented Programming Using C++, 4/e, Farrell Joyce, CENGAGE Publications.

Course Outcome:

CO1:Apply Object oriented approach to design software.
CO2: Implement programs using classes, objects.
CO3: Implement programs using Inheritance.
CO4:Analyze polymorphic behavior of objects.
CO5: Memory management and Exception Handling.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	3	-	-	2	3	2	1	-	3
CO2	1	3	2	3	-	-	3	3	2	1	-	3
CO3	1	2	2	3	-	-	2	3	2	1	-	2
CO4	1	2	2	3	-	-	3	2	2	1	-	3
CO5	1	2	2	3	-	-	2	3	2	1	-	2

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	1.2	2.4	2	3	-	-	2.4	2.8	2	1	-	2.6

DIGITAL ELECTRONICS CIRCUIT (BEC03001)

Course Objective:

This course objective is to have an understanding in basic parameters of a logic inverter, analyze and design an NMOS logic inverter with a resistive load, an enhancement NMOS load or a depletion NMOS load, analyze and design a CMOS logic inverter, TTL and ECL logic inverter, Understand the operation of latch circuit and flip-flop circuits.

Module-I

Binary addition and subtraction using 2's complements and 1's complements, Binary codes-BCD codes, Gray codes, Excess-3 code, ASCII Character Code Gate level Minimization: Boolean functions, Canonical & standard form; min terms & max term, Digital Logic Gates for Multiple inputs. The Map Method, K Map for two, three, four, five input variables, Product of Sum (POS), Sum of product (SOP) simplification, Don't care conditions. NAND & NOR Implementation, AND-OR invert, OR-AND invert implementation, Ex-OR Function

Module-II

Combinational Logic: Combinational Circuits, Analysis & Design of Binary Half Adder & Full Adder circuit, Half and Full-subtractor circuit, Binary Multiplier, Magnitude comparator, Decoders, Encoders, Multiplexers,DeMultiplexer, Error detection& correction:

Module-III

Synchronous Sequential Logic: Sequential Circuit, Latches, Flip-flop (S-R, J-K, D, T, M/S), Analysis of Clocked Sequential circuits, State Reduction & Assignment, Design procedure.

Register &Counters: Shift Register, Synchronous Counter, Modulo-n Counters, Up-Down Counter, Asynchronous Counter, Ripple Counters, Ring Counters

Module-IV

Memory & Programmable Logic: Read only Memory (ROM), Random Access Memory (RAM), Memory Decoding, Programmable Logic Array (PLA), Programmable Array Logic (PAL), Sequential Programmable Devices.

Module –V

Register Transfer Levels: Register transfer Level (RTL) notation, Algorithmic State machine, Design Example. Digital Integrated logic Circuits: RTL, DTL, TTL, ECL, MOS & C-MOS Logic circuits

Text books:

1. Digital Design, 4th edition by M. Morris Mano, M. D. Ciletti, Pearson Education.

Reference Books:

2. Digital Fundamentals – Floyd & Jain, Pearson education
3. Switching Theory & Digital Electronics – V. K. Jain, Khanna Publishers.
4. Digital Principles & Applications – Malvino, Leach &Saha, 6th Edition, Tata Mc Graw Hill

Course Outcome:

CO1: An ability to understand basic parameters of a logic inverter.
CO2: An ability to analyze and design an NMOS logic inverter with a resistive load, an enhancement NMOS load or a depletion NMOS load.
CO3: An ability to analyze and design a CMOS logic inverter.
CO4: An ability to analyze a TTL and ECL logic inverter.
CO5: An ability to understand the operation of latch circuit and flip-flop circuits.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	1	2	3	2	1	1
CO2	2	2	2	3	1	-	2	3	2	3	-	2
CO3	2	3	1	3	1	-	1	2	2	3	-	-
CO4	3	1	2	1	2	-	1	2	3	3	-	-
CO5	3	2	1	2	2	-	-	2	2	2	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	2.6	2.2	1.6	2.2	1.4	-	1	2.2	2.4	2.6	0.2	0.8

ECONOMICS FOR ENGINEERS (3-0-0) (BHU03001)

Course Objectives:

- To understand the basic economic principle as a consumer in an economy
- To be able to know the utility measurement in the presence of risk and uncertainty
- To prepare the Engineering students to learn about the production process and analyse the cost/revenue data.
- To provide the foundation for engineers to make good decisions in business environment and learn about the market mechanism.
- To be able to make decision on project alternatives and justify projects on an economic basis

Syllabus:

Module-1:

Theory of Demand: Demand and Utility, Demand function and the factors determining demand, Law of Demand, Reasons for downward sloping demand curve, Exceptions to the law of demand. The market forces of Supply and Demand, Elasticity of demand and its application, Utility analysis: cardinal and ordinal measurability of utility, Assumptions of cardinal utility analysis, law of diminishing marginal utility, Consumer's equilibrium: Principle of equi-marginal utility

Module-2:

Indifference curve analysis of demand: Concepts, properties, Equilibrium of the consumer, Price Consumption Curve (PCC) and Income Consumption Curve, Decomposition of price effect into income effect and substitution effect, Revealed preference hypothesis, Individual choice under Risk and Uncertainty: St. Petersburg paradox and Bernoulli's hypothesis, Neumann-Morgenstern method of constructing utility index, Friedman-Savage hypothesis, Markowitz hypothesis

Module-3

Production function: short run analysis, Total product, Average product and Marginal product, output elasticity of input, law of variable proportion, Long run production function: Isoquants and concepts of returns to scale, Optimum factor combinations, Homogeneous Production Function, Cobb–Douglas production function, CES Production function, Cost Analysis: Concepts, Accounting cost, Fixed and variable cost, opportunity cost, Short run and long run cost curves, Relationships between average cost and marginal cost

Module-4

Market and its classifications, Perfect competition: Characteristics, Short run and long run equilibrium of firm under perfect competition. Monopoly market: Price and output determination. Modern theories of firms: Baumol's theory of sales revenue maximisation, Bain's limit pricing model

Module-5

Time value of money: use of cash flow diagram, Annual economic worth, present worth, future worth, Internal Rate of Return (IRR), Net Present Value (NPV), Payback period method, Analysis of public projects: Cost-Benefit analysis, cost effectiveness

Reference Books:

1. Koutsoyiannis, A. (1979). Modern Microeconomics. The Macmillan Press Ltd., London
2. Varian, H. R. (1992). Introduction to Micro Economic Analysis, Norton and company, New York
3. Salvatore, D. (2008). Microeconomics: theory and applications. Oxford University Press
4. Pindyck, R. S., D. N. Rubinfeld and P. L. Meheta (2009). Microeconomics, Pearson India, New Delhi
5. Panneerselvam, R. (2007). Engineering Economics, Prentice-Hall of India, New Delhi
6. Henderson, J. M. and R. E. Quant (2011). Microeconomic Theory: A Mathematical Approach, Indian Higher Education, New Delhi
7. Intriligator, M. D., R. G. Bodkin and C. Hsiao(1995). Econometric Models, Techniques, and Applications, Pearson India, New Delhi

Programme Outcomes of BTech Programme

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: 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.
PO5	Modern tool usage: 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.
PO6	The engineer and society: 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.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: 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.
PO11	Project management and finance: 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.
PO12	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.

Course Outcomes:

Upon completion of the subject the student will be able to :

CO1	Utilise economics principles in consumption process
CO2	Describe the utility measurement and measure the utility associated with risk
CO3	Efficient use of resources in production and take decision regarding optimum output
CO4	Describe market mechanism and analyse product market to take proper decisions
CO5	Implement economic principles in company related decision making

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	-	-	-	3	3
CO2	-	-	-	-	-	3	2	2	-	-	2	1
CO3	-	-	-	-	-	3	3	-	-	-	3	-
CO4	-	-	-	-	-	2	2	1	1	1	3	-
CO5	-	-	-	-	-	1	2	1	2	-	3	1

Program Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	-	-	-	-	-	3	2	1	1	1	3	2

Sessional

DATA STRUCTURE LABORATORY (BCS03002)

Course Objective:

The objective is to develop linear and non-linear data structure, express different operation on AVL tree, evaluate infix to postfix expression, and apply searching and sorting algorithms in real life applications.

1. Write a C Program to create a stack using an array and perform –
   i) Push operation,
   ii) Pop operation
2. Write a C Program to create a queue and perform – i) Push, ii) Pop, iii) Traversal
3. Write a C Program that uses Stack Operations to perform the following:-
   a. Converting an infix expression into postfix expression
   b. Evaluating the postfix expression
      i. Write a C Program that uses functions to perform the following operations on a single
4. linked list :i)Creation, ii) Insertion, iii) Deletion, iv) Traversal
5. Write a C Program that uses functions to perform the following operations on a
6. double linked list: i)Creation, ii) Insertion, iii) Deletion
7. Write a C Program that uses functions to perform the following operations on a Binary
8. Tree : i) Creation, ii) Insertion, iii) Deletion
9. Write a C Program to construct an AVL-Tree and delete the selective nodes.
10. C Programs on : i) Bubble sort, ii) Selection sort, iii) Insertion sort, iv) Quick sort, v) Radix sort vi) Heap sort, vii) 2 Way Merge Sort
11. C Programs on : i) Sequential Search, ii) Binary Search

Course Outcome:

CO1: Develop linear and non-linear data structure
CO2: Express different operation on AVL tree
CO3: Evaluate infix to postfix expression
CO4: Apply searching and sorting algorithms in real life applications

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	3	2	-	-	-	-	-	-	3
CO2	3	3	3	3	2	2	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	2	2
CO4	3	3	3	2	1	1	-	-	-	-	1	2

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	3	3	3	3	2	1	-	-	-	-	1	2

OBJECT ORIENTED PROGRAMMING LAB. **(BCS03003)**

Course Objective:

The objective is to analyze basic system information, perform troubleshooting and optimize the system performance, configure a Linux distribution to perform common system administrator tasks, develop shell scripts and programming and employ these principles in solving technical problems, examine the differences and similarities of Linux GUI's and select the appropriate Linux GUI.

1. Programs on concepts of class and objects (1 class)
2. Programs using Inheritance (1 class)
3. Programs using Polymorphism (1 class)
4. Programs on use of Operator overloading (1 class)
5. Programs on use of memory management (1 class)
6. Programs on exception handling and use of templates (1 class)
7. Programs on file handling in C++ (1 class)
8. Design a problem on stock and accounting of a small organization, railway reservation, payroll preparation and optimization problem (3 classes)

Course Outcome:

CO1: Analyze basic system information, perform troubleshooting andoptimize the system performance.
CO2: Configure a Linux distribution to perform common systemadministrator tasks.
CO3: Develop shell scripts and programming and employ theseprinciples in solving technical problems.
CO4: Examine the differences and similarities of Linux GUI's and selectthe appropriate Linux GUI.
CO5: Generate local or domain users accounts and implement securitypolicies.
CO6: Design FTP servers and Web servers to deploy services for theclients.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	3	1	-	3	-	1	-	-	2
CO2	1	2	-	3	1	-	3	-	1	-	-	2
CO3	3	2	-	3	1	-	3	-	1	-	-	2
CO4	1	2	-	3	1	-	3	-	1	-	-	2
CO5	1	2	-	3	3	-	3	-	1	-	-	2

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	1.8	2	-	3	1.4	-	3	-	1	-	-	2

DIGITAL ELECTRONICS LAB (BEC03002)

Experiment 1 (Number System, Truth Table and Logic Gates)

I. To convert a number from one number system to another.
II. To study and verify the truth table of various logic gates (NOT, AND, OR, NAND, NOR, EX-OR, & EX-NOR).

Experiment 2 (Half Adder)

I. To design and verify a half adder using S= (x+y)(x'+y') C= xy
II. To design and verify a half adder using S= xy'+x'y C= xy
III. To design and verify a half adder using S= (C+x'y')' C=xy
IV. To design and verify a half adder using S= (x+y)(x'+y') C= (x'+y')'
V. To design and verify a half adder using S = x X-OR y C=xy

Experiment 3 (Full Adder)

I. To design and verify a full adder using S = x'y'z+x'yz'+xy'z'+xyz C=xy+xz+yz
II. To design and verify a full adder using S = z X-OR(x X-OR y) C=xy'z+x'yz+xy
III. To design and verify a full adder using full adder IC 7483.

Experiment 4 (Half Subtractor)

I. To design and verify a half subtractor using D = x'y +xy' B=x'y.
II. To design and verify a half subtractor using D = x X-OR y B=x'y.
III. To design and verify a full subtractor using D = x'y'z+x'yz'+xy'z'+xyz B=x'y+x'

Experiment 5 (Combinational Circiut, BCD, Number Converter etc.)

I. Design a 4 bit magnitude comparator using combinational circuits.
II. Design a BCD to Excess 3 code converter using combinational circuits
III. Design a BCD to decimal converter using combinational circuits.
IV. Design a octal to binary converter using combinational circuits.
V. Design a 3 bit binary to Grey code converter using combinational circuits.
VI. Design a combinational circuit whose output is the 2's complement of the input number.

Experiment 6 (Multiplexer)

I. To design and implement a 4:1 multiplexer.
II. To design and implement a 8:1 multiplexer
III. To design and implement a 16:1 multiplexer
IV. To design a multiplexer tree to implement 32:1 multiplexer using two 16:1 multiplexer.

Experiment 7 (Demultiplexer)

I. To design and implement a 2:4 demultiplexer.
II. To design and implement a 3:8 demultiplexer.
III. To design and implement a 4:16 demultiplexer.
IV. To design and implement a 1:4 demultiplexer.
V. To design and implement a 4:16 demultiplexer using two 3:8 demultiplexer.

Experiment 8 (Decoder)

I. To design and verify a 2:4 a decoder.
II. To design and verify a 3:8 a decoder.
III. To design a BCD to decimal decoder.
IV. To design and verify a 4:16 decoder.
V. Implement a full adder circuit with a decoder

Experiment 9 (Encoder)

I. To design and implement a 4:2 encoder.
II. To design and implement a 8:3 encoder.
III. To design and implement a decimal to BCD encoder.
IV. To design and implement a octal to binary encoder.

Experiment 10 (Flip-Flops)

I. To design and verify the operation of RS flip-flops using logic gates.
II. To design and verify the operation of T flip-flops using logic gates
III. To design and verify the operation of D flip-flops using logic gates.
IV. To design and verify the operation of JK flip-flops using logic gates.
V. To verify the operation of a RS flip-flop using ICs.
VI. To verify the operation of a T flip-flop using ICs
VII. To verify the operation of a D flip-flop using ICs
VIII. To verify the operation of a JK flip-flop using ICs.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	-	1	2	2	2	1	2
CO2	2	3	2	1	-	-	2	2	2	2	1	3
CO3	2	3	3	2	-	-	1	1	2	1	1	3
CO4	3	3	1	1	-	-	-	1	1	1	2	3
CO5	2	3	2	2	-	-	-	1	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.4	3	2	1.6	-	-	0.8	1.4	1.8	1.6	1.2	2.6

ADVANCE PROGRAMMING LAB (BCS03004)

1. Implement a sequential search
2. Create a calculator program
3. Explore string functions
4. Implement Selection Sort
5. Implement Stack
6. Read and write into a file
7. Demonstrate usage of basic regular expression
8. Demonstrate use of advanced regular expressions for data validation.
9. Demonstrate use of List
10. Demonstrate use of Dictionaries
11. Create Comma Separate Files (CSV), Load CSV files into internal Data Structure
12. Write script to work like a SQL SELECT statement for internal Data Structure made in earlier exercise
13. Write script to work like a SQL Inner Join for an internal Data Structure made in earlier exercise
14. Demonstrate Exceptions in Python

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	-	-	2	1	2	2	1	2
CO2	3	2	2	1	-	-	2	2	2	2	-	2
CO3	3	2	1	2	-	-	1	1	3	1	-	2
CO4	3	3	2	2	-	-	1	2	2	1	1	2
CO5	3	2	1	1	-	-	2	1	2	1	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	2.2	1.6	1.6	-	-	1.6	1.4	2.2	1.4	0.6	1.8

Fourth Semester

COMPUTER ORGANIZATION (BCS04001)

Course Objective:

The objective is to analyze the designing process of combinational and sequential circuits, express arithmetic logic and shift micro operations in symbolic form at a register transfer level, identify the addressing modes used in macro instructions, apply algorithms for arithmetic operations and implementation for ALU design, and develop micro code for typical instructions in symbolic form.

Module-I

Basic Organization of Computers, Classification Micro, Mini, Mainframe and Super Computer. System Bus and Interconnection: Single and multi-bus, Computer Function Von-Neumann M/c: Structure of IAS.

Data Representation: Fixed Point Representation, Floating Point Representation. Addition and Substraction, Multiplication (Booth Algorithm), Division Algorithm, Floating Point Arithmatic Operation, Decimal Arithmatic Operation.

Module-II

Instruction Format: Three Address, Two Address, One Address and Zero Address Instruction.

Addressing Modes: Types of Addressing modes, Numerical Examples, Program Relocation, Compaction. Data Transfer & Manipulation: Data transfer, Data Manipulation, Arithmetic, Logical & Bit Manipulation Instruction, Program Control: Conditional Branch Instruction,

Module -III

CPU Organization: Instruction-cycle, Fetching and storing a word in Memory, Register Transfer. Performing an Arithmetic & Logic Operation, Branching. Control word, Stack Organisation, Register Stack, Memory Stack, Subroutine. Control Unit Operation: Hardware Control & Micro Programmed Control.

Module-IV

Memory Organization: Computers Memory System Overview, Characteristics of Memory System, Memory Hierarchy, Main Memory types, Memory cell Operation.

Cache Memory: Cache Principles, Elements of Cache Design, Cache Size, Cache Mapping function, Replacement Algorithm, LRU, FIFO, LFU, Write policy. Number of Caches: Single versus two level caches, Pentium Cache Organization. Associative Memory, Virtual Memory.

Module-V

Input/Output Organization: Peripheral Devices, I/O Interface, I/O Bus, Interface Module, Asynchronous Data Transfer, Strobe Control, Handshaking, Asynchronous Serial Transfer, Asynchronous Communication Interface, Modes of Transfer: Programmed I/O, Interrupt Driven I/O, Direct Memory Access (DMA), DMA Controller, I/O Channel & Processor. Interrupt: Class of interrupt, Priority Interrupt: Daisy Chaining Priority, Parallel Priority Interrupt. Program Interrupt, Types of Interrupt, RISC & CISC Characteristic.

Text Books:

1.Computer Organization & Architecture – William Stallings, 7th Edition, PHI
2. Computer Organization – by V.CarlHamacher, Z.G.Vranesic, and S.G.Zaky, 5th Edition. McGraw Hill.

Reference Books:

1. Computer System Architecture : Morris Mano, 3rd Edition, PHI
2. Computer Architecture and Organization, by - John P. Hayes, 3rd Edition, Mc Graw Hill International Editions.
3. Computer Organization& Design, (3rd Edition) by – D.A.Patterson&J.L.Hennessy – Morgan Kaufmann Publishers (Elseviers).

Course Outcome:

CO1: Identify Basic Organization of Computers.
CO2: Identify the addressing modes used in macro instructions.
CO3: Apply algorithms for arithmetic operations and implementation for ALU design.
CO4: Identify Characteristics of Memory System.
CO5: Develop micro code for typical instructions in symbolic form.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	1	1	-	1	2	1	2	1	1
CO2	3	3	2	2	1	-	2	2	2	3	1	1
CO3	3	2	1	1	1	-	1	2	2	2	-	1
CO4	2	2	1	1	2	2	2	1	2	3	-	-
CO5	1	1	2	2	1	1	1	2	1	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	2.2	2.2	1.6	1.4	1.2	0.6	1.4	1.8	1.6	2.4	0.4	0.6

THEORY OF COMPUTATION (BCS04002)

Course Objectives:

Finite automata are useful models for many important kinds of hardware and software. Here are the most important kinds: Software for designing and checking the behaviour of digital circuits; The "lexical analyzer" of a typical complier, that is, the compiler component that breaks the input text into logical units, such as identifiers, keywords, and punctuation; Software for scanning large bodies of text, such as collections of Web pages, to find occurrences of words, phrases, or other patterns;

Module I

Automata, Computability, and Complexity, Strings and languages: symbol, alphabet, string/ word. Language - Definition, language states, Mathematical proving techniques, difference between natural and formal language.

Module II

Fundamentals& Finite Automata:Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, Deterministic Finite Automaton (DFA) and Non deterministic Finite Automaton (NFA), transition diagrams and Language recognizers.Equivalence of DFA and NFA, NFA to DFA conversion,NFA with e - transitions - Significance, acceptance of languages. Equivalence between NFA with and without e - transitions, minimization of FSM, Finite Automata with output- Moore and Mealy machines and conversion of Mealy to Moore and vice-versa.

Module III

RegularExpression and Languages": Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Regular grammars-right linear and left linear grammars, conversion of right linear grammar to left linear and vice-versa, equivalence between regular grammar, regular expression and FA, Pumping lemma of regular sets, closure properties of regular sets.

Module IV

Context Free Grammars and Push Down Automata: Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings.Ambiguity in context free grammars. Reduction of Context Free Grammars. Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL.Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFG and PDA, inter-conversion. Introduction to DCFL and DPDA. DPDA Vs NPDA.

Module V

Turing Machine and its Computational Complexity:Chomsky hierarchy of languages, Context sensitive language, Context sensitive grammar,Turing Machine, definition, model, design of TM, Variants of TM, linear bounded automata,Computable functions, recursively enumerable languages. Church's hypothesis. Decidable, Undecidable and reducible problems, Efficiency of computation, Turing Machine and complexity, Language family and complexity classes, the complexity classes P and NP.

Text books:

1. "Introduction to Automata Theory Languages and Computation". Hopcroft H.E. and Ullman J. D. Pearson Education
2. Introduction to Theory of Computation –Sipser 2nd edition Thomson

Reference books:

1. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
2. Introduction to languages and the Theory of Computation ,John C Martin, TM
3. "Elements of Theory of Computation", Lewis H.P. &Papadimition C.H. Pearson PHI.
4. Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekaran, 2nd edition, PHI
5. "An introduction to Formal Languages and Automata", Peter Linz, Narosa.
6. Formal Language and automata theory- H.S. Behera, J. Nayak and H. Pattnayak, Vikas Publishing House Pvt. Ltd.

Course Outcome:

CO1: Understand the representation of language in mathematical form.

CO2: Understand the implementation of DFA, NFA and ∈-NFA.

CO3: Convert regular expression to DFA.

CO4: Differentiate context-free grammar and context-sensitive grammar.

CO5: Identify the expressive power of an automata

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	-	-	-	3	1	-	1
CO2	3	2	2	2	2	1	-	-	3	1	-	-
CO3	3	2	3	2	2	3	2	2	3	1	-	-
CO4	3	3	2	1	2	1	1	1	3	1	-	-
CO5	3	3	3	2	1	1	1	-	3	-	-	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	3	2.6	2.4	1.6	1.8	1.2	0.8	0.6	3	0.8	-	0.6

DESIGN AND ANALYSIS OF ALGORITHMS (BCS04003)

Course Objective:

The objective is to understand asymptotic notations to analyze the performance of algorithms, identify the differences in design techniques and apply to solve optimization problems, apply algorithms for performing operations on graphs and trees, solve novel problems, by choosing the appropriate algorithm design technique for their solution and justify their selection, and analyze deterministic and nondeterministic algorithms to solve complex problems.

Module I

Introduction to Design and analysis of algorithms, Growth of Functions (Asymptotic notations), Recurrences, Solution of Recurrences by substitution, Recursion tree method, Master Method, Analysis of Searching and Sorting Techniques: Brute Force Technique, Divide and Conquer Algorithms, Decrease and Conquer, Heaps and Heap sort, Lower Bounds for Sorting.

Module II

Greedy Algorithms: Activity Selection Problem, Elements of Greedy Strategy, Fractional Knapsack Problem, Huffman Codes.

Dynamic Programming: Matrix Chain Multiplication, Elements of Dynamic Programming, Longest Common Subsequence, 0/1 Knapsack, Travelling Salesman Problem

Module III (6 Lectures)

Data Structure for Disjoint Sets, Disjoint Set Operations, Linked list Representation, Graph Algorithm - BFS and DFS, Minimum Spanning Trees: Kruskal algorithm, Prim's Algorithm, Single Source Shortest paths: Bellmen Ford Algorithm, Dijkstra's Algorithm, All Pair Shortest Path: Floyd-Warsall Algorithm.

Module IV

String matching: Rabin-Karp Algorithm, KMP Algorithms, Boyer- Moore Algorithm, Polynomial Evaluation and Interpolation, Fast Fourier Transform, Strassen's Matrix multiplication, Convolution.

ModuleV

NP-Completeness, Polynomial time verification, Reducibility, Proof of NP-Completeness (NCDP, CDP, CNDP, Hamiltonian cycle), Approximation Algorithms, Traveling Salesman Problem.

Text Books

1. M.R.Kabat "Design and Analysis of Algorithms", PHI Learning (p) Ltd
2. T.H.Coreman et.al. "Introduction to Algorithms" Pearson Education

Reference Books

1. S. Sridhar ""Design and Analysis of Algorithms", Oxford University Press
2. A.V.Aho et.al., "The Design and Analysis of Algorithms" Pearson Education, NewDelhi
3. K, Louden " Mastering Algorithms", O' Reily Media Inc

Course Outcome:

CO1: Understand asymptotic notations to analyze the performance of algorithms

CO2: Apply Divide & Conquer, Greedy strategy to solve various problems.

CO3: Apply dynamic programming to get the optimal solution.

CO4: Solve novel problems, by choosing the appropriate algorithm design technique for their solution and justify their selection

CO5: Analyze deterministic and nondeterministic algorithms to solve complex problems

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	1	3	2	-	-	-	-	-	-	3
CO2	3	3	3	3	2	2	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	2	2
CO4	3	3	3	2	1	1	-	-	-	-	1	2
CO5	3	3	3	3	2	1	-	-	-	-	1	2

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	3	3	3	2	1	-	-	-	-	1	2

GRAPH THEORY (BMA04001)

Course Objective:

The objective of this course is to learn fundamental concepts of graphs, paths, cycles, trails, trees, understand Ramsey's Theorem Graph isomorphism, special graphs, decomposition, Connection, Characterizing bipartite graphs Hamiltonian cycles, Dirac's Theorem, Eulerian circuits, vertex and edge connectivity, Berge's Theorem, Hall's Theorem, learn vertex coloring, edge coloring and list coloring.

Module-I

Fundamental Concepts:Graphs, Paths, Cycles, Trails, Vertex Degrees, Counting, directed graphs. Trees and Distance : Basic Properties, Spanning Trees and Enumeration, Optimization and Trees.

Ramsey's Theorem Graph isomorphism, special graphs, decomposition, Connection. Characterizing bipartite graphs Hamiltonian cycles: Dirac's Theorem

Module-II

Eulerian circuits: characterization of Eulerian graphs Cut-vertices, edges. Trees: equivalent c onditions for trees, and related
results.Vertex and edge connectivity : Whitney's inequality, cubic graphs,
expansion. 2- and 3-connected graphs: Whitney's theorem
in Testing Center, Thomassen's 3-connectivity theorem Menger's theorem with applications.

Module-III

Introduction to matchings : Berge's theorem. Bipartite matching: Hall's Theorem, Konig-Egervary theorem.General matchings: Tutte's theorem, Berge-Tutte formul a, Petersen's 1-factor theorem, Petersen's 2-factor theorem

Module-IV

Vertex-coloring, chromatic number, constructions of Mycielski and Zykov, Brooks' theorem. Turan's Theorem. Edgecoloring, chromatic index of bipartite graphs, Vizing's Theorem.List Coloring, Kernel lemma and Galvin's Theorem.

Plnarity : Planar and plane graphs, Euler's Formula, Kuratowski graphs, Kuratowski's Theorem

List coloring of planar graphs: Thomassen's Theorem, planar duals
Lower bound for Ramsey's Theorem.

Module-V

Advanced Topics on: Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

Course Outcome:

CO1: Learn fundamental Concepts: Graphs, Paths, Cycles, Trails, Vertex Degrees, Counting, and directed graphs.

CO2: Understand Eulerian circuits, Trees, equivalent conditions for trees, Vertex and edge connectivity, Whitney's inequality, cubic graphs, 2- and 3-connected graphs, Whitney's theorem Thomassen's 3-connectivity theorem and Menger's theorem.

CO3: Introduction to Berge's theorem, Hall's theorem, Konig-Egervary theorem, Tutte's theorem, Berge-Tutte formula, Petersen's 1-factor theorem, Petersen's 2-factor theorem.

CO4: Determine vertex coloring, edge coloring, list coloring, and planarity.

CO5: Design spanning trees

Text Book –

Introduction to Graph Theory – Douglas B. West, PHI.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	3	-	-	-	2	2	3	-	3
CO2	3	2	-	3	-	-	-	2	2	2	-	2
CO3	2	2	-	3	-	-	-	2	2	3	-	3
CO4	3	2	-	3	-	-	-	2	2	3	-	3
CO5	3	2	-	3	-	-	-	2	2	2	-	3

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.8	2	-	3	-	-	-	2	2	2.6	-	2.8

ORGANIZATIONAL BEHAVIOUR (BHU04001)

Credit- 3-0-0 Class Hours - 30

Syllabus

Module I (6 hours)

Fundamentals of OB: Learning objectives, Definition, scope and importance of OB, why to study OB, Relationship between OB and the individual, Evolution of OB, Theoretical framework (cognitive), Behavioristic and social cognitive, Models of OB, New Challenges of OB Manager,Limitations of OB
Learning: Nature of learning, Determinant of learning, How learning occurs, Learning and OB Case Study Analysis

Module II (6 hours)

Personality: Definition and importance of personality for performance, Nature and Determinants of personality, Theories of Personality, Personality Traits, Personality and OB

Perception: Meaning and concept of perception, Perceptual process, Importance of perception in OB Motivation: Definition & Concept of Motive & Motivation, Theories of Motivation (Herzberg's Two Factor model Theory, Maslow's Need Hierarchy, Aldefer's ERG theory) Case Study Analysis

Module III (6 hours)

Communication: Importance, The Communication Process, Types of communication, Barriers to communication, Communication networks, Making communication effective

Groups in organization: Nature, Types of Groups, Why do people join groups? Stages of Group

Development, Group cohesiveness, Group decision making and managerial implication,

Developing Work Teams, Team Building, Effective team building

Leadership: Concept of Leadership, Styles of Leadership, Theories of leadership (Trait theory,

Behavioral theory, Contingency theory), How to be an effective leader, Success stories of

today's Global and Indian leaders. Case Study Analysis

Module IV (6 hours)

Conflict: Nature of conflict, Sources of Conflict, Conflict resolutions, Stages of conflict episode, Conflict management technique

Transactional Analysis (TA): Meaning of TA, Ego states, Types of transactions, Life position

Case Study Analysis

Module V (6 hours)

Organizational Change: Why organizational change? Types of Organizational Change, Planned change, Kurt Lewin's-Three step model, Resistance to Change, Managing resistance to change. Organizational Culture: Meaning & definition, Types of culture, creating, sustaining and

changing a culture, Concept of workplace spirituality.

International OB: Introduction to International business, Individual and group behavior in

International organization, How culture influence International OB?

Case Study Analysis

Reference Books

1. Stephen P. Robbins, Organizational Behaviour, Printice Hall of India, New Delhi, 2013
2. K. Aswathappa, Organizational Behaviour, Himalaya Publishing House, Bombay, 2018
3. Nelson, D. L., and Quick, J. C. (2007)., Understanding Organizational Behaviour (3rded.)., Thompson South-Western Publication
4. Pareek, U. (2012), Understanding Organizational Behaviour (3rded.)., Oxford University Press.

Programme Outcomes of BTech Programme

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: 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.
PO5	Modern tool usage: 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.
PO6	The engineer and society: 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.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: 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.
PO11	Project management and finance: 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.
PO12	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.

COURSE OUTCOMES: At the end of this course, the students will be able to

CO1	Explain the transition process of management thought from traditional period to modern approaches**.**
CO2	Transfer the different motivational theories and evaluate motivational strategies used in a variety of organizational settings.
CO3	Identify and analyze the factors affecting individual and group behavior and evaluate the appropriateness of various leadership styles.
CO4	Evaluate the appropriateness of various conflict management strategies used in organizations and develop strategies for resolving group conflict.
CO5	Explain how organizational change and culture affect working relationships within organizations.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	**2**	**2**	**2**	**1**	**1**	**3**	**2**
CO2	-	-	-	-	-	**1**	**1**	**1**	**3**	**1**	**-**	
CO3	-	-	-	-	-	**2**	**1**	-	**3**	**3**	**3**	-
CO4	-	-	-	-	-	**-**	**1**	**-**	**1**	**2**	**1**	**1**
CO5	-	-	-	-	-	**3**	**1**	1	**2**	**1**	3	**3**

Program Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	-	-	-	-	-	**2**	**1**	**1**	**3**	**2**	**3**	**2**

Sessional

COMPUTER ORGANIZATION AND ARCHITECTURE LAB (BCS04002)

Course Objective:

The objective is to learn simulation of fast multiplication and division algorithms, disassemble and assemble of personal computer and familiar with different components of motherboard.

1. Simulation and design of Fast Multiplication and Division Programs.
2. Some experiments using hardware training kits for floppy drive, dot matrix printer etc.
3. Dismantling and Assembling a PC along with study of connections, ports, chipsets, SMPS etc. Draw a block diagram of motherboard and other board.
4. A Study Project on some hardware technologies (memory, serial bus, parallel bus, microprocessor, i/o devices, motherboard etc.)

Course Outcome:

CO1: Simulation of fast multiplication and division algorithms

CO2: Disassemble and assemble of personal computer

CO3: Be familiar with different components of motherboard

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	-	1	2	1	1	2	1
CO2	3	2	2	1	1	-	1	2	2	2	2	1
CO3	3	3	3	2	2	2	-	1	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	2.6	2.6	2.4	1.6	0.8	1	0.4	1.6	1.4	1.4	2.2	1.6

DESIGN AND ANALYSIS OF ALGORITHMS LAB (BCS04003)

Course Objective:

The objective of this course is to implement polynomial addition, heap sort, DFS and BFS, estimate time and space complexity of an algorithm, and learn NP complete and NP hard problem and their solutions.

Elementary Problems

1. Implement polynomial addition using a single linked list.

2. Implement insertion routine in an AVL tree using rotation .

3. Implement heap sort using a max heap.

4. Implement DFS/BFS routine in a connected graph.

Divide and Conquer Algorithm

1. write a quick sort routine,run it for a different input sizes and calculate the time of running . Plot a graph input size vs time.

2. Implement two way merge sort and calculate the time of sorting .

Greedy Algorithm :

1. Given a set of weights,form a Huffman tree from the weight and also find out the code corresponding to each weight .

2. Take a weighted graph as an input ,find out one MST using Kruskal/Prim's algorithm .

Dynamic Programming:

1. Find out a solution for 0/1 Knapsack problem .

2. Given two sequences of character, find out their longest common subsequence using dynamic programming.

NP complete and NP hard problems :

1. Find out a solution to graph colorability problem of an input graph.

2. Find out a solution to sum of subset problems.

Course Outcome:

CO1: Implement polynomial addition, heap sort, DFS and BFS

CO2: Estimate time and space complexity of an algorithm

CO3: Learn NP complete and NP hard problem and their solutions

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	1	3	2	-	-	-	-	-	-	3
CO2	3	3	3	3	2	2	-	-	-	-	2	2
CO3	3	3	3	3	2	2	-	-	-	-	2	2

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	3	3	3	2	1	-	-	-	-	1	2

Fifth Semester

OPERATING SYSTEMS (BCS05001)

Course Objective:

The objective of the course is to analyze the concepts of Operating System and process, illustrate the Scheduling of a processor for a given problem instance, identify the dead lock situation and provide appropriate solution, analyze memory management techniques and implement page replacement Algorithm, and understand the implementation of file systems and directories.

Module I

Introduction:Operating Systems. Simple Batch Systems, Multiprogramming and Time-Sharing systems. Personal Computer Systems, Parallel Systems, Distributed systems and Real time Systems. Operating Systems structures: systems components, protection system, O.S. Services, System Calls.

Module II

Process Management: Process concept, process scheduling, Operation on process, Cooperating Processes, Inter process communication. Threads CPU Scheduling: Basic concepts, scheduling algorithms.Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock.

Module III

Memory Management: Background, Logical versus Physical Address space, swapping, contiguous Allocation. Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, page Replacement Algorithms. Allocation of frames, Thrashing, Demand Segmentation.

Module IV

File System Interface: File concept, Access Methods Directory implementation, Recovery.I/O systems: Overview, I/O Hardware, Application of I/O interface, Kernel I/O – subsystem Transforming I/O requests to Hardware operations.

Module V

Secondary Storage Structure: Disk Structure. Disk scheduling, Disk management, Swap space management, Disk Reliability, Case Studies LINUX, WINDOW NT.

Text Book:

1. Operating System Concepts: Abraham Silberschatz and Peter Bear Galvin, Addison Wesley.

Reference Book:

1. Operating System, McGraw Hill, Madnik& Donovan.
2. Operating Systems and system progamming, SCITECH, P. Blkeiahn Prasad.
3. Moswen O.S. – PHI, Andrew, S. Tannenbaum

Course Outcome:

CO1: Analyze the concepts of Operating System.

CO2: Analyze the concepts of process, thread and deadlock situation and Illustrate the Scheduling of a processor for a given problem instance.

CO3: Analyze memory management techniques and implement page replacement Algorithm.

CO4: Understand the implementation of file systems and directories.

CO5: Understand the implementation of Disk Structure and illustrate different case studies of different OS

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	-	3	2	3	2	-	3
CO2	3	3	2	2	-	-	3	2	3	2	-	3
CO3	3	3	2	2	-	-	3	2	3	2	-	3
CO4	3	3	2	2	-	-	3	2	3	2	-	3
CO5	3	3	2	2	-	-	3	2	3	2	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	3	2	2	-	-	3	2	3	2	-	3

COMPUTER ARCHITECTURE (BCS05002)

Course Objective:

To identify the requirement for improving the performance of computing systems. To understand the overlapped and simultaneous parallelism. To identify the characteristics and performance of interconnection networks. To design computer systems for different applications.

Module I

Metrics for computer performance: clock rate, MIPS, CPI Strength and weakness of performance metrics role of Amdalh's in computer performance.

Module II

Hierarchical memory system, main, cache and auxiliary memory, I/O subsystem, Average and Worst case access time, Multi-level cache memory, Split Cache, Cache Consistency.

Classification of computer architecture: SIMD, MIMD, SISD and MISD Processing unit design: Data path implementation, Microprogrammed execution.

Module III

Principles of pipelining and vector processing: Pipelining, Instruction and Arithmetic Pipelines, Principles of Designing Pipelined Processor, Instruction pipelining and parallel processing, Instruction level parallelism: VLIW, Vector processor, Multithreaded processor, Superscalar architecture branch prediction Prefetching Speculative execution Vector Processing Requirements.

Module IV

Structure and Algorithms for array processors: SIMD Array Processors, SIMD Interconnection Networks, Parallel Algorithms for array Processors, Programming, Performance Evaluation and Compiler Transformations for parallel computers. Associative Array Processing.

Module V

Multiprocessor architecture and programming: Inter processor Communication Mechanisms, System Deadlocks and Protection, Multiprocessor Scheduling Strategies, Parallel Algorithm for Multiprocessor. Multiprocessor and Multi Computer architectures. Cache coherence problem.

Text Books:

1. J. L.Henessy and D. A. Pattersan,, *Computer Architecture A Quantitative approach,*, Elsevier , 5th ed. 2009.
2. V.Rajaraman and C.Sivaramamurthy, *Parallel Computers Architecture and Programming*, PHI , 2000

Reference Books:

1. Kai Hwang, *Advanced Computer Architecture: Parallelism, Scalability, Programmability*, Tata McGraw Hill , 2004
2. H.G.Cragon, *Memory Systems and Pipelined Processors*, Narosa , 1998.

Course Outcome

CO1: To design computer system for solving computational and communication intensive problems
CO2: To verify the performance of computing systems with extended components.
CO3: To Performance Evaluation and Compiler Transformations for parallel computers
CO4: Designing of Pipelined Processor
CO5: To understand the solutions for cache coherence and dead lock problem in multiprocessor and multi computer based systems

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	1	1	-	1	1	2	1	2	1	1
CO2	3	2	1	2	-	-	2	2	2	3	1	2
CO3	3	2	1	1	1	-	1	2	2	1	1	1
CO4	3	2	1	1	2	2	2	2	2	1	2	-
CO5	1	1	2	2	1	1	1	2	1	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.6	1.6	1.2	1.4	0.8	0.8	1.4	2	1.6	1.8	1	0.8

DATABASE MANAGEMENT SYSTEMS (BCS05003)

Course Objective:

The objective is to analyze the basic concepts and architecture associated with DBMS, apply normalization steps in database design and removal of data anomalies, describe the characteristics of database transactions, create, maintain and manipulate a relational database using SQL, and employ the conceptual and relational models to design large database systems.

Module – I

Database system architecture: Data Abstraction, Data Independence, Three-Schema Architecture.

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints.

Module – II

Relation Query Languages:Relational Algebra, SQL, Data Definition Language (DDL), Data Manipulation Language (DML), Tuple and Domain Relational Calculus.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Module – III

Query processing and Optimization: Evaluation of Relational Algebra Expression, QueryEquivalence, Join strategies, Query optimization Algorithms.

Module – IV

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

Module – V

Advanced Topics: (Introduction to concepts only)Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books:

1. Elmaski&Navathe- Fundamentals of Database systems, 4thEdition, PearsonEducation

2. A. Silberschatz, H. F. Korth, S. Sudarshan-Database System Concepts, 5th Edition, McGraw Hill International Edition.

Reference Books:

1. Bipin Desai- An introduction to Database System, Galgotia publication.

2. G.W.Hansen and J.V.Hansen, Database Management and Design, 2nd Edition, PHI

Course Outcome:

CO1: Understand the basic concepts, database modeling and architecture associated with DBMS.

CO2: Use DDL and DML to query, update, and manage a database and also understand the need of normalization and the various normal forms for a good relational database design.

CO3: Gain knowledge on the basics of query evaluation techniques and query optimization.

CO4: Understand the basic issues and concepts associated with transaction processing and concurrency control.

CO5: Become familiar with the introductory concepts of some of the advanced topics of DBMS.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	3	-	-	2	2	3	2	-	3
CO2	3	3	2	3	-	-	2	2	3	2	-	3
CO3	3	3	2	3	-	-	2	2	3	2	-	3
CO4	3	3	2	3	-	-	2	2	3	2	-	3
CO5	3	3	2	3	-	-	2	2	3	2	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	3	2	3	-	-	2	2	3	2	-	3

Professional Elective-I

COMPUTER GRAPHICS (BCSPE501)

Course Objective:

The objective is to be familiar with GUI, use of points and lines algorithm, learn basic transformation such as translation, rotation and scaling, learn line and polygon clipping, and use of halftone pattern and dithering.

Module I

Application of Computer Graphics; Graphics Hardware: Raster-Scan and Random Scan Displays. Output Primitives:Points and Lines, Line Drawing Algorithms, Circle Drawing Algorithms, Region Filling Algorithms, Side Effects of Scan Conversion, Antialiasing.

Module II

Two-Dimensional Geometric Transformations: Basic Transformations (Translation, Rotation, Scaling), Matrix Representation and Homogeneous coordinates, Composite Transformation, Reflection, Shear, Transformation between coordinate system.

Two-Dimensional Viewing:Viewing Pipeline, Window-to-viewport Coordinate Transformation. Two-Dimensional Clipping: Point Clipping, Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm)

Module III

Three-Dimensional Transformation and Projection:Translation Rotation, Scaling, Reflections, Shear, Projection: Types of Projections (Parallel and Prospective), Mathematical Description of Projections. Three-Dimensional Viewing and Clipping:Three-Dimensional Viewing, Clipping, Viewing Transformation

Module IV

Three Dimensional Object Representations: Curve Design, Blending Functions and its types,Spline Curve, Bezier Curves and Surfaces, B-Spline Curves and surfaces.

Fractal Geometry Methods:Fractal Generation Procedure, Classification of Fractals Dimension, geometric Construction of Deterministic self-similar.

Module V

Visible Surface Detection Methods:Hidden Lines and Surfaces,DepthComparisons,Back-face Detection, Z-Buffer, A-Buffer.

Illumination Models: Basic Models, Displaying Light Intensities, Halftone Pattern and Dithering Techniques.

Surface Rending Methods: Polygon Rendering Methods, Gouraud and Phong Shading.

Text Books:

1. Computer Graphics, D.Hearn and M.P.Baker (C Version), Prentice Hall, 1999

Reference Books:

1. Computer Graphics Principle and Practice, J.D.Foley, A.Dam, S.K.Feiner, Addison, Wesley.
2. Schaum's Outlines Computer Graphics, Z. Xiang and Roy A Plastock, 2nd Edition, McGraw Hill Education, Indian Edition 2006.

Course Outcome:

Upon completion of the subject, the students will demonstrate the ability to:

CO1: To express the fundamental concepts of graphics.

CO2: Design two-dimensional graphics by applying two dimensional transformations.

CO3: Design three-dimensional graphics by analyzing three dimensional transformations.

CO4: Analyze and implement curves and surfaces.

CO5: Demonstrate knowledge of rendering techniques.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	3	-	-	2	-	2	3	-	3
CO2	3	3	2	3	-	-	2	-	2	3	-	3
CO3	3	3	2	3	-	-	2	-	2	3	-	3
CO4	3	3	2	3	-	-	2	-	2	3	-	3
CO5	3	3	2	3	-	-	2	-	2	3	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course	3	3	2	3	-	-	2	-	2	3	-	3

SIMULATION AND MODELING (BCSPE502)

Course Objective:

The objective is to understand the inventory concepts which include the technique of simulation, major application areas, concept of a system, environment, continuous and discrete systems models, Monte Carlo method etc., study of probability concepts in simulation including stochastic variables, discrete and continuous, probability functions, numerical evaluation of continuous probability functions etc., analyze discrete system simulation and GPSS which includes discrete events, representation of time, simulation of a telephone system, delayed calls, introduction to GPSS, and understand simulation languages and practical systems.

Module I

Introduction: Definition, Advantages and Disadvantages of Simulation, Areas of application, Concept of a System, Environment, Components of a system, Continuous and discrete systems, Modeling, Types of models, Monte Carlo Method, Comparison of Simulation and Analytical Methods. Discrete and continuous models.

Module II

Probability Concepts in Simulation: Discrete and Continuous Probability Functions, Random Number Generators – Linear Congruential Generator, Mid Square Method, rejection Method, Testing of random Numbers, Generation of Stochastic variates in Arrival Patterns and Service times.

Module III

Discrete System Simulation: Discrete Events, Representation of Time, generation of arrival patterns, fixed time step versus next event simulation, Simulation of a Telephone System, delayed calls.

Module IV

Computer model of queuing and scheduling systems, Design and Evaluation of simulation Experiments: Length of simulation runs, validation, variance reduction techniques, analysis of simulation output.

Module V

Simulation Languages: Introduction to GPSS: Creating and moving transactions, queues, facilities and storages, gathering statistics, conditional transfers, program control statements, priorities and parameters, standard numerical attributes, functions, gates, logic switches and tests, Variables, Select and Count, Continuous and discrete systems languages.

Text Book:

1. System Simulation – Geoffrey Gordon, 2nd Edition, PHI
2. System Simulation with Digital computer – NarsinghDeo, PHI

Reference Book:

1. Discrete-Event System Simulation-Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, P. Shahabudeen

Course Outcome:

CO1: To understand the inventory concepts which include the technique of simulation, major application areas, concept of a system, environment, continuous and discrete systems models, Monte Carlo method etc.

CO2: To Study of probability concepts in simulation including stochastic variables, discrete and continuous, probability functions, numerical evaluation of continuous probability functions etc.

CO3: To learn discrete system in simulation process with real time telephone system example.

CO4: To know different Computer model of queuing and scheduling systems and to design and evaluate various simulation Experiments.

CO5: To analyze discrete system simulation and GPSS which includes discrete events.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	1	2	1	-	-	-	-	1
CO2	3	3	2	1	1	2	1	-	-	-	-	1
CO3	3	3	2	1	1	2	1	-	-	-	-	1
CO4	3	3	2	1	1	2	1	-	-	-	-	1
CO5	3	3	2	1	1	2	1	-	-	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	3	2	1	1	2	1	-	-	-	-	1

Optimization Techniques (BCSPE503)

Module 1

Linear optimization: formulation and geometrical ideas of linear programming problems, simplex method, revised simplex method, duality, sensitivity analysis, transportation and assignment problems.

Module 2

Nonlinear optimization: basic theory, method of Lagrange multipliers, KarushKuhn-Tucker theory, convex optimization.

Numerical optimization techniques: line search methods, gradient methods, Newton's method, conjugate direction methods, quasi-Newton methods, projected gradient methods, penalty methods.

Module 3

Non-Linear Programming Problems: One variable unconstrained optimization, multivariable unconstrained optimization, Karush-Kuhn-Tucker (KKT) conditions for constrained optimization, quadratic programming, separable programming, convex and non-convex programming, steepest and Quasi-Newton method.

Module 4

Dynamic Programming: Characteristics of dynamic problems, deterministic dynamic programming and probabilistic dynamic programming, Network analysis, Shortest path problems, minimum spanning tree problem, interior point methods.

Module 5

Multi-objective Optimization Problems: Linear and nonlinear programming problems, Weighting and Epsilon method, P-norm methods, Gradient Projection Method, STEM method, Convex Optimization.

Texts:

1. M. C. Joshi, Optimization: Theory and Practice, Alpha Science International, Ltd; 1 edition, 2004.
2. D. G. Luenberger, Linear and Nonlinear Programming, 2nd Ed., Kluwer, 2003.
3. Ehrgott M. *Multi-criteria Optimization*, Springer
4. Colletee Y. and Siarry P. *Multiobjective Optimization*, Springer

References:

1.S. S. Rao, Optimization: Theory and applications.
2.R. Fletcher, Practical Methods of Optimization, 2nd Ed., John Wiley, 1987.
3.M. S. Bazarra, J.J. Jarvis, and H.D. Sherali, Linear Programming and Network Flows, WSE, 2003.
4.U. Faigle, W. Kern, and G. Still, Algorithmic Principles of Mathematical Programming, Kluwe, 2002.
5.D.P. Bertsekas, Nonlinear Programming, 2nd Ed., Athena Scientific, 1999.
6.M. S. Bazarra, H.D. Sherali, and C. M. Shetty, Nonlinear Programming: Theory and Algorithms, John Wiley, WSE, 2004.

7.N. S. Kambo, Mathematical Programming Techniques, East West Press, 1997.

8.E.K.P. Chong and S.H. Zak, An Introduction to Optimization, 2nd Ed., Wiley, 2001 (WSE, 2004).
9.Miettien K.M. *Non-linear multi-objective optimization*, Kluwers International Series
10. Rao S. S.*Engineering Optimization Theory and Practices*, John Wiley and Sons
11. Deb K. *Multi-objective evolutionary optimization for product design and manufacturing*, Springer

Course Outcomes:

CO1: To understand the ideas of linear programming problems and Simplex method
CO2: To understand the concept of nonlinear optimization and numerical optimization techniques
CO3: To analyze the Non-Linear Programming Problems and unconstrained optimization problems
CO4: To apply the concept of Dynamic Programming in solving practical problems
CO5: To understand and analyze Multi-objective Optimization Problems

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	1.6	1	1.2	-	-	-	-	-	-	-	-

INTRODUCTION TO CRYPTOGRAPHIC (BCSPE504)

Module-I

Introduction to Security: Definition, Goal and Challenges, Security Attacks, Security Services, Security Mechanisms, Techniques, Mathematics of Cryptography: Integer Arithmetic, Modular arithmetic, Matrices, Linear Congruence, Algebraic Structures: Group, Ring, Field, Galois Field.

Module-II

Traditional symmetric-key cipher, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Stream and Block Cipher. Steganography. Modern Symmetric Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers,

Module-III

Data Encryption Standard (DES): DES Structure, DES Analysis, Multiple DES, Security of DES, Advanced Encryption Standard (AES), AES Transformation functions, Analysis of AES. Mathematics for Asymmetric-key cryptography: Prime Numbers, Testing of Primality, Chinese Remainder Theorem, Exponentiation and Logarithm

Module-IV

Asymetric –key cryptography: RSA Algorithm, Elgamal Cryptosystem, Elliptic Curve Cryptography, Diffe-Hellman Key Exchange. Message Integrity and Message authentication: Application of Cryptographic Hash Functions, Secure Hash Algorithm (SHA), Message Authentication Requirements, Message authentication functions, Message Authentication Codes (MAC),

Module-V

Digital Signature, Digital Signature Standards attacks on digital signature, Entity authentication: password based authentication, challenge response protocol, Zero-Knowledge protocol. Key management: symmetric key distribution, Kerberos, symmetric key Agreement, public key distribution

Text Book:

B. A. Forouzan, *Cryptography & Network Security*, McGraw Hill, Special Indian Edition, 2007.

W. Stallings, *Cryptography and Network Security*, Pearson Education, 3rd Ed, 2006.

References:

1. R. E. Smith, Internet Cryptography, AWL.
2. A. J. Menezes, Handbook of Applied Cryptography, CRC Press.
3. J. Hershey, Cryptography Demystified, McGraw Hill.
4. J. Knudsen, Java Cryptography, O'Reilly.

Course Outcomes:

CO1: Understand the basics of security and apply knowledge of computing and mathematics for developing efficient security algorithms.
CO2: Understand the concept of traditional symmetric cryptography along with classical and modern block cipher techniques.
CO3: Gain knowledge on symmetric encryption techniques and application of mathematical functions on asymmetric cryptography
CO4: Study the concept of asymmetric cryptography.
CO5: Application of cryptographic techniques for authentication of a system.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	1	-	2	2	3	2	-	3
CO2	3	3	3	2	1	-	2	2	3	2	-	3
CO3	3	3	3	2	1	-	2	2	3	2	-	3
CO4	3	3	3	2	1	-	2	2	3	2	-	3
CO5	3	3	3	2	1	-	2	2	3	2	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	3	3	2	1	-	2	2	3	2	-	3

Sessional

OPERATING SYSTEMS LAB (BCS05004)

Course Objective:

The objective is to be familiar with Unix and Linux command, implement different scheduling algorithms, develop first fit, best fit and worst fit algorithm for memory, illustrate the function of a dispatcher, make packaging and sending in IPC, and implement various synchronization problem.

1. Study of Unix/Linux Commands.(2 classes)
2. Write a program to allocate blocks of memory.
3. Write a program to implement best fit algorithm in paging memory.
4. Write a program to implement the bit vector for free space management.
5. Write a program to implement first fit algorithm in paging memory.
6. Write a program to implement worst fit algorithm in paging memory.
7. Write a program to create a unique file name by the user or by the system.
8. Write a program to implement DEKKERS ALGORITHM for mutual exclusion problem.
9. Write a program to implement DINING PHILOSOPHER problem.
10. Write a program for FCFS cpu scheduling algorithm.
11. Write a program for FIFO page replacement algorithm.
12. Write a program for LRU page replacement algorithm.
13. Write a program for Optimal page replacement algorithm.
14. Write a program to implement paging scheme.
15. Write a program for ROUND ROBIN CPU scheduling algorithm.
16. Write a program for SJF cpu scheduling algorithm.
17. Write a program to implement producer-consumer problem of IPC.
18. Write a program for to create two processes and wait for them to complete.
19. Write a program to make packaging and sending as in IPC.
20. Write a program to illustrate the function of a dispatcher.

Course Outcome:

CO1: Be familiar with Unix and Linux command
CO2: Implement different scheduling algorithms
CO3: Develop first fit, best fit and worst fit algorithm for memory
CO4: Illustrate the function of a dispatcher
CO5: Make packaging and sending in IPC

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	3	2	3	2	-	3
CO2	3	3	2	2	-	-	3	2	3	2	-	3
CO3	3	3	2	2	-	-	3	2	3	2	-	3
CO4	3	3	2	2	-	-	3	2	3	2	-	3
CO5	3	3	2	2	-	-	3	2	3	2	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	3	3	2	2	-	-	3	2	3	2	-	3

DATABASE MANAGEMENT SYSTEMS LAB (BCS05005)

Course Objective:

The objective of the course is to be familiar with SQL syntax, distinguish different join operations, creation and manipulation of SQL views, and use of package.

1. Use of SQL Syntax for creation, insertion, updation, and deletion operation.
2. Use of SQL for Single table retrieval and group by clauses.
3. Use of SQL for sub-queries, set operations, and date manipulations.
4. Use of SQL for multiple table retrieval using join.
5. Use of Creation and Manipulation of SQL Views.
6. Programming approach using PL/SQL.
7. Use of PL/SQL Cursors(implicit, explicit, and parameterized).
8. Concurrency control using LOCK.
9. Data Redundancy using ROLLBACK, SAVEPOINT, and COMMIT
10. Use of Package (ORACLE)

Course Outcome:

CO1: Be familiar with SQL syntax

CO2: Distinguish different join operations

CO3: Creation and manipulation of SQL views

CO4: Use of package

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	-	-	2	2	3	2	-	3
CO2	3	3	2	3	-	-	2	2	3	2	-	3
CO3	3	3	2	3	-	-	2	2	3	2	-	3
CO4	3	3	2	3	-	-	2	2	3	2	-	3
CO5	3	3	2	3	-	-	2	2	3	2	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	3	3	2	3	-	-	2	2	3	2	-	3

COMPUTER GRAPHICS LAB (BCS05005)

L-T-P: 0-0-3 **Cr.-1.5**

1. Study of in-built graphics library functions.
2. Implementation of line drawing algorithms.
3. Implementation of circle drawing algorithm.
4. Implementation of region filling algorithms.
5. Implementation of 2-D Transformations.
6. Implementation of line clipping algorithm.
7. Implementation of polygon clipping algorithm.
8. Implementation of 3- D Transformations.
9. Implementation of Curve Generation.
10. A mini-project to be designed by students using features of computer graphics.

Course Outcome:

CO1. Express the fundamental concepts of graphics.

CO2. Implement basic geometrical objects using scan conversion.

CO3. Design two-dimensional graphics by applying two dimensional transformations.

CO4. Design three-dimensional graphics by analyzing three dimensional transformations.

CO5. Analyze and implement curve generation.

Course Articulation Matrix

	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**
CO1	3	3	2	3	-	-	2	-	2	3	-	3
CO2	3	3	2	3	-	-	2	-	2	3	-	3
CO3	3	3	2	3	-	-	2	-	2	3	-	3
CO4	3	3	2	3	-	-	2	-	2	3	-	3
CO5	3	3	2	3	-	-	2	-	2	3	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**
Cours	3	3	2	3	-	-	2	-	2	3	-	3

Sixth Semester

COMPUTER NETWORKS (BCS06001)

Course Objective:

The objective is to analyze the concepts of networks, types and architectures, identify error free transmission of data and analyzes data collision with various protocols, apply various routing algorithms over a network to provide optimal path, illustrate the real time applications of networks, and examine the addressing entities of a network with implementation of TCP, UDP protocols.

Module I

Overview of Data Communications and Networking.PhysicalLayer :Analog and Digital, Analog Signals, Digital Signals, Analog versus Digital, Data Rate Limits, Transmission Impairment, More about signals.Digital Transmission: Line coding, Block coding, Sampling, Transmission mode.Analog Transmission: Modulation of Digital Data; Telephone modems, modulation of Analog signals.

Module II

Multiplexing: FDM, WDM, TDM, and Transmission Media: Guided Media, Unguided media (wireless)Circuit switching and Telephone Network: Circuit switching, Telephone network.

Data Link Layer: Error Detection and correction, Types of Errors, Detection, Error Correction, Data Link Control and Protocols:Flow and Error Control, Stop-and-wait ARQ.

Module III

Go-Back-N ARQ, Selective Repeat ARQ, HDLC, Point –to- Point Protocol, Multiple Access, Random Access, Controlled Access, Channelization.Local area Network: Ethernet, Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Wireless LANs: IEEE 802.11, Bluetooth virtual circuits: Frame Relay and ATM.NetworkLayer:Host to Host Delivery, Internetworking, addressing, Routing.

Module IV

Network Layer Protocols: ARP, RARP, NAT, BOOTP, DHCP, IPV4, ICMP, IPV6, ICMPV6 and Unicast routing protocols. Transport Layer: Process to Process Delivery: UDP, TCP, congestion control and Quality of service.

Module V

Application Layer :Client Server Model, Peer to peer network, Domain Name System (DNS): Electronic Mail (SMTP) and file transfer (FTP) HTTP and WWW.

Text Books:

1. Data Communications and Networking: Behrouz A. Forouzan, Tata McGraw-Hill, 4th EdComputer Networks: A. S. Tannenbum, D. Wetherall, Prentice Hall, Imprint of Pearson 5th Ed

Reference Book : .

1. Computer Networks:A system Approach:Larry L, Peterson and Bruce S. Davie,Elsevier, 4th Ed
2. Computer Networks: Natalia Olifer, Victor Olifer, Willey India
3. Data and Computer Communications: William Stallings, Prentice Hall, Imprint of Pearson, 9th Ed.
4. Data communication & Computer Networks: Gupta, Prentice Hall of India
5. Network for Computer Scientists & Engineers: Zheng, Oxford University Press
6. Data Communications and Networking: White, Cengage Learning

Course Outcome:

CO1: Analyse the concepts of networks, types and architectures
CO2: Identify error free transmission of data and analyse data collision with various protocols.
CO3: Apply various routing algorithms over a network to provide optimal path.
CO4: Illustrate the real time applications of networks
CO5: Examine the addressing entities of a network with implementation of TCP, UDP protocols.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	1	3	3	2	2	2	2	2	1	2
CO2	2	2	2	2	1	3	2	2	3	3	2	2
CO3	1	2	1	2	1	3	2	2	2	2	2	1
CO4	2	2	1	3	3	2	3	2	3	3	1	2
CO5	1	2	2	2	2	2	1	1	3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	1.4	2	1.4	2.4	2	2.4	2	1.8	2.6	2.4	1.4	1.8

SOFTWARE ENGINEERING (BCS06002)

Course Objective:

The objective of this course is to identify and build an appropriate process model for a given project, analyze the principles at various phases of software development, translate a specification into a design, and identify the components to build the architecture for a given problem, all using an appropriate software engineering methodology. It also focuses to define a Project Management Plan and tabulate appropriate Testing Plans at different levels during the development of the software, and understand the software project estimation models and estimate the work to be done, resources required and the schedule for a software project.

Module I

Introduction – evolution & impacts, motivation for software engineering, programs software products, emergence of software engineering, recent trends in software development practices. Software life cycle models – reasons behind using life cycle models, study of various life cycle models – classical waterfall, iterative waterfall, prototyping, evolutionary, spiral, etc. comparison of various life cycle models.

Module II

Software project management– Responsibilities, Planning. Project & Empirical Estimation Techniques. COCOMO, Staffing, Scheduling, Team Structure, Risk Management, Configuration Management. Requirement analysis & specification– Gathering Requirements & Analysis, SRS.

Module III

Software design & modelling – Cohesion & Coupling, Software Design Approaches, Object Oriented Design vs. Function Oriented Design, Function Oriented Software Design (SA/SD Methodology, Structured Analysis, DFDs, Structured & Detailed Design).

Object Oriented Software Development (Design Patterns & Generalized Process), Object Modelling using UML (UML Concepts, UML Diagrams, USE Case Model; Class, Interaction, Activity & State Chart Diagrams)

Module IV

User interface design – Basic concepts & its types, Component based GUI Development, User Interface Design Methodology. Coding & testing – Coding & Code Review, Testing – Unit, Black box & White box, Debugging, Program Analysis Tools, Integration &System Testing, General issues related to testing.

Module V

Software reliability & quality management – Software Reliability & Quality, Statistical Testing, Quality Management System, ISO 9000, SEI CMM, PSP.Case – Environment & scope, Support in SDLC, Characteristics & Future Scope of CASE Tools, Architecture of CASE EnvironmentSoftware maintenance – Characteristics, Reverse Engineering., Maintenance Process Models. Software reuse– Basic Issues, Reuse Approach.

Text Book:

1. Rajib Mall, "Fundamental of Software Engineering", PHI
2. Roger S. Pressman, "Software Engineering A Practitioners Approach". Mc-Graw Hill Publication.

Reference Book:

1. Richard Farley, "Software Engineering Concepts". Mc-Graw Hill Publication.

Course Outcome:

CO1: Identify and build an appropriate process model for a given project
CO2: Analyze the principles at various phases of software development.
CO3: Translate a specification into a design, and identify the components to build the architecture for a given problem, all using an appropriate software engineering methodology.
CO4: Define a Project Management Plan and tabulate appropriate Testing Plans at different levels during the development of the software.
CO5: Understand the CASE tool its architecture along with software maintenance and reuse.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	3	3	1	-	1	3	2	1	1	1	3
CO2	-	3	3	1	-	1	3	2	1	1	1	3
CO3	-	3	3	1	-	1	3	2	2	1	2	3
CO4	-	3	3	1	-	1	3	1	1	2	3	3
CO5	-	3	3	1	-	1	3	2	2	1	1	3

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	-	3	3	1	-	1	3	1.8	1.4	1.2	1.6	3

Professional Elective-II

COMPILER DESIGN (BCSPE601)

Course Objective:

The objective of the course is to introduce the major concept areas of language translation and compiler design, enrich the knowledge in various phases of compiler ant its use, code optimization techniques, machine code generation, and use of symbol table, extend the knowledge of parser by parsing LL parser and LR parser, and provide practical programming skills necessary for constructing a compiler.

Module I

Compiler Overview and Lexical Analysis: Overview of language processing: preprocessors, compiler, assembler, interpreters, linkers, Bootstrap loaders and cross compiler. Structure of a compiler: phases of a compiler. Lexical Analysis: Role of Lexical Analysis, Input buffering, Regular Expressions, NFA, DFA, Minimization of DFA, Transition diagram for tokens, reserved words and identifiers. Lexical error and its recovery, LEX.

Module II

Syntax Analysis Role of a parser, Top down parsing, derivation, ambiguity, left recursion, left factoring, backtracking parsing, recursive decent parsing, predictive parsing, LL(1) Grammars. Bottom up parsing, Shift Reduce Parsing, handle, handle pruning, Operator precedence parser, precedence function, LR Parsers, Construction of SLR, CLR, LALR Parsing tables, parser conflicts, Dangling ELSE Ambiguity, Error recovery in Parsing. YACC.

Module III

Semantic Analysis and Intermediate code generation: Semantic analysis, SDD and SDTS, evaluation of semantic rules, implementation of S-attributed and L-attributed definition. Type analysis and type checking. Intermediate code, three address code, quadraples, triples, indirect triplet, abstract syntax trees, Declarations, Assignment statements, Boolean expressions, Case statements, Back patching, Procedure calls. Symbol tables, use of symbol tables. Runtime Environment: storage organization, stack allocation, access to non-local data, heap management, parameter passing mechanisms.

Module IV

Optimization: Machine independent code optimization: Common sub expression elimination, constant folding, copy propagation, dead code elimination, strength reduction, loop optimization, basic blocks, data flow analysis.

Module V

Code generation: Issues in the design of code generation, The target machine, A simple code generator, DAG representation of basic blocks. Machine dependent code optimization: Peephole optimization, register allocation, instruction scheduling, inter procedural optimization, garbage collection via reference counting.

Text books:

1. Compilers, Principles Techniques and Tools- Alfred V Aho, Monical S Lam, Ravi Sethi, Jeffrey D. Ullman,2 nded, Pearson,2007.
2. Principles of compiler design, V. Raghavan, 2 nded, TMH, 2011.

Reference books:

1. Compiler construction, Principles and Practice, Kenneth C Louden, CENGAGE
2. Compiler Design, O. G. Kakde, University Science Press.
3. Compiler Design, K. Muneeswaram, Oxford University Press.
4. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003

Course Outcome:

CO1: Identify the role of compiler and its phases and Role of the lexical analysis
CO2: Role of the top-down and bottom-up parser
CO3: Distinguish s-attributed and l-attributed definition
CO4: Analyze different ways of code optimization
CO5: Issues of a code generator

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	1	-	-	-	3	2	-	-
CO2	3	3	3	1	1	-	1	-	2	2	-	1
CO3	3	2	3	2	2	-	2	2	3	1	-	-
CO4	3	2	1	1	2	-	3	2	3	1	-	-
CO5	3	2	2	2	1	-	1	-	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	3	2.2	2.2	1.2	1.4	-	1.4	0.8	2.6	1.4	0.4	0.6

SOFTWARE TESTING & RELIABILITY (BCSPE602)

Course Objective:

The objective of this course is to learn basic of software testing, software testing life-cycle, testing methodology, black box testing, white box testing, mutation testing, test management, testing metrics, testing tools, object-oriented testing and web-based testing.

Module I

Introduction- Basics of Software Testing, Goals of Software Testing, Model for Software Testing. Software Testing Terminology & Methodology - Software Testing Terminology, Software Testing Life Cycle, Software Testing Methodology. Verification&Validation- Verification of High Level Design, Low Level Design, Verification of a Code.

Module II

Black Box Testing- Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing,State Table Based Testing. White Box Testing- Need, Logic Coverage Criteria, Basic Path Testing, Graph Matrices, Loop Testing, Data Flow Testing, Mutation Testing. Static Testing – Inspections, Structured Walkthrough, Technical Reviews. Validation Activities- Unit Validation Testing, Integration Testing, Function Testing, System Testing, Acceptance Testing. Regression Testing.

Module III

Test Management- Test Organization, Test Planning, Test Design & Test Specification. Software Metrics, Testing Metrics for Monitoring and Controlling the Testing Process, Efficient Test Suite Management- Test Suite Minimization & Test Suite Prioritization, Software Quality Management.

Module IV

Automation & Testing Tools- Need for Automation, Categorization of Testing Tools, Selection of Testing Tools, Overview of Testing Tools. Testing Object Oriented Software- OOT Basics, Object Oriented Testing.

Module V

Testing Web Based System- Web Based System, Challenges in Testing for Web Based System, Web Engineering, Testing for Web Based System. Debugging

Text books

1. Foundations of Software Testing – Aditya P Mathur. Pearson Education
2. Software Testing Principles and Practices- Naresh Chauhan, Oxford University Press.
3. Software Testing Tools - Dr.K.V.K.K.Prasad, Dreamtech press.
4. Software Testing: Principles and Practices- Srinivasan Desikan, Gopalaswamy Ramesh, Pearson Education.

Reference books

1. Software Testing - B.Bezier- 2nd Edn, Techniques, Dreamtech, New Delhi
2. Software Testing, Second Edition By: Ron Patton, Pearson Education
3. Software Testing Principles and Tools By M.G. Limaye TMG Hill Publication.

Course Outcome:

CO1: Be familiar with software testing goals and software testing life cycle.

CO2: Learning black box testing, white box testing, mutation testing and regression testing.

CO3: Gain knowledge in test management and testing metrics.

CO4: Analyze& develop automated testing tools

CO5: Learn object-oriented testing and web-based testing.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	2	3	-	-	2	2	2	1	-	2
CO2	-	3	3	3	-	-	2	2	2	2	-	2
CO3	-	3	3	3	-	-	2	1	2	1	-	2
CO4	-	3	2	3	-	-	3	2	2	1	-	3
CO5	-	3	2	3	-	-	3	2	2	2	-	2

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	-	3	2.4	3	-	-	2.4	1.8	2	1.4	-	2.2

MULTIMEDIA SYSTEM (BCSPE603)

Course Objective:

The objective of this course is understanding of technical aspect of Multimedia Systems, creation of various file formats for audio, video and text media, Develop various Multimedia Systems applicable in real time, Design interactive multimedia software.

Prerequisite: Knowledge of computer graphics, computer networking and database systems.

Module-I

Prerequisite Basic of database, computer networks and computer graphics. Multimedia Systems Design: An Introduction Multimedia Elements. Multimedia Systems Architecture, Evolving Technologies for Multimedia Systems, Defining Objects for Multimedia Systems.

Module-II

Image Compression Schemes. Video Compression. Audio Compression. Rich-Text Format. TIFF File Format. Resource Interchange File Format (RIFF), MIDI File Format. JPEG DIB File Format for Still and Motion Images. JPEG Still Image. AVI video File Format. MPEG Standards.

Module-III

Multimedia Application Design. Multimedia Application Classes. Types of Multimedia Systems. Virtual Reality Design. Components of Multimedia Systems. Multimedia database issues and solutions.

Module-IV

Multimedia Authoring, User Interface and Multimedia Authoring Systems. Hypermedia Application Design Considerations. User Interface Design.

Module-V

Distributed Multimedia Systems, Components of a Distributed Multimedia System. Distributed Client-Server Operation. Middleware in Distributed Workgroup Computing. Distributed Multimedia Databases. Managing Distributed Objects. Application Workflow Design Issues.

Text Books:

1. Prabhat K. Andleigh, KiranThakrar “Multimedia Systems Design” 1/e, Pearson , ISBN
1. 978-93-325-4938-8
2. Fundamentals of Multimedia by Ze-Nian Li&Mark.S.Drew
3. Introduction to Multimedia Communication, Application, Middleware, Networking by
4. K.R.Roa, Zoran S,Bojkovic&Dragorad A. Milovanovic.

References:

1. Organization of Multimedia Resources: Principles and Practice of InformationRetrieval by Mary A. Burke
2. Multimedia Systems Design by PrabhatK.Andleigh/ KiranThakrar.

Course Outcomes:

CO1: To learn and understand technical aspect of Multimedia Systems.
CO2: To understand the standards available for different audio, video and text applications.
CO3: To Design and develop various Multimedia Systems applicable in real time.
CO4: To learn various multimedia authoring systems.
CO5: To understand various networking aspects used for multimedia applications.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	3	-	2	3	2	1	1	-	-
CO2	2	2	2	3	-	2	3	2	1	1	-	-
CO3	2	2	2	3	-	2	3	2	1	1	-	-
CO4	2	2	2	3	-	2	3	2	1	1	-	-
CO5	2	2	2	3	-	2	3	2	1	1	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2	2	2	3	-	2	3	2	1	1	-	-

WIRELESS SENSOR NETWORKS (BCSPE604)

Course Objective:

The objective of this course is to learn fundamentals of Wireless Sensor Networks, understand single-node architecture, network architecture, gateway concepts, networking sensors, geographic sensors, routing protocols, Sensor Node Hardware – Berkeley Motes, Node-level software platforms, and State-centric programming.

Module I

OVERVIEW OF WIRELESS SENSOR NETWORKS: Challenges for Wireless Sensor Networks, Enabling Technologies ForWirelessSensor Networks.

Module II

ARCHITECTURES: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, GatewayConcepts.

Module III

NETWORKING SENSORS: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and NameManagement, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

Module IV

INFRASTRUCTURE ESTABLISHMENT: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

Module V

SENSOR NETWORK PLATFORMS AND TOOLS: Sensor Node Hardware – Berkeley Motes, ProgrammingChallenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Course Outcome:

CO1: Be familiar with basics and challenges of wireless sensor network
CO2: Learning single-node and network architectures
CO3: Gain knowledge in routing protocols and time synchronisation
CO4: Design localization of nodes
CO5: Analyze sensor node hardware and node level simulators

Text books:

1. Holger Karl & Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks”, John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, “Wireless SensorNetworks- An Information Processing Approach”, Elsevier, 2007.

Reference Books:

1. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor NetworksTechnology, Protocols, And Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	1	3	3	2	2	2	2	2	1	2
CO2	2	2	2	2	1	3	2	2	3	3	2	2
CO3	1	2	1	2	1	3	2	2	2	2	2	1
CO4	2	2	1	3	3	2	3	2	3	3	1	2
CO5	1	2	2	2	2	2	1	1	3	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	1.4	2	1.4	2.4	2	2.4	2	1.8	2.6	2.4	1.4	1.8

Professional Elective - III

Internet of Things (BCSPE605)

Course Objective:

The student will understand the architecture of IoT and its applications
An overview of the concepts, processes, and best practices needed to successfully apply it in real time applications
Students will learn the basic protocols of IoT and able to model or simulate their own protocols.

Module I

Overview of Internet of Things: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

Module – II

Reference Architecture: IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

Module – III

IoT Data Link Layer & Network Layer Protocols: PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP

Module – IV

Transport & Session Layer Protocols : Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

Module –V

Service Layer Protocols & Security: Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4 , 6LoWPAN, RPL, Application Layer

Text Books

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI

Reference Books

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-11847347-4, Willy Publications
3. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014.

Course Outcome:

CO1: To Understand the Architectural Overview of IoT
CO2: To Understand the IoT Reference Architecture and RealWorld Design Constraints
CO3: To Understand the various IoT Protocols in DATA LINK LAYER & NETWORK LAYER
CO4: To Understand the various IoT Protocols in Transport and Session layer
CO5: To understand the security mechanism in IOT Applications

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	-	-	-	-	1	1	-	1
CO2	2	2	3	1	-	-	-	-	1	1	-	1
CO3	3	1	3	1	-	-	-	-	1	1	-	1
CO4	3	2	3	3	-	-	-	-	1	1	-	1
CO5	3	2	3	1	-	-	-	-	-	2	-	3

CO1: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

CO2: **Program Articulation Matrix row**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.8	2	3	2.2	-	-	-	-	0.8	1.2	-	1.4

MICROPROCESSORS AND MICROCONTROLLERS (BCSPE607)

Course Objectives:

The objective of this course is to become familiar with the architecture and the instruction set of an Intel microprocessor Assembly language Programming will be studied, as well as the design of various types of Digital and analog interfaces and need to understand the architecture of 8085 and 8051.

Module I

Architecture of Microprocessors: General definitions of mini computers, microprocessors, micro controllers and digital signal processors. Overview of 8085 microprocessor. Overview of 8086 microprocessor. Signals and pins of 8086 microprocessor.

Module II

Assembly language of 8086: Description of Instructions. Assembly directives. Assembly software programs with algorithms, interfacing with RAMs, ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255 etc. Interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc.

Module III

Architecture of Micro controllers: Overview of the architecture of 8051 microcontroller. Overview of the architecture of 8096 16-bit microcontroller. Description of Instructions. Assembly directives. Assembly software programs with Algorithms.

Module IV

Assembly Level Programming: Addition of two 8-bit numbers, sum 8 bits, Subtraction of two 8-bit numbers, difference 8 bits, Addition of two 8-bit numbers, sum 16 bits. Decimal addition of two 8-bit numbers, sum 16 bits, Addition of two 16-bit numbers, sum 16 bits or more.

Module V

Interfacing with 8051: Interfacing with keyboards, LEDs, 7 segment LEDs, LCDs, Interfacing with ADCs. Interfacing with DACs, etc.

Text Book:

1. Krishna Kant, "Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096". PHI 2007.
2. Douglas V Hall, "Microprocessors and Interfacing, Programming and Hardware" TMH, 2006.

References:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay the 8051 Microcontroller and Embedded Systems, Second Edition, Pearson education 2008.
2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.
3. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 2007.
4. Ajit Pal, "Microprocessors Principles and Applications", TMH, 2005.

Course Outcomes:

CO1: Design and implement programs on 8086, arm, pic, design i/o circuits.
CO2: The program prepares students to successfully compete for employment in electronics, manufacturing and embedded fields.
CO3: Design memory interfacing circuits, design and implement 8051 microcontroller-based systems.
CO4: Gaining hand on experience on theory on the basis of programming
CO5: Describe the architecture and instruction set of arm microcontroller

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	-	-	-	-	-	3	-	-	-
CO2	3	2	2	1	-	-	1	2	-	2	-	1
CO3	3	2	3	2	-	-	2	2	3	1	-	-
CO4	2	3	2	1	-	-	3	-	3	-	-	-
CO5	2	3	2	2	-	-	1	-	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.6	2.4	1.375	1.2	-	-	1.4	0.8	2.2	0.8	0.4	0.6

CLOUD COMPUTING (BCSPE608)

Course Objective:

The student will also learn how to apply trust-based security model to real-world security problems. An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures. Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Module I

Introduction to Cloud Computing: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

Module II

Cloud Computing Architecture: Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing Environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model. Cloud Deployment Models: Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

Module III

Security Issues in Cloud Computing: Infrastructure Security, Infrastructure Security: The Network Level, the Host Level, The Application Level, Data Security and Storage, Aspects of Data Security,

Data Security Mitigation Provider Data and Its Security. Identity and Access Management :Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.

Module IV

Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS.

Module V

Case studies on CloudSim, AWS, Google Cloud, Oracle Cloud etc.

Text Books

1. R. Buyya, C. Vecchiola and S. T. Selvi, Mastering Cloud Computing Foundations and
2. Applications Programming, Morgan Kaufmann, Elsevier, 2013.
3. B. Sosinsky, Cloud Computing Bible, Wiley, 2011.
4. D. N. Chorafas, Cloud Computing Strategies, CRC Press, Taylor and Francis Group, 2011.
5. I. Foster and C. Kesselman, The Grid: Blueprint for a New ComputingInfrastructure, Morgan Kaufmann, Elsevier, 2004.

Reference Books

1. R. Buyya, High Performance Cluster Computing: Architectures and Systems, Volume 1, Pearson Education, 2008.
2. Chakrabarti, Grid Computing Security, Springer, 2007.
3. Wilkinson, Grid Computing: Techniques and Applications, CRC Press, 2009.
4. S. R. Prabhu, Grid and Cluster Computing, PHI, 2008.
5. Janakiram, Grid Computing, Tata McGraw-Hill, 2005.
6. P. K. Pattnaik, M. R. Kabat and S. Pal, Fundamentals of Cloud Computing, Vikas Publishing House Pvt. Ltd., 2015.

Course Outcome:

CO1: Learn emerging techniques in cloud computing and its applications.

CO2: Gain knowledge in Cloud Architecture and Deployment Model.

CO3: Identify security aspects of each cloud model

CO4: Develop a risk-management strategy for moving to the Cloud.

CO5: Acquire knowledge about CloudSim, Cloudlet, Virtual Machine and its Provisioning.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	3	2.4	2.4	-	-	-	-	-	-	-	-

PATTERN RECOGNITION (BCSPE609)

Course Objective:

Students will understand basic concepts in pattern recognition and to Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques. Analyse classification problems probabilistically and estimate classifier performance.Understand the principles of Bayesian parameter estimation and apply them in relatively simple probabilistic models.

Module-I

Introduction: Machine Perception, Pattern Recognition Systems, Design Cycle, Learning And Adaptation, Training And Learning In Pattern Recognition Approach, Applications Of Pattern Recognition, Patterns And Features, Different Types Of Pattern Recognition

Module-II

Probability: Introduction, Probability Of Events, Random Variables, Joint Distributions And Densities, Moments Of Random Variables, Estimation Of Parameters From Samples, Minimum Risk Estimators.

Module-III

Statistical decision making: introduction, baye's theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, the leaving one- out technique. Characteristic curves, estimating the composition of populations.

Module-IV

Nonparametric decision making: introduction, histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error discriminate functions, choosing a decision making technique.

Module-V

Unsupervised Learning And Clusterings: Unsupervised Bayesian Learning, Data Decryption And Clustering, Criterion Functions And Clustering, Hierarchical Clustering, Online Clustering, Component Analysis.

Text Books:

1. Pattern Classification Duda R. O., AndHart P E., And Stork D G., Wiley Publishers 2. Pattern Recognition AndImage Analysis, Earl Gose, Richard J And Steve J, PHI 3. Pattern Recognition (Statistical, Structural AndNeural Approaches), Robert Schalkoff.

Course Outcome:

CO1: Understand basic concepts in pattern recognition and to Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
CO2: Analyse classification problems probabilistically and estimate classifier performance.
CO3: Understand the principles of Bayesian parameter estimation and apply them in relatively simple probabilistic models.
CO4: Learn decision making techniques and different function.
CO5: Gain knowledge about different types of clustering technique and its implementation in real life problems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-
CO3	3	3	2	3	3	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	3	-	2	-
CO5			3	3	3	-	-	-	3	-	3	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	3	3	3	3	3	-	-	-	3	-	3	-

Sessional

COMPUTER NETWORK LAB (BCS06003)

Course Objective:

The objective is to demonstrate techniques to correct and detect errors during transmission, demonstrate understanding of how computers communicate with each other and the routingalgorithms employed to assure that the communication is reliable, and implementation of client server applications with protocols TCP and UDP.

1. To study about different physical equipment used for networking.
2. To Connect 2 PCs using Peer to Peer communication.
3. Development of Stop & Wait protocol for file transfer
4. Study of Network Utilities.
5. Write a program to generate CRC code for checking error.
6. To Plot Efficiency of pure Aloha and slotted ALOHA in MATLAB.
7. To plot Channel Efficiency for Ethernet in MATLAB.
8. To Study the Network Simulator (NS2).
9. To implement wired network topology and wireless network Topology in ns2.
10. To implement UDP protocol and study performance using Network simulator (ns2).
11. Write a program to implement bit stuffing &Destuffing.
12. Write a program to implement character stuffing &Destuffing.
13. Write a C program for IPV4, Implementation of decimal to binary, Implementation of binary to decimal.

Course Outcome:

CO1: Demonstrate techniques to correct and detect errors during transmission.
CO2: Demonstrate understanding of how computers communicate with each other and the routing algorithms employed to assure that the communication is reliable
CO3: Implementation of client server applications with protocols TCP and UDP.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	3	3	2	2	2	2	2	1	2
CO2	2	2	2	2	1	3	2	2	3	3	2	2
CO3	1	2	1	2	1	3	2	2	2	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	1.4	2	1.4	2.4	2	2.4	2	1.8	2.6	2.4	1.4	1.8

SOFTWARE ENGINEERING LAB (BCS06004)

Course Objective:

The objective is to implement time management software of a company, implement restaurant, supermarket, newspaper agency, medicine shop, book shop automation system, and implement library and payroll management system.

1. Time management software of a company
2. Hotel automation software
3. Judiciary information system software
4. Restaurant automation software
5. Supermarket automation software
6. Newspaper agency automation software
7. Medicine shop software
8. Bookshop automation software
9. Road tax information management system
10. Railway reservation system
11. Electricity billing system
12. Inventory control system
13. Library management system
14. Payroll management system
15. Banking system

Course Outcome:

CO1: Implement time management software of a company
CO2: Implement restaurant, supermarket, newspaper agency, medicine shop, book shop automation system
CO3: Implement library and payroll management system

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	3	3	-	-	2	2	1	3	-	2
CO2	-	2	2	3	-	-	1	2	1	2	-	3
CO3	-	2	2	3	-	-	2	1	1	3	-	3
CO4	-	2	3	3	-	-	2	1	1	3	-	3
CO5	-	2	2	3	-	-	1	1	1	3	-	2

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	-	2	2.4	3	-	-	1.6	1.4	1	2.8	-	2.6

Seventh Semester

ARTIFICIAL INTELLIGENCE- (BCS07001)

Course Objective:

The objective of the course is to learn different forms of logic, deal with inconsistencies and uncertainties of logic, familiar with informed and uniformed searching techniques, study different matching techniques, and learn pattern recognition and expert systems.

Module I

Introduction to AI, production system, production rules, State-space problem, Problem Solving by Intelligent search: BFS, DFS, Iterative Deepening Search, Hill Climbing, Simulated Annealing, heuristic Search: A*,AO* , Adversary Search: MIN-MAX Algorithm, Alpha-Beta Cut-off algorithm.

Module II

Propositional Logic, Theorem Proving by Propositional Logic, Resolution principle, Predicate Logic, wff conversion to clausal form, Dealing with Imprecision and Uncertainty: Probabilistic Reasoning, Dempster-Shafer Theory for Uncertainty Management.

Module III

Machine Learning: Supervised learning, unsupervised learning, Reinforcement learning, Artificial Neural Net, perceptron model, feed-forward neural network, Back propagation.

Module IV

Fundamentals: Components, degrees of freedom, joints, reference frames, characteristics Mathematical modelling of a robot: Mapping between frames, Description of objects in space, Transformation of vectors.

Module V

Direct Kinematic model: Mechanical Structure and notations, Description of links and joints, Kinematic modelling of the manipulator, Denavit-Hartenberg, Kinematic relationship between adjacent links, Manipulator Transformation matrix, Inverse Kinematics: Manipulator workspace, Solvable of inverse kinematic model, Manipulator Jacobian, Jacobian inverse, Application of robotics : path planning of mobile robot.

Text book:

1. Fu, Gonzales and Lee, Robotics, McGraw Hill
2. *Robotics* and Control Mittal and Nagrath Tata McGraw-Hill Education
3. *Artificial Intelligence and Soft Computing*: Behavioral and Cognitive Modeling of the Human Brain, Amit Konar, CRC Press
4. Artificial Intelligence, Dan W Patterson, Prentice Hall of India
5. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education

Reference Books:

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India
2. Artificial Intelligence, Nils J.Nilsson, ELSEVIER.
3. E.Rich and K.Knight, Artificial Intelligence, - TMH

Course Outcome:

CO1: To learn different forms of logic

CO2: Deal with inconsistencies and uncertainties of logic

CO3: Be familiar with informed and uniformed searching techniques

CO4: To study different matching techniques

CO5: To learn pattern recognition and expert systems

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	2	2	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-
CO3	2	1	2	3	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-
CO5	1	2	2	1	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.2	1.4	2	1.8	-	-	-	-	-	-	-	-

INTERNET & WEB PROGRAMMING (BCS07002)

Course Objective:

The objective of the course is to compare and Contrast HTML, DHTML, CSS, JavaScript, XML and other Web technologies, implement JavaScript Language to perform functionalities at client side application areas which include Banking, develop Graphical User Interface applications in Java by importing Applets and AWT, assess and evaluate the role of "WEBSERVERS" for the management and delivery of electronic information, design well formed JSP and Servlets Documents, and develop Web based applications by Servlets and JSP to have an interactive applications such as Client Server Architecture.

Module I

Internet Architecture: Internet overview, evolution of internet. Internet components: Local Area Networks, Access Networks, Core Networks, Routers, Transmission infrastructure, ISPs. TCP/IP model, TCP/IP vs OSI model. HTML: HTML Overview, Structure of HTML Documents, Document Types, HTML Elements and attributes. Anchor Attributes, Image Tag and its attributes, Image and Anchors, Table.

Module II

Image Map: Attributes, Client Side Image Maps and Server Side Maps.
HTML Layout: Background, colors and text, Tables, Frames, Layers, Page content Division <Div>, <SPAN>. CSS: Style Sheet Basic, Properties, Positioning with Style Sheet.
Forms: <FORM> Elements, Form controls. Dynamic HTML.

Module III

Java Script: Introduction, Client-Side JavaScript, Server-Side JavaScript, JavaScript Objects, JavaScript Security. Operators: Assignment Operators, Comparison Operators, Arithmetic Operators, Increment, Decrement, Unary Negation, Logical Operators, String Operators, Special Operators, Conditional operator, Comma operator, delete, new, this, void.

Statements: Break, comment, continue, delete, do … while, export, for, for…in, function, if…else, import, labelled, return, switch, var, while.

Module IV

JavaScript (Properties and Methods of Each) :Array, Boolean, Date, Function, Math, Number, Object, String, regExp. Document and its associated objects, document, Link, Area, Anchor, Image, Applet, Layer.
Events and Event Handlers: General Information about Events, Defining Event Handlers, event.

Module V

Server Side Programming: Common Gateway Interface (CGI), Active Server Pages.

Internet applications: FTP, Telnet, Email, Chat. World Wide Web: HTTP protocol. Search Engines. E-commerce and security issues including symmetric and asymmetric key, encryption and digital signature, and authentication. Emerging trends, Internet telephony, and virtual reality over the web, etc. Intranet and extranet, firewall.

Text Books:

1. Computer Networking: A Top-Down Approach Featuring the Internet by Kurose and Ross.
2. Web Design the Complete Reference by Thomas Powell, Tata McGrawHill.

Reference Books:

1. HTML The Complete Reference by Thomas Powell, Tata McGrawHill.
2. JavaScript the Complete Reference, Second Edition by Thomas Powell, Fritz Schneider. Tata McGrawHill.

Course Outcome:

CO1: Analyze internet architecture and implement HTML.
CO2: Implement CSS, forms and dynamic HTML.
CO3: Implement JavaScript Language to perform functionalities at client side application areas which include Banking.
CO4: Develop Graphical User Interface applications in Java by importing Applets and AWT.
CO5: Assess and evaluate the role of "WEBSERVERS" for the management and delivery of electronic information.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	-	2	-	-	1	1	-	2	-	3
CO2	2	3	-	1	-	-	-	1	-	1	-	2
CO3	2	3	-	2	-	-	-	1	-	2	-	3
CO4	2	3	-	1	-	-	-	3	-	1	-	3
CO5	1	3	-	1	-	-	-	3	-	2	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	1.6	3	-	1.4	-	-	0.2	1.8	-	1.6	-	2.8

Professional Elective - IV

IMAGE PROCESSING (BCSPE701)

Course Objective:

The objective is to study of digital images, bits and bytes, raster scan format, quantization, understanding of scaling, translation, rotation, sums and differences, study of contrast and grey levels, histograms, Gaussian and other non-linear stretches, understanding of topography and shaded relief displays, contours, parallax and stereo, perspective viewing and anaglyphs, and study on image morphing, false color images, principle components analysis.

Module-I

Introduction: What Is Digital Image Processing? The Origins of Digital Image Processing. Examples of Fieldsthat Use Digital Image Processing. Fundamental Steps in Digital Image Processing. Componentsof an Image Processing System. Image Sampling and Quantization.Some Basic Relationships between Pixels.Linear and Nonlinear Operations.

Module-II

Image Enhancement in the Spatial DomainSome Basic Gray Level Transformations.Histogram Processing.Enhancement Using Arithmetic/Logic Operations.Basics of Spatial Filtering.Smoothing Spatial Filters. SharpeningSpatial Filters.Combining Spatial Enhancement Methods.

Module-III

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain. Smoothing Frequency- Domain Filters. Sharpening Frequency Domain Filters. Homo-morphic Filtering.

Module-IV

Morphological Image Processing and Image Segmentation: Dilation and erosion, opening and closing, Hit-or-Miss transformations, basic morphological algorithms, Detection of discontinues, edge linking and boundary detection, thresh holding,

region –based segmentation.

Module-V

Use of Image Processing in Pattern Recognition: Introduction to the tools of Matlab and Open CV. Case study on Object Identification, Biometrics and Content Based Image retrieval.

Text Books:

1. Rafael C Gonzalez and Richard E Woods, Digital Image Processing, Pearson Education, 2002.
2. Anil K Jain, Fundamental of Digital Image Processing, Prentice Hall of India, 2004.

Reference Books:

1. William K Pratt, Digital Image Processing PIKS Scientific Inside, 4th Edition, Wile.
2. Vipul Singh, Digital Image Processing With Matlab&LabView, Reed Elsevier India Pvt Ltd, 2013.

Course Outcome:

CO1: Study of digital images, bits and bytes, raster scan format, quantization
CO2: Understanding of scaling, translation, rotation, sums and differences
CO3: Study of contrast and grey levels, histograms, Gaussian and other non-linear stretches
CO4: Understanding of topography and shaded relief displays, contours, parallax and stereo, perspective viewing and anaglyphs
CO5: Study on image morphing, false color images, principle components analysis

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	-	-	-	1
CO2	3	3	3	2	2	1	1	1	-	-	-	1
CO3	3	3	3	2	2	1	1	1	-	-	-	1
CO4	3	3	3	2	2	1	1	1	-	-	-	1
CO5	3	3	3	2	2	1	1	1	-	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1
Cours	3	3	3	2	2	1	1	1	-	-	-	1

PARALLEL AND DISTRIBUTED COMPUTING (BCSPE702)

Course Objective:

The objective is to gain knowledge in issues for constructing the distributed systems, examine how the message oriented communication can be done in a Distributed system to achieve the synchronous and asynchronous communication, implement the suitable clock Synchronization algorithms to manage the resources in a distributed operating system environment, compare the client and data centric consistency models to improve performance and scalability in terms of memory, and analyze issues dealing with recovery failure and able to implement Distributed file system in Network file system.

Module I

Need for Parallel Computers, Models of Computation, Analyzing Parallel Algorithms, Expressing Parallel Algorithms, Matrix Vector Multiplication, Matrix Matrix Multiplication.

Module II

Database Query Processing, 15 Puzzle Problem, Parallel Discrete Event Simulation, Image Dithering, Dense LU Factorization.

Module III

Hyper Quick Sort, Merge Sort, Bitonic Merge Sort, Odd Even Transposition, Enumeration Sort, Sorting on the CRCW Model, CREW Model and EREW Model, MPI and PVM.

Module IV

Introduction to Distributed Systems, Routing Algorithms, Destination-Based Routing, The All-Pairs Shortest-Path Problem, The Netchange Algorithm, Routing with Compact Routing Tables, Hierarchical Routing.

Module V

Fault Tolerance in Distributed Systems, Fault Tolerance in Asynchronous and Synchronous Systems, Failure Detection, Stabilization.

Text Books

1. G. Tel, Introduction to Distributed Algorithms, 2nd Edition, Cambridge University Press, 2000.
2. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Second Edition, Addison Wesley, 2003.

Reference Books:

1. F. T. Leighton, Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes, M K Publishers, San Mateo California, 1992.
2. B. Wilkinson, M. Allen, Parallel Programming Techniques and Applications using Networked Workstations and Parallel Computers, Prentice Hall, 2005.
3. Michael J. Quinn, Parallel Computer Theory and Practice, McGraw Hill, Second Edition, 1994.
4. S. G. Akl, The Design and Analysis of Parallel Algorithms, PHI, 1989.

Course Outcome:

CO1: Gain knowledge in issues for constructing the distributed systems
CO2: Examine how the message oriented communication can be done in a Distributed system to achieve the synchronous and asynchronous communication
CO3: Implement the suitable clock Synchronization algorithms to manage the resources in a distributed operating system environment.
CO4: Compare the client and data centric consistency models to improve performance and scalability in terms of memory.
CO5: Analyze issues dealing with recovery failure and able to implement Distributed file system in Network file system

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	-	2	-	-	1	1	-	2	-	3
CO2	2	3	-	1	-	-	-	1	-	1	-	2
CO3	2	3	-	2	-	-	-	1	-	2	-	3
CO4	2	3	-	1	-	-	-	3	-	1	-	3
CO5	1	3	-	1	-	-	-	3	-	2	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	1.6	3	-	1.4	-	-	0.2	1.8	-	1.6	-	2.8

DATA MINING (BCSPE703)

Course Objective:

The objective is to learn Data Mining overview, Data Warehouse and OLAP Technology, Data Mining Primitives, System Architectures, Mining Association Rules in Large Databases, Classification and Prediction, Classification by Back propagation, Categorization of Major Clustering Methods, and Applications and Trends in Data Mining.

Module I

Data Mining Overview :What Defines a Data Mining Task? Task-Relevant Data, The Kind of Knowledge to be Mined, KDD, Data Preprocessing – Data Integration and Transformation, Data Reduction,Data Mining Primitives, System Architectures.

Module II

Mining Association Rules in Large Databases, Association Rule Mining, Market Basket Analysis: AssociationRule Mining, Basic Concepts, Association Rule Mining A Road Map, Mining Association Rules from FrequentItemsets, Mining Multilevel Association Rules from Transaction Databases, Multilevel Association Rules,Approaches to Mining Multilevel Association Rules, Mining Distance-Based Association Rules, Association Mining and Correlation Analysis.

Module III

Classification and Prediction – What is Classification? What Is Prediction? Issues Regarding Classification andPrediction, Classification by Decision Tree Induction, Bayesian Classification, Bayes Theorem, Classification byBack propagation, A Multilayer Feed-Forward Neural Network, MLP, Classification Based of Concepts from Association Rule Mining, k-NearestNeighbor Classifiers, Fuzzy Set Approaches, Linear and Multiple Regression,Nonlinear Regression, Classifier Accuracy evaluation methods.

Module IV

Cluster Analysis – What Is Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of MajorClustering Methods, Classical Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods, Agglomerative and Divisive Hierarchical Clustering, ClusteringUsing Wavelet Transformation, Clustering High-Dimensional Space, Model-Based Clustering Methods, Fuzzy C-Means clustering, Cluster evaluation metrics.

Module V

Case study on Data Mining techniques in engineering applications: Brain Tumor detection, Time series data analysis, Fraud detection, Sentiment analysis, Market Profit Analysis etc. (Some recent research papers on the above may be used for case study.)

Text Book:

1. Data Mining: – Concepts and Techniques by Jiawei Han and MichelineKamber, -- Morgan Kaufmann Publisher (Elsevier)
2. Data Mining Concepts, Models, Methods and Algorithms ByMehmedKantardzic Wiley Interscience, IEEE Press.

Course Outcome:

CO1: To understand the concepts of Data Mining
CO2: To design the data mining decisions using the association rule mining
CO3: To analyze different supervised techniques: Prediction and Classifications
CO4: To apply the unsupervised data mining techniques for clustering
CO5: To evaluate data mining techniques while solving real world problems

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	-	-	-	-	1	-	-	2
CO2	2	2	3	1	-	-	-	-	1	-	-	1
CO3	3	1	3	1	-	3	-	-	1	-	-	1
CO4	3	2	3	3	-	-	-	-	1	-	-	1
CO5	3	2	3	1	-	-	-	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.8	2	3	2.2	-	0.6	-	-	0.8	-	-	1

Sessional

INTERNET AND WEB PROGRAMMING LAB (BCS07003)

Course Objective:

The objective is to be familiar with HTML and PHP, embedding audio and video files in HTML, develop server side scripting, and learning CGI scripting using PERL or C.

1. Web design environment : HTML elements coding and testing
2. Cascading style sheet
3. Implementation of website navigation
4. Implementation of table elements
5. Implementation of textual linking
6. Implementation of page templates
7. Implementation of frames and frame elements
8. Implementation of web typography
9. Implementation of graphics and coloring
10. Server side and client side scripting (PHP and JavaScript)
11. Mini project on website design using active and dynamic contents

Course Outcome:

CO1: Be familiar with HTML and PHP

CO2: Embedding audio and video files in HTML

CO3: Develop server side scripting

CO4: Learn CGI scripting using PERL or C

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	-	2	-	-	1	1	-	2	-	3
CO2	2	3	-	1	-	-	-	1	-	1	-	2
CO3	2	3	-	2	-	-	-	1	-	2	-	3
CO4	2	3	-	1	-	-	-	3	-	1	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	1.6	3	-	1.4	-	-	0.2	1.8	-	1.6	-	2.8

Eighth Semester

Professional Elective

RANDOMISED ALGORITHM (BCSPE801)

Course Objective:

An algorithm which uses random choices during its execution is called a randomized algorithm. A randomized algorithm for a problem is usually simpler and/or faster than their deterministic counterpart. Surprisingly, there are just a handful of probability tools which are used to analyze a randomized algorithm. However, their use is quite nontrivial and is based on careful insight. In this course, firstly the student will be taught the probability tools required to design and analyze a randomized algorithm.

Module I

An overview of randomized algorithms and their importance, Elementary probability theory, Random Variable, linearity of expectation and application. Markov Inequality, Chebyshev Inequality, Chernoff Bound. Proof for extremely low deviation of the running time of quick sort.

Module II

Random Sampling for divide and conquer - median finding algorithm, Random sampling for estimating parameters - estimating size of transitive closure of a directed graph in O(m log n) time, Random sampling for computing witnesses – faster algorithm for Boolean product witness matrix

Module III

Randomized Incremental Construction and backward analysis: closest pair problem, trapezoidal decomposition. Algebraic Techniques: Fingerprinting and Freivalds' technique Min cut algorithm, Analyzing a randomized experiment/algorithm by breaking it into stages: rumor spreading, client server problem.

Module IV

Principle of deferred decision and applications, Load Balancing: Power of two choices, Hashing with worst case constant search time, Random walk in a graph, relation between cover time of a graph and electric networks.

Module V

Probabilistic methods, Method of Bounded Difference, Embedding arbitrary metric into tree metric, Discussion of many recent and important randomized algorithms.

Text Book :

1. Randomized algorithms by Rajeev Motwani and PrabhakarRaghavan, Cambridge press (Indian edition available).
2. Introduction to Probability theory and Its Applications (volume 1) by William Feller (Indian edition available).

Course Outcome:

CO1: Learn randomized algorithms and their importance .
CO2: Analyze Random Sampling for divide and conquer and computing witnesses
CO3: Be familiar with Randomized Incremental Construction and backward analysis
CO4: Gain knowledge about Principle of deferred decision and applications.
CO5: Learn load balancing and probabilistic methods.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	3	1	-	2	2	2	3	-	2
CO2	3	1	2	3	1	-	1	3	2	3	-	2
CO3	3	1	1	2	-	-	2	3	2	3	-	2
CO4	3	2	1	2	-	-	2	2	3	2	-	2
CO5	3	2	1	2	-	-	2	2	3	2	-	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	3	1.6	1.4	2.4	0.4	-	1.8	2.4	2.4	2.6	-	2

MOBILE COMPUTING (BCSPE802)

Course Objective:

The objective is to be familiar with personal communication services, study global system for mobile communication, learn server-side programming, and learn case studies of the IRIDIUM and GLOBALSTAR, and quality of services in 3G.

Module I

Overview of wireless technologies: Signal propagation, Multiplexing, Modulation and Spread Spectrum techniques;Media access control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), FDMA, TDMA, CDMA.

Module II

Mobile NetwokLayer : Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP), General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard. Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms.

Module III

Mobile Transport Layer : Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Module IV

GSM : Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management),

Module V

Server-side programming in Java, Pervasive web application architecture, Device Independent example application.

Text Book:

1. Mobile Communication, J.Schiller, Pearson
2. Mobile computing, Talukdar&Yavgal.

Reference Book:

1. Mobile and Personal Communication Systems and Services", Raj Pandya, Prentice Hall of India, 2001.

Course Outcome:

CO1: Be familiar with personal communication services and wireless communication technologies

CO2: To learn Mobile IP, GPRS and MANET used in mobile communication.

CO3: To study Mobile Transport layer and various transmission techniques.

CO4: To know basic elements and working features of GSM, Bluetooth and Wireless Application Protocol.

CO5: To get knowledge on server side java programming.

1. **Course Articulation Matrix**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2	2	1	1	-	1	2	2	2	3	1
CO2	1	2	2	1	1	-	1	2	2	2	3	1
CO3	1	2	2	1	1	-	1	2	2	2	3	1
CO4	1	2	2	1	1	-	1	2	2	2	3	1
CO5	1	2	2	1	1	-	1	2	2	2	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

2. **Program Articulation Matrix row for this Course**

	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**
Cours	1	2	2	1	1	-	1	2	2	2	3	1

COMPUTER VISION (BCSPE803)

Course Objective:

The objective is to be familiar with GUI, use of points and lines algorithm, learn basic transformation such as translation, rotation and scaling, learn line and polygon clipping, and use of halftone pattern and dithering.

Module I

Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable pipelines; Performance characteristics.

The OpenGL: The OpenGL API; Primitives and attributes; Color; Viewing; Control functions;

The Gasket program; Polygons and recursion; The three-dimensional gasket; Plotting implicit functions.

Module II

Input and Interaction: Interaction; Input devices; Clients and servers; Display lists; Display lists and modeling; Programming event-driven input; Menus; Picking; A simple CAD program; Building interactive models; Animating interactive programs; Design of interactive programs; Logic operations.

Module III

Geometric Objects and Transformations: Scalars, points, and vectors; Three-dimensional primitives; Coordinate systems and frames; Modeling a colored cube; Affine transformations; Rotation, translation and scaling. Transformations in homogeneous coordinates; Concatenation of transformations; OpenGL transformation matrices; Interfaces to three-dimensional applications; Quaternions.

Module IV (10 LECTURES)

Viewing: Classical and computer viewing; Viewing with a computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden-surface removal; Interactive mesh displays; Parallel-projection matrices; Perspective-projection matrices; Lighting and Shading: Light and matter; Light sources; The Phong lighting model; Polygonal shading; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global illumination.

Module V

Curves and surfaces: Representation of curves and surfaces; Design criteria; Parametric cubic polynomial curves; Interpolation; Hermite curves and surfaces; Bezier curves and surfaces; Cubic B-Splines; General B-Splines; Rendering curves and surfaces; Curves and surfaces in OpenGL.

Text Book:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson, 2009.

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 2nd Edition, Pearson, 2004.
2. F.S. Hill,Jr.: "Computer Graphics Using OpenGL",2nd Edition, Pearson, 2001.
3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Addison-wesley 1997.

Course Outcome:

CO1: Be familiar with GUI

CO2: Use of points and lines algorithm

CO3: Learn basic transformation such as translation, rotation and scaling

CO4: Learn line and polygon clipping

CO5: Use of halftone pattern and dithering

1. **Course Articulation Matrix**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	3	2	1	2	1	1	1
CO2	3	3	3	2	3	3	2	1	2	1	1	1
CO3	3	3	3	2	3	3	2	1	2	1	1	1
CO4	3	3	3	2	3	3	2	1	2	1	1	1
CO5	3	3	3	2	3	3	2	1	2	1	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

2. **Program Articulation Matrix row for this Course**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course	3	3	3	2	3	3	2	1	2	1	1	1

BIOINFORMATICS (BCSPE804)

Module I

Basic concepts of Molecular Biology: Cellular Architecture, Nucleic Acids (RNA & DNA), DNA replication, Repair Cellular and recombination. Transcription, Translation, Genetic code, Gene expression, Protein structure and function, Molecular biology tools. Statistical methods: Estimation, Hypothesis testing, Random walks, Markov Models (HMM).

Module II

Suffix Trees: Definitions and examples, Ukkonen's linear-time suffix tree algorithm, Applications (exact string matching, longest common sub strings of two strings, Recognizing DNA contaminatin).

Module III

Pair-wise Sequence Alignment (Edit distance Dynamic Programming Calculation of edit distance, string similarity, gaps). Pair-wise sequence alignment (local), HMM for pair-wise alignment.

Module IV

Multiple String Alignment: Need of MSA, Family & Super family representation, multiple sequence comparison for structural inferences, multiple alignments with sum-of-pairs, consensus objective functions. Profile HMM for multiple sequence alignment. Database searching for similar sequence (FASTA, BLAST), PAM, BLOSOM, substitution matrices.

Module V

Phylogenetic Reconstruction: Phylogenetic Trees, Parsimony methods, Distance methods, Evolutionary models, Hierarchical clustering method, Maximum Likelihood method, Model comparison, Fragment Assembly Problem.

Text Books:

1. N.C. Jones & P.A. Pevzner – An introduction to Bioinformatics Algorithms. The MIT Press-2004.
2. D. Gusifield-Algorithms on Strings, Trees and sequences, Cambridge University Press, 1997.
3. R. Durbin, S. Eddy, A. Krugh, G. Mithison-Biological Sequence analysis, Cambridge University Press,1998.
4. J. Setubal and J. Meidanis-Introduction to Computational Molecular Biology PWS Publishing Company, 1997.
5. W.J. Ewens& G.R. Grant-Statistical methods in Bioinformatics-Springer-1989.

Reference Book:

1. M.S. Waterman – Introduction to Computational Biology – Chapman & Hall CRC.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	2	2	1	1	1	1	-	1
CO2	3	2	1	2	2	1	1	2	1	2	-	1
CO3	2	3	2	1	1	1	2	3	1	1	1	2
CO4	2	3	1	1	-	1	1	1	2	1	1	-
CO5	2	1	1	2	-	1	1	2	1	1	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	2.4	2.2	1.2	1.6	1	1.2	1.2	1.8	1.2	1.2	0.6	0.8

Professional Elective - VI

REAL TIME SYSTEMS (BCSPE805)

Course Objective:

To introduce the characteristics of real-time systems & their different types and to discuss the characteristics and constraints of some commercial real-time operating systems. To discuss and analyze different task scheduling algorithms in uniprocessor and multiprocessor environments. To discuss the features and algorithms for real-time communications to take place in different network structures. To explain the characteristics of real-time databases and their applications in real world.

Module I

Introduction to Real-Time systems: Basic concepts, applications of Real-Time systems, basic model of Real-Time systems, characteristics of Real-Time systems, types of Real-Time systems: hard, firm, soft, timing constraints, modeling timing constraints.

ModuleII

Real-Time task scheduling: Basic concepts, clock driven scheduling, table driven scheduling, cyclic, schedulers, hybrid schedulers, event driven scheduling, EDF Scheduling, RMA, DMA, resource sharing among RT tasks, Priority inversion, Priority Inheritance Protocol, Highest Locker Protocol, Priority Ceiling Protocol, Scheduling Real-Time tasks in multiprocessor and distributed systems, Fault tolerant scheduling of tasks, clocks in distributed Real-Time systems.

Module III

Commercial Real-Time Operating Systems: Time services, Features of real-time operating systems, UNIX and Windows as RT OS, POSIX, PSOS, VRTX, QNX, RT Linux, Lynx, other RT OS, benchmarking RT OS, Real-Time OS: OS services, I/O subsystem, Network OS.

Module IV

RT communications: QoS framework, models, Real-Time Communication in a LAN, IEEE 802.4, RETHER, Communication over Packet Switched Networks, Routing algorithms, RSVP, rate control.

Module V

RT databases: Applications, characteristics of temporal data, Concurrency control, Commercial RT databases, Special topics in Real-Time systems.

Text Book:

1. R. Mall, *Real-Time Systems*, Pearson , 2007
2. J. W. S. Liu, *Real-time Systems*, Pearson Education , 2008

Reference Books:-

1. C. M. Krishna and K. G. Shin, *Real-Time Systems*, McGraw Hill , 2004
2. P. A. Laplante, *Real-Time Systems Design and Analysis*, Willey , 2004

Course Outcome:

CO1: Understand and develop real-time applications.
CO2: Develop efficient algorithms for real-time task scheduling in uniprocessor and multiprocessor environments.
CO3: Get an exposure to the different types of commercial real-time operating systems.
CO4: Identify the limitations of a non real-time operating system in running a real-time application.
CO5: Identify and address the important issues in real-time communications and will be able to use real-time databases.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	1	-	-	1	1	2	-	-	1
CO2	1	2	-	2	-	-	2	2	1	1	-	1
CO3	3	3	-	1	-	-	1	1	-	-	-	2
CO4	3	3	-	1	-	-	1	1	-	1	1	3
CO5	2	3	-	1	-	-	2	1	-	1	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO	2.4	2.6	-	1.2	-	-	1.4	1.2	0.6	0.6	0.2	2

EMBEDDED SYSTEM (BCSPE806)

Course Objective:

The objective is to get an introduction to embedded system, processor in the system, other hardware units, software embedded into a systems, exemplary embedded system-on-chip (SOC), study devices and device drivers, I/O devices, timer and counting devices, serial communication using the IC, CAN and advance I/O buses between the networked multiple devices, interrupt servicing (handling) mechanism.

Module I

Introduction to embedded systems: Categories of embedded systems, overview of embedded system architecture; specialties of embedded systems recent trends in embedded systems, Communication interfaces: RS232/UART RS422/RS485.

Module II

Survey of software Architectures: Round Robin, Round Robin with interrupts, Function Queue scheduling Architecture, RTOS Architecture, Architecture selection, Introduction to RTOS, Task and task states, Task and data, Semaphore and shared data, More operating system services, Message Queues, Mail boxes and pipes, Timer functions , events, Memory Management, Interrupt routine in an RTOS environment.

Module III

Embedded Software Development Tools: Host and Target Machines, Linker/ Locator for Embedded Software , Getting Embedded Software into the target system, Debugging Techniques, Testing on your host machine, Instruction set Simulators, The Assert Macro using Laboratory tools.

Module IV

Writing Software for Embedded Systems: The compilation process, Native versus cross compilers, Run time libraries, Writing a library, Using alternative libraries, Using a standard library, Porting Kernels, C extensions for Embedded Systems, Downloading, Emulation and Debugging Techniques, Directional

Module V

Buffering and other data structures: What is a Linear buffer, buffer, Double buffering, buffer exchanging, Linked lists, FIFO, Circular buffers, Buffer under run and overrun, Allocating buffer memory, memory leakage, Memory and performance trade offs.

Text Books:

1. “Embedded / Real time systems: Concepts, Design and Programming”, Dr.K V K K Prasad, Dream Tech press, New Delhi, 2003.
2. “Embedded Software Primer”, David Simon, AddisonWesley, 1999.

References:

1. “Introduction to Embedded Systems”, Raj Kamal, TMS, Tata McGraw Hill Publications, 2002.
2. “Embedded System Design, A Unified Hardware/ Software Introduction”, Frank Vahid, Tony D. Givargis, John Wiley and Sons, Inc 2002

Course Outcome:

CO1: Introduction to embedded system, processor in the system, other hardware units, software embedded into a systems.

CO2: Case studies of programming with RTOS: case study of an embedded system for a smart card hardware and software co-design.

CO3: To know various Embedded Software Development Tools.

CO4: To Write Software for Embedded Systems using compilers, writing libraries.

CO5: To acquire knowledge on buffering data structure used in embedded system.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	1	-	-	1	1	2	-	-	1
CO2	1	2	-	2	-	-	2	2	1	1	-	1
CO3	3	3	-	1	-	-	1	1	-	-	-	2
CO4	3	3	-	1	-	-	1	1	-	1	1	3
CO5	2	3	-	1	-	-	2	1	-	1	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.4	2.6	-	1.2	-	-	1.4	1.2	0.6	0.6	0.2	2

MACHINE LEARNING (BCSPE807)

Course Objectives

Students have understanding of issues and challenges of Machine Learning.

Understanding of the strengths and weaknesses of many popular machine learning approaches.

Evaluation of machine learning algorithms and model selection.

Module I

Basics Concepts of Machine Learning: Brief Introduction to Machine Learning Concepts, Machine Learning Terminology, Machine Learning vs. Statistics, Types of Machine Learning Algorithms, Supervised Learning vs. Unsupervised Learning, Applications of Machine Learning.

Module II

Supervised Learning: Basic concepts of Supervised Learning, Decision tree induction, Evaluation of classifiers, Rule induction, Classification using association rules, Naïve Bayesian classification, Naïve Bayes for text classification, Support vector machines, Combining Classifiers Ensemble methods: Bagging and Boosting, Applications of Supervised Learning.

Module III

Unsupervised Learning: Clustering - K-means, Representation of clusters, Hierarchical clustering, Distance functions, Gaussian Mixture Model (GMM), Spectral Clustering, Expectation Maximization (EM), Principal Components Analysis (PCA).

Module IV

Introduction to Reinforcement Learning and Deep Learning: Reinforcement Learning Tasks and their types in reinforcement learning, Approaches to Reinforcement Learning and Examples, Machine Learning vs. Deep Learning, Introduction to Deep Learning and its applications.

Module V

Ensemble Methods and Evaluation of Machine Learning Models: Machine Learning for Time-Series Analysis, Ensemble Methods – Bagging, Boosting, Stacking, Evaluating Machine Learning Models - Training, Validation and Testing, K-fold Cross validation, Confusion Matrix, Evaluation Metrics, Hypothesis Testing.

Textbooks:

1. Tom Mitchell, Machine Learning.

2. Christopher Bishop, Pattern Recognition and Machine Learning.

Course Outcomes:

CO1: Understand the basics of machine learning and applications of machine learning.
CO2: Understand a wide variety of supervised learning algorithms.
CO3: Understand a wide variety of unsupervised learning algorithms.
CO4: Understand the basic concepts of Reinforcement Learning and Deep Learning.
CO5: Learn how to apply the machine learning algorithms on a dataset; perform evaluation of the algorithms and model selection.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	1	-	3	2	2	3	1	1
CO2	3	3	1	3	1	-	3	2	1	2	1	-
CO3	3	2	1	3	-	-	3	2	2	2	2	-
CO4	2	2	1	2	-	-	3	2	1	2	1	-
CO5	2	3	2	2	-	-	2	2	1	3	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: No Correlation

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	2.6	2.4	1.4	2.4	0.4	-	2.8	2	1.4	2.4	1	0.4

NATURAL LANGUAGE PROCESSING (BCSPE808)

Module I

Introduction: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

Module II

Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Module III

Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Tree banks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

Module IV

Semantics and Pragmatics: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

Module V

Discourse Analysis and Lexical Resources: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, Word Net, Prop Bank, Frame Net, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.

References:

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008

Course Outcomes:

CO1: Upon completion of the course, the students will be able to:
CO2: To tag a given text with basic Language features
CO3: To design an innovative application using NLP components
CO4: To implement a rule based system to tackle morphology/syntax of a language
CO5: To design a tag set to be used for statistical processing for real-time applications
CO6: To compare and contrast the use of different statistical approaches for different types of NLP applications.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	2	-	2	1	1	2	1	-	3
CO2	2	3	1	2	-	2	2	2	2	1	-	2
CO3	1	3	2	2	-	2	3	2	2	2	-	3
CO4	1	3	3	2	-	2	1	2	2	3	-	3
CO5	1	3	1	2	-	2	1	2	2	1	-	2

Program Articulation Matrix row for this Course

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO	1.4	2.8	1.8	2	-	2	1.6	1.8	2	1.6	-	2.6