Course Structure &Syllabus
of
B. Tech. Programme
in
Information Technology

Academic Year – 2019-20

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, ODISHA
Burla, Sambalpur-768018, India
www.vssut.ac.in

Information Technology

Vision:

To be a recognized leader by imparting quality technical education and thereby 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 academic for the betterment of the society.

Mission:

- To produce best quality Information Technology professional and researchers by providing state of the art training, hands on experience and healthy research environment.
- To collaborate with industry and academic around the globe for achieving quality technical education and excellence in research through active participation of all the stakeholders.
- To promote academic growth by offering inter-disciplinary postgraduate and doctoral programs.
- 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)

The educational objectives of department of Information Technology of VSSUT, Burla are to prepare its graduates:

PEO-1: To provide graduating students with core competencies by strengthening their mathematical, scientific and basic engineering fundamentals.

PEO-2: To train graduates in diversified and applied areas with analysis, design and synthesis of data to create novel products and solutions to meet current industrial and societal needs.

PEO-3: To inculcate high professionalism among the students by providing technical and soft skills with ethical standards.

PEO-4: To promote collaborative learning and spirit of team work through multidisciplinary projects and diverse professional activities.

PEO-5: To encourage students for higher studies, research activities and entrepreneurial skills by imparting interactive quality teaching and organizing symposiums, conferences, seminars, workshops and technical discussions.

	M1	M2	M3	M4
PEO-1	3	1	2	1
PEO-2	3	1	2	1
PEO-3	3	2	2	2
PEO-4	3	3	3	2
PEO-5	3	2	3	2

Programme Outcomes:

POs describe what students are expected to know or be able to do by the time of graduation from the program. Program Outcomes are established as per the process describe in 2.1.3. The Program Outcomes of UG in Information Technology are:

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.

Programme Specific Outcomes:

PSO 1: Students should be able to develop and implement the solution of real life computing problems using contemporary technologies.
PSO 2: Students should be able to apply ethical principles and commit to professional and social responsibilities.
PSO 3: Students should be able to apply ethical principles and commit to professional and social responsibilities.

COURSE STRUCTURE
FOR
BACHELOR OF TECHNOLOGYIN INFORMATION TECHNOLOGY
COURSES TO BE EFFECTIVE FROM JULY/AUGUST 2019

COURSE STRUCTURE FIRST YEAR		**FIRST SEMESTER (THEORY)**		
Sl.No	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**Credits**
1	**UBS**	**Mathematics-I**	**3-1-0**	**4**
2	**UBS**	**Chemistry**	**3-0-0**	**3**
3	**UES**	**Basic Electronics**	**3-0-0**	**3**
4	**UHS/ UES**	**Programming for Problem Solving**	**3-0-0**	**3**
5	**UES**	**Basic Civil Engg.**	**3-0-0**	**3**
SESSIONALS				
1	**UBL**	**Chemistry Lab**	**0-0-3**	**1.5**
2	**UEL**	**Basic Electronics Lab**	**0-0-3**	**1.5**
3	**UHL/ UES**	**Programming Lab**	**0-0-3**	**1.5**
4	**UEL**	**Engineering Graphics & Design**	**0-0-3**	**1.5**
NON-CREDIT				
	UMC	**Induction Programme and participation in Clubs/Societies**	**0-0-0**	**0**
Total			**15-1-12**	**22**

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COURSE STRUCTURE SECOND SEMESTER FIRST YEAR (THEORY)				
Sl.No	**CourseCode**	**Subject**	**Contact Hrs. L-T-P**	**Credits**
1	UBS	Mathematics - II	3-1-0	4
2	UES/UHS	English For Business Communication	3-0-0	3
3	UBS	Physics	3-0-0	3
4	UES	Basic Electrical Engg.	3-0-0	3
5	UES	Engineering Mechanics	3-0-0	3
SESSIONALS				
1	UBL	Physics Laboratory	0-0-3	1.5
2	UEL	Basic Electrical Engg. Lab	0-0-3	1.5
3	UEL /UHL	Business Communication Skills Lab	0-0-3	1.5
4	UEL	Workshop & Manufacturing Practices	0-0-3	1.5
NON-CREDIT				
	UMC	NSS/NCC/Yoga	0-0-0	0
Total			15-1-12	22

COURSE STRUCTURE THIRD SEMESTER SECOND YEAR (THEORY)				
Sl.No	**CourseCode**	**Subject**	**Contact Hrs. L-T-P**	**Total Credits**
1	UBS	Math-III	3-1-0	4
2	UPC	Data structure	3-0-0	3
3	UPC	Digital Electronics	3-0-0	3
4	UES	Object Oriented Programming	3-0-0	3
5	UHS	Economics for Engineers	3-0-0	3
SESSIONAL				
1	UPL	Data Structure Lab.	0-0-3	1.5
2	UEL	Object Oriented Programming Lab-I	0-0-3	1.5
3	UPL	Digital Electronics Lab.	0-0-3	1.5
4	UPL	Advance Programming Lab	0-0-3	1.5
NON-CREDIT				
	UMC	Essence of India Traditional Knowledge/ Environmental Sciences	0-0-0	0
TOTAL			14-1-12	22

COURSE STRUCTURE FOURTH SEMESTER SECOND YEAR (THEORY)				
SI. No	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**Credit**
1	**UPC**	**Data Base Engineering**	**3-1-0**	**4**
2	**UPC**	**Data Communication and Computer Networks(DCCN)**	**3-0-0**	**3**
3	**UPC**	**Computer Organization& Architecture**	**3-0-0**	**3**
4	**UBS/UES**	**Discrete Mathematics**	**3-0-0**	**3**
5	**UHS**	**Organizational Behaviors**	**3-0-0**	**3**
SESSIONALS				
6	**UES**	**Data Base Engineering Lab.**	**0-0-3**	**1.5**
7	**UEL or UPL***	**DCCN Lab**	**0-0-3**	**1.5**
8	**UPL**	**CO Lab.**	**0-0-3**	**1.5**
9	**UPL**	**Object Oriented Programming Lab-II**	**0-0-3**	**1.5**
NON-CREDIT				
	UMC	**Environmental Sciences/ Essence of India Traditional Knowledge**	**0-0-0**	**0**
	USI	**Summer Internship/ Training**	**0-0-0**	**0**
Total			**14-1-12**	**22**

COURSE STRUCTURE THIRD YEAR		FIFTH SEMESTER (THEORY)			
SI. No	**Course Code**	**Subject**		**Contact Hrs. L-T-P**	**Credit**
1	**UPC**	**Operating System**		**3-0-0**	**3**
2	**UPC**	**Web Technology**		**3-0-0**	**3**
3	**UPC**	**Design and Analysis of Algorithms**		**3-0-0**	**3**
4	**UPE**	**Professional Elective -I**	**Formal Language & Automata Theory(FLAT) Information Theory & Coding, Wireless Sensor Network(WSN), Cryptographic Foundation, ICT for Development, Mobile Computing.**	**3-0-0**	**3**
5	**UOE**	**Open Elective -I**		**3-0-0**	**3**
6	**UHS**	**Professional Ethics, Professional Law &Human Values / Financial Management, Costing, Accounting, Balance Sheet & Ratio Analysis**		**2-0-0**	**2**
SESSIONAL					
1	**UPL**	**Operating System Lab.**		**0-0-3**	**1.5**
2	**UPL**	**Web Technology Lab**		**0-0-3**	**1.5**
3	**UPL**	**Design and Analysis of Algorithms Lab.**		**0-0-3**	**1.5**
Total				**17-0-9**	**21.5**

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COURSE STRUCTURE THIRD YEAR		**SIXTH SEMESTER (THEORY)**			
SI. No	**Course Code**	**Subject**		**Contact Hrs. L-T-P**	**Credit**
1	**UPC**	**Compiler Design**		**3-0-0**	**3**
2	**UPC**	**Software Engineering**		**3-0-0**	**3**
3	**UPE**	**Professional Elective -II**	**Computer Graphics& Multimedia, Microprocessor & Microcontroller**	**3-0-0**	**3**
4	**UPE**	**Professional Elective-III**	**Soft Computing, Human Computer Interface, Network Security, Cellular Automata, Internet of Things, Digital ImageProcessing, Pattern Recognition, Bio Informatics**	**3-0-0**	**3**
5	**UOE**	**Open Elective-II**		**3-0-0**	**3**
6	**UHS**	**Financial Management Costing, Accounting, Balance Sheet & Ratio Analysis/ Professional Ethics, Professional Law &Human Values**		**2-0-0**	**2**
SESSIONALS					
1	**UPL**	**Compiler Design Lab.**		**0-0-3**	**1.5**
2	**UPL**	**Software Engineering Lab.**		**0-0-3**	**1.5**
3	**UPL**	**Professional Elective Lab-II.**		**0-0-3**	**1.5**
NON-CREDIT					
	USI	**Summer Industry Internship/ Training/ Project**		**0-0-0**	**0**
Total				**17-0-9**	**21.5**

List of Professional Elective (Fifth Semester)		
Sl. No.	**Category**	**Subject Name**
1	**UPE-I**	**Formal Language & Automata Theory**
2		**Information Theory & Coding**
3		**Wireless Sensor Network**
4		**Cryptographic Foundation**
5		**ICT for Development**
6		**Mobile Computing**
1	**UPE-II**	**Computer Graphics& Multimedia**
2		**Microprocessor & Microcontroller**
1	**UPE-III**	**Soft Computing**
2		**Human Computer Interface**
3		**Network Security**
4		**Cellular Automata**
5		**Internet of Things**
6		**Digital Image Processing**
7		**Pattern Recognition**
8		**Bio Informatics**

COURSE STRUCTURE SEVENTH SEMESTER FOURTH YEAR (THEORY)					
SL NO	**COURSE CODE**	**SUBJECT**		**CONTACT HRS L-T-P**	**CR**
1	**UPC**	**Artificial Intelligence**		**3-0-0**	**3**
2	**UPC**	**Cyber Security**		**3-0-0**	**3**
4	**UPE**	**Professional Elective-IV**	**E- Commerce & ERP, Fault Tolerant Systems, Machine Learning, Object Oriented Analysis and Design, Simulation & Modelling, Robotics, Software Project Management**	**3-0-0**	**3**
5	**UOE**	**Open Elective-III**		**3-0-0**	**3**
SESSIONALS					
1	**UPR**	**Project - I**		**0-0-6**	**3**
2	**UPL**	**Artificial Intelligence Lab.**		**0-0-3**	**1.5**
3	**USI**	**Seminar on internship**		**0-0-3**	**1.5**
TOTAL				**12-0-12**	**18**

COURSE STRUCTURE FOURTH YEAR		**EIGHTH SEMESTER (THEORY)**			
SL NO	**COURSE CODE**	**SUBJECT**		**CONTACT HRS L-T-P**	**CR**
1	**UPE**	**Professional Elective-V**	**Advance Operating Systems, VLSI Design, Parallel Computing, Real Time Systems, Data Analytics, Computer Vision, Cloud Computing**	**3-0-0**	**3**
2	**UPE**	**Professional Elective-VI**	**Advance Computer Architecture, Data Mining, Neural Network & Deep Learning, Intrusion Detection System, Natural Language Processing**	**3-0-0**	**3**
3	**UOE**	**Open Elective-IV**		**3-0-0**	**3**
SESSIONALS					
1	**UPR**	**Project II**		**0-0-12**	**6**
2	**UPR**	**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.

List of Professional Elective (Third Year)

Sl. No.		Subject Name
1	UPE-IV	E- Commerce & ERP
2		Fault Tolerant Systems
3		Machine Learning
4		Object Oriented Analysis and Design
5		Simulation & Modelling
6		Robotics
7		Software Project Management
1	UPE-V	Advance Operating Systems
2		VLSI Design
3		Parallel Computing
4		Real Time Systems
5		Data Analytics
6		Computer Vision
7		Cloud Computing
1	UPE-VI	Advance Computer Architecture
2		Data Mining
3		Neural Network & Deep Learning
4		Intrusion Detection System
5		Natural Language Processing

List of Open Electives

Sl. No.		Subject Name
1	UOE-I	Object Oriented Programming
2		Data Structure
3		ICT for Development
4		Mobile Computing
5		Web Technology
1	UOE-II	Design & Analysis of Algorithm
2		Operating System
3		Internet of Things (IoT)
4		Pattern Recognition
5		Bio-Informatics
1	UOE-III	Simulation & Modelling
2		Data Base Engineering
3		Computer Organization & Architecture
4		Artificial Intelligence
5		Robotics
1	UOE-IV	Cloud Computing
2		Data Mining
3		Advance Computer Architecture
4		Intrusion Detection
5		Computer Vision

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

Suggested grouping of open elective subjects:

COURSE CODE	SL. NO.	OPEN ELECTIVE SUBJECTS	DEPARTMENT TO OFFER
UOE-I	1	Energy Science and Engineering	Electrical Engg./ME/CHEM ENGG
	2	Soft Skills & Interpersonal Communication	Humanities
	3	Cyber Laws and Ethics	Computer Sc. &Engg. /IT
		ICT for Developments	IT
		Probability & Statistics	MATHS
	4	Biology for Engineers	
UOE-II	1	Internet of Things (IOT)	IT
	2	Project Management	Civil Engg. /ME/PE
		Introduction to Philosophical Thoughts	Humanities
		Database Management System(DBMS)	CSE /IT
	3	Introduction to Art & Aesthetics	Architecture Dept.
UOE-III	1	Data Analytics	IT
	2	Modern Manufacturing Process	Production Engg./MME/ME
		Entrepreneurship Development	ME/PE/MME
	3	Image Processing	Electronics & TC Engg.
UOE-IV	1	HR planning Development & Management	Humanities
	2	Economics Policy in India	Humanities
		Virtual Lab	Comp Sc /IT
	3	Applied Optimization	CE/ME/PE

*** This list of Open Elective Subjects is not exhaustive. Departments are encouraged to suggest the additional subjects (which they can offer) to the Dean, Academic Affairs for its floating. It is suggested to visit the MOOCs, SWAYAM, etc for the subjects and syllabi before the Workshop on Curriculum Development.**

Abbreviations:
UBS : Basic Science Course
UPC : Professional Core Course
UHS: Humanities and Social Sciences including management
UPE : Professional Elective Course
UOE : Open Elective Course
UM : Mandatory Coures (non- credit)
UES : Engineering Science Courses
UPL : Professional Core Lab
UBL : Basic Science Lab
UEL : Engineering Science Lab
UPR : Project
USI : Summer Internship / Training

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1^{st} & 2^{nd}

SEMESTER

FIRST SEMESTER

B. Tech.: Mathematics-I (Calculus and Linear Algebra)(BMA01001) [3-1-0]

Module 1: Calculus (8 Lectures)

Rolle's theorem, Mean value theorems (statements only) and applications. Introduction to improper integrals. 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 andorthogonal 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

Subject: Chemistry (BCH01001) Credits: 4 [3-1-0]

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

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

Program Articulation Matrix

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

BASIC ELECTRONICS (BEC01001)

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 OUTCOME: After completion of course student should be able to 1. Understand different types of signals and its application to semiconductor devices andcircuits. 2. Understand different BJTs and itsoperation. 3. Understand the Feedback Amplifiers and Operational Amplifiers. 4. Understand fundamentals of different Digital arithmetic operations and Digitalcircuits. 5. Understand some important Electronic Instruments and Communicationsystems.	

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

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

PROGRAMMING FOR PROBLEM SOLVING (BIT01001)

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

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

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

Basic of Civil Engineering (BCE01001)

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

SESSIONAL

B Tech Chemistry Lab: BCH01002

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

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

Program Articulation Matrix

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

BASIC ELECTRONICS LAB (BEC01002)

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

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

PROGRAMMING FOR PROBLEM SOLVING LAB (BHU01002)

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	2	3	-	-	3
CO2	3	3	3	3	2	-	-	2	3	-	-	3
CO3	3	3	3	3	2	-	-	2	3	-	-	3
CO4	3	3	3	3	2	-	-	2	3	-	-	3
CO5	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 (BCE01002)

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**

SECOND SEMESTER

Mathematics-II (Differential Equations and Complex Variables) (BMA02001) **[3 -1-0]**

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, Legendre polynomials. 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, radius of 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 differential equations 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 expansions of functions in various fields of engineering problems
CO5	Compute roots of algebraic and transcendental equations, and also evaluate the integrals by 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

ENGLISH FOR BUSINESS COMMUNICATION (BHU02001)

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 PHYSICS (BPH02001)

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 and identify the importance Elastic properties in Engineering Applications
CO2	Demonstrate simple harmonic Oscillator, Damped Harmonic and Forced Oscillators. Express 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	The basic mathematical concepts related to electromagnetic vector fields, Understand the concepts related to Gauss law, Electric and magnetic Flux, Faraday's law, induced emf, Displacement current, Ampere's Circuital law and Maxwell's equations. Expalin the transverse nature of electromagnetic wave
CO5	Identify and understand the kinds of experimental results which are incompatible with classical physics, Interpret the wave function and apply operators to it to obtain information about a particle's physical properties Solve the Schrodinger equation to obtain wave functions for some basic, physically important types of potential in one dimension

	Describe the requirements for a system to act as a laser. To explain lasing with need of metastable state and population inversion To explain the drawbacks of three level laser system and its solution in four level laser system.

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

BASIC ELECTRICAL ENGINEERING (BEE02001)

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

	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
Course	3	3	2	1	1	2	1	-	-	-	-	1

ENGINEERING MECHANICS (BME02001)

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 (BPH02002)

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2	1	1	3	3	1	1
CO2	3	3	2	1	3	2	1	1	3	3	1	1
CO3	3	3	2	1	3	2	1	1	3	3	1	1
CO4	3	3	2	1	3	2	1	1	3	3	1	1
CO5	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 (BEE02002)

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

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

Business Communication and Presentation Skills Lab (BHU02002)

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)

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA

DEPARTMENT OF INFORMATION TECHNOLOGY

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 (BME02002)

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.

	PO1	**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

THIRD SEMESTER

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

(BMA03001)

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, Fouriertransformation, 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 STRUCTURE

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

Module – I Introduction to Data Structures (6 Lectures)

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

Module – II Linear Data Structures (8 Lectures)

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 (10 Lectures)

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.

Module – IV Sorting, Searching (8 Lectures)

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 (8 Lectures)

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:

1. Data Structures and algorithm Analysis in C – M. A. Weiss (Pearson Education)
2. Data Structures using C++ - E. Horowich, S. Sahni

Course Outcomes

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

CO1	Compute asymptotic notations of an algorithm to analyze the consumption of resources (time/space).
CO2	Conceptualize and implement linear data structures like array, stack, queue and list ADT.
CO3	Analyze and Implement non-linear data structures like tree and graph.
CO4	Identify, model, solve and develop code for real life problems like shortest path and MST using graph theory.
CO5	Develop and compare the comparison-based search algorithms and sorting algorithms.

1. **Course Articulation Matrix**

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

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	2	3	2	-	2	-	-	-	2	-

DIGITAL ELECTRONICS

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

Module -I: **(8 Lectures)**

Introduction to Digital Systems: Introduction to Digital electronics ,Digital and Analog Signals and Systems, Binary Digits, Logic Levels, and Digital Waveforms, Logic Systems-Positive and negative, Logic Operations, Combinational and Sequential Logic Functions, Programmable Logic, Fixed-Function Logic Devices.

Number Systems and Codes: Introduction to Number Systems-Types-Decimal, Binary, Octal, Hexadecimal; Conversion from one number system to other; Binary arithmetic operations; Representation of Negative Numbers;1's complement and 2's complement, Complement arithmetic, BCD code, Digital Codes -Excess-3 code, Gray code, Binary to Excess -3 code conversion and vice versa, ASCII code, EBCIDIC code , Error Detection Codes.

Module -II: **(8 Lectures)**

Logic Gates: Logical Operators, Logic Gates-Basic Gates, Other gates, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters.

Boolean Algebra: Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canaonical representation of Boolean expressions, Duality Theorem, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map.

Module -III: **(8 Lectures)**

Combinational Circuits-Part 1: Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor; Parallel adder and Subtractor; Ripple Carry and Look-Ahead Carry Adders.

Combinational Circuits- Part 2: BCD adder, BCD subtractor, Parity Checker/Generator, Multiplexer, De multiplexer, Encoder, Priority Encoder; Decoder, BCD to Seven segment Display and Comparators.

Module -IV: (10Lectures)

Sequential Circuits: Introduction to Sequential Circuits, Flip-Flops: Types of Flip Flops - RS, T, D, JK; Triggering of Flip Flops; Flip Flop conversions; Master-Salve JK,
Shift Registers: Introduction to shift registers, Basic Shift Register Operations, types of shift registers, Bidirectional Shift Registers, Shift Register Counters. Typical ICS for shift registers.

Module -V: (6 Lectures)

Counters: Introduction to counters, Types of Counters-Asynchronous and synchronous counters, Up/Down Synchronous Counters.

Text Book:

1. M. Morris Mano, "Digital Design", 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.

Reference Book:

1. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.
5. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
6. Donald D.Givone, "Digital Principles and Design", TMH, 2003.

Course Outcomes:

After completing this course, the students should be able to:

1. Define and memorize concepts of digital circuit operation and principles,
2. Conceptualize and discuss different logic circuits, laws and theorems.
3. Apply the knowledge of Boolean algebra, rules, theorems and concepts to design and demonstrate various digital circuits.
4. Analyze, compare and differentiate the operations of various sequential logic circuits.
5. Design various sequential circuits.

Course Articulation Matrix

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

OBJECT ORIENTED PROGRAMMING

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

Module – I **(10 Lectures)**

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 **(8 Lectures)**

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 **(8 Lectures)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

(8 Lectures)

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

(6 Lectures)

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.
Projects design and development using C++.

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:

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

1. Implement basics of object oriented programming
2. Apply object oriented concept to implement programs using classes, objects.
3. Analyzeand implement programs using Inheritance.
4. Demonstrate polymorphic behaviour of objects and apply in real-life problem statement.
5. Apply object oriented approach to develop software incorporated with memory management and exception handling.

Course Articulation Matrix

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

Economics for Engineers (3-0-0)

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

DATA STRUCTURE LABORATORY

L-T-P: (0-0-3)

Cr. 1.5

1. Array: Insertion and Deletion of elements in an array.
2. Stack: Write a C Program to create a stack using an array and perform –
    i) Push operation,
    ii) Pop operation
3. Queue: Write a C Program to create a queue and perform –
    i) Push,
    ii) Pop,
    iii) Traversal
4. Application of queue: Write a C Program that uses Stack Operations to perform the following:-
    i) Converting an infix expression into postfix expression
    ii) Evaluating the postfix expression
5. Linked List:
    (a) Write a C Program that uses functions to perform the following operations on a single linked list :
        i) Creation,
        ii) Insertion,
        iii) Deletion,
        iv) Traversal

    (b) Write a C Program that uses functions to perform the following operations on a double linked list:
        i) Creation,
        ii) Insertion,
        iii) Deletion
6. Binary Tree: Write a C Program that uses functions to perform the following operations on a Binary Tree :
    i) Creation,
    ii) Insertion,
    iii) Deletion
7. AVL Tree: Write a C Program to construct an AVL-Tree and delete the selective nodes.
8. Sorting: 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
9. Searching: C Programs on :i) Sequential Search, ii) Binary Search

Course Outcomes

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

CO1	Implement array, stack, queue
CO2	Demonstrate and implement different applications of stack.
CO3	Explore and Implement Linked List.
CO4	Implement Binary tree and AVL tree.
CO5	Solve problems of sorting and searching with different techniques.

1. **Course Articulation Matrix**

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

OBJECT ORIENTED PROGRAMMING LAB - I

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

1. Simple C++ Programs to Implement Various Control Structures.(If statement, Switch case, do-while loop,for loop, while loop.
2. Implementation of functions and recursion using C++.
3. Programs on types of function call, Inline Functions and static members and static member functions.
4. Programs using Class and Objects.
5. Programs to understand friend function and friend class.
6. Programs on Constructors and Destructors.
7. Programs to overloading of unary and binary operators as member function and non-member function.
8. Programs to Implement Inheritance and Function Overriding.
9. Programs to implement exceptional handling.
10. Programs on Templates and standard template libraries.

Course Outcome

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

1. Implement basics of object oriented programming
2. Apply object oriented concept to implement programs using classes, objects.
3. Analyzeand implement programs using Inheritance.
4. Implementpolymorphic behaviour of objectsto apply in real-life problem statement.
5. Apply exception handlingto implementobject oriented program.

Course Articulation Matrix

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

DIGITAL ELECTRONICS LAB

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

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 Circuit, 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 an 8:3 encoder.
III. To design and implement a decimal to BCD encoder.
IV. To design and implement an 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 Outcomes:

After completing this lab, the students should be able to:

1. Express the number system conversions and verify different circuit operation and principles.
2. Demonstrate different arithmetic circuits.
3. Implement number converters.
4. Construct MUX, DEMUX, Encoder, Decoder etc.
5. Analyze different sequential circuits.

Course Articulation Matrix

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

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA

DEPARTMENT OF INFORMATION TECHNOLOGY

ADVANCE PROGRAMMING LAB

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

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 Outcomes:

Upon completion of this course, students should be able to:

1. Write, Test and Debug Python Programs
2. Implement Conditionals and Loops for Python Programs
3. Incorporate functions and represent Compound data using Lists, Tuples and Dictionaries
4. Apply data read and write operations with files in Python and develop Application

Course Articulation Matrix

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

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA

DEPARTMENT OF INFORMATION TECHNOLOGY

4^{th}

SEMESTER

DATABASE ENGINEERING

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

Module-I **(12 Lectures)**

Introduction to Databases: Introduction, Characteristics of database approach,Advantages of using the DBMS approach, History of database applications.
Overview of Database Languages and Architectures: Data Models, Schemas,and Instances. Three schema architecture and data independence, databaselanguages, and interfaces, The Database System environment. Conceptual Data
Modelling using Entities and Relationships: Entity types, Entity sets,attributes, roles, and structural constraints, Weak entity types, ER diagrams,examples, Specialization and Generalization.

Module-II **(8 Lectures)**

Relational Model: Relational Model Concepts, Relational Model Constraintsand relational database schemas, Update operations, transactions, and dealingwith constraint violations. Relational Algebra: Unary and Binary relationaloperations, additional relational operations (aggregate, grouping, etc.) Examplesof Queries in relational algebra. Mapping Conceptual Design into a LogicalDesign: Relational Database Design using ER-to-Relational mapping. SQL:SQL data definition and data types, specifying constraints in SQL, retrievalqueries in SQL, INSERT, DELETE, and UPDATE statements in SQL,Additional features of SQL.

Module-III **(6 Lectures)**

SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier

Module-IV **(8 Lectures)**

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.
Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms

Module-V **(6 Lectures)**

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.
Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.
Introduction to Database Recovery Protocols: Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures

Text Book:

1. Elmarsi, R. &Navathe, S. B.,(2007),Fundamental of Database System, Pearson Education.
2. Ramakrishna, R. &Gehrke, J.,(2003), Database Management Systems, McGraw-Hill.

References:

1. Molina, H. G., Ullman, J. D., and Widom,J., (2001),Database Systems The Complete Book, Pearson Education.
2. Raj, P., Raman, A., Nagaraj, D., and Duggirala, S., (2015), High-Performance Big-Data Analytics: Computing Systems and Approaches, Springer.
3. Sabharwal, N. & Edward, S. G., (2014), Big Data NoSQL Architecting MongDB, CreateSpace Independent Publishing Platform

Course Outcomes

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

CO1	Obtain sound knowledge in the theory, principles and applications of database management system, and be familiar with design of E-R models for different domains.
CO2	Be familiar with the relational database theory, and be able to write relational algebra and calculus expressions for queries.
CO3	Master the basics of SQL and construct queries using SQL and be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
CO4	Mater sound design principles for logical design of databases, including the E- R method and normalization approach.
CO5	Master the basics of query evaluation techniques and query optimization and be familiar with the basic issues of transaction processing and concurrency control

1. **Course Articulation Matrix**

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

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	2	3	1	-	1	-	-	-	2	-

DATA COMMUNICATION AND COMPUTER NETWORKS

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

Module I **(6 LECTURES)**

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.

Module II **(8 LECTURES)**

Multiplexing: FDM, WDM, TDM, and Transmission Media: Guided Media, Unguided media (wireless), Switching:circuitSwitching,packet switching

Data Link Layer: Error Detection and correction, Types of Errors, Detection, Error Correction.

Module III **(8 LECTURES)**

Data Link Control and Protocols:Flow and Error Control, Stop-and-wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Multiple Access, Random Access, Controlled Access, Channelization.Local area Network: Ethernet, Traditional Ethernet, Fast Ethernet, Gigabit Ethernet. Virtual circuits: Frame Relay and ATM.

Module – IV **(10 LECTURES)**

Network Layer:Host to Host Delivery, Internetworking, addressing, Routing.

Network Layer Protocols: ARP, RARP, NAT, BOOTP, DHCP, IPV4, ICMP, IPV6, ICMPV6 and Unicast routing protocols.

Module-V **(8 LECTURES)**

Transport Layer: Process to Process Delivery: UDP, TCP, Congestion control.

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

Text Book:

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 Books:

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

Course Outcomes

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

CO1	Analyze the concepts of networks, types and architectures
CO2	Study of various modulation and identify error free transmission of data.
CO3	Grasp the importance of flow and error control
CO4	Use addressing and its related protocol for data transfer.
CO5	Demonstrate the use of TCP, UDP protocol for host to host data transfer and Application layer protocol for application to application data transfer.

1. **Course Articulation Matrix**

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

COMPUTER ORGANIZATION AND ARCHITECTURE

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

Module-I **(10 Lectures)**

Introduction:

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

Computer Arithmetic:

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

Module-II **(10 Lectures)**

Instruction Set Architecture:

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,

CPU Organization:

Fundamental Concepts: Instruction-cycle, Fetching and storing a word in Memory, Register Transfer, Performing an Arithmetic & Logic Operation, Branching. Control word, Stack Organization, Register Stack, Memory Stack, RPN, Evaluation of Arithmetic Expression using RPN, Subroutine, Control Unit Operation: Hardware Control & Micro Programmed Control.

Module-III **(10 Lectures)**

Memory Organization:

Computers Memory System Overview, Characteristics of Memory System, The Memory Hierarchy, Semi- Conductor Main Memory types, Organization, 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. Associative Memory: Hardware Organization, Match Logic. Read Operation, Write Operation, Auxiliary Memory: Magnetic Disks, Magnetic Tape. Virtual Memory: Paging, Paging h/w, Address Mapping using pages, Segmentation h/w, Demand Paging, Memory Management h/w.

Module-IV **(4Lectures)**

Input/ Output Organization:

Peripheral Devices, Input – output 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.

Module-V **(6Lectures)**

Interrupt:

Class of interrupt, Priority Interrupt: Daisy Chaining Priority, Parallel Priority Interrupt. Program Interrupt, Types of Interrupt.

Parallel Processing:

Flynn's Classification, Introduction to Pipelining and hazards, Speedup, Efficiency, Throughput. RISC vs CISC

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, (3rdEdition) by – D.A.Patterson&J.L.Hennessy – Morgan Kaufmann Publishers (Elsevier).

Course Outcome:

After completing this course, the students should be able to:

1. Define and memorize different functional units and components of Computer.
2. Conceptualize and discuss different typesof Instruction, Instruction format, Instruction cycle and Addressing Modes.
3. Designs different types of Memory and CU.
4. Analyse, compare and differentiatedata transfer techniques.
5. Solve pipeline problems.

Course Articulation Matrix

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

Mathematics IV - Discrete Mathematics (Only for IT) 4 Credits [3-1-0]

Module I: **Propositional Logic and Counting** ***(8 Lectures)***

Logic: Propositional equivalence, predicates and quantifiers, methods of proofs, proof strategy, mathematical induction, strong induction

Counting: The basics of counting, the pigeonhole principle, principle of inclusion and exclusion and its applications

Module II: **Relations and Recurrence relations** ***(8 Lectures)***

Relations: Relations and their properties, *n*-array relations and their applications, representingrelations, closure of relations, equivalence of relations, partial orderings.

recurrence relations, solving homogeneous and non-homogeneous recurrence relations, generating functions.

Module III: **Graph theory** ***(8 Lectures)***

Graph theory: Introduction to graphs, graph terminology, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, planar graphs, graph coloring,

Module IV: **Algebraic Structure and Group theory** ***(8 Lectures)***

Group theory: Algebraic Structure, groups, subgroups, generators and evaluation of powers, cosets and Lagrange's theorem, group homomorphism, isomorphism, automorphism, normal subgroups.

Module V: **Lattices and Boolean Algebra** ***(8 Lectures)***

Lattice theory: Lattices and algebraic systems, principles of duality, basic properties of algebraic systems defined by lattices, distributive and complimented lattices, Boolean lattices and Booleanalgebras, uniqueness of finite Boolean expressions

Text Books:

1) *K.H. Rosen: Discrete Mathematics and its application, 5th edition, Tata McGraw Hill.*
2) *C.L. Liu, D. P. Mohapatra, Elements of Discrete Mathematics, Tata McGraw-Hill Publishing*

Course Outcomes:

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

CO1	Recognise recursive definitions and structural induction
CO2	Demonstrate equivalence of relations, recurrence relations and generating functions
CO3	Describe Euler and Hamilton paths, Planar graphs, Graph colouring with applications
CO4	Recognise Group structure, homomorphism, isomorphism and automorphism
CO5	Analyse Lattice theory and Boolean algebras

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

ORGANIZATIONAL BEHAVIOUR 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**

DATABASE ENGINEERING LAB

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

LIST OF EXPERIMENTS:

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views, Synonyms, Sequence, Indexes, Save point.
4. Creating an Employee database to set various constraints.
5. Creating relationship between the databases.
6. Study of PL/SQL block.
7. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
8. Write a PL/SQL block that handles all types of exceptions.
9. Creation of Procedures.
10. Creation of database triggers and functions
11. Mini project (Application Development using Oracle/ Mysql)
    a. Inventory Control System.
    b. Material Requirement Processing.
    c. Hospital Management System.
    d. Railway Reservation System.
    e. Personal Information System.
    f. Web Based User Identification System.
    g. Timetable Management System.
    h. Hotel Management System.

Text Book:

1. Introduction to SQL, Rick F. Vander Lans, Pearson education.

References

1. Oracle PL/SQL, B. Rosenzweig and E. Silvestrova, Pearson education.
2. SQL & PL/SQL for Oracle 10 g, Black Book, Dr. P. S. Deshpande, Dream Tech.
3. Oracle Database 11 g PL/SQL Programming, M. Mc Laughlin, TMH

Course Outcomes

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

CO1	To obtain sound knowledge and create, insert update a table with SQL.
CO2	Create various database and apply different constraints.
CO3	Master the basics of SQL and construct queries using SQL and be familiar with a commercial relational database system (Oracle) by writing SQL using the system.
CO4	Study PL/SQL block.
CO5	Apply the various concept on new problems.

1. **Course Articulation Matrix**

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

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	2	3	1	-	1	-	-	-	2	-

DATA COMMUNICATION AND COMPUTER NETWORKS LAB

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

List of Experiment

1. To study about different physical equipment used for networking.
2. To study about various layers of OSI model.
3. To Connect 2 PCs using Peer to Peer communication.
4. Write a program to generate CRC code for checking error.
5. Study of network addresses. (class and classless address)
6. Implementation of simple LAN network with various topology.
7. Implementation of DHCP in a network.
8. Implementation of DHCP server in a network.
9. Implementation of connected multiple a network with static addressing.
10. Implementation of Static and dynamic routing between the network.
11. Write a program to demonstrate client-server application.

Course Outcomes

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

CO1	Know details of OSI model and different physical equipment used for networking
CO2	Study of various modulation and identify error free transmission of data and Learn the importance of flow and error control
CO3	Learn different addressing schemes.
CO4	Implementation of LAN and DHCP.
CO5	Implementation of routing and demonstration of client-server application.

1. **Course Articulation Matrix**

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

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	2	3	2	-	2	-	-	-	2	2

COMPUTER ORGANIZATION LAB

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

1. Design of 4-bit adder – subtractor using decoder only, multiplexer only, IC only and enable line and logic gates using Proteus software.
2. Design of 4-bit shift registers using flip flops using Proteus software.
3. Design of a 4-bit unsigned multiplier ckt. using Proteus software.
4. Design of counters using Proteus software.
5. Design of a small ALU ckt. having 8 functional units.
6. Observation of an ALU trainer kit.
7. Observation of the read write operations of a RAM and Hard disc trainer kits.
8. Dismantling a PC and observation of its different parts.
9. Observation of PC trainer kit and learning about some H/W faults.
10. Observation of design of embedded systems like room temperature measurement kit and real time clock kit.

Course Outcomes:

After completing this lab, the students should be able to:

1. Verify different Adder-subtractor circuit operation using different combinational circuits.
2. Demonstrate Shift register and counter circuits.
3. Implement Multiplier circuits.
4. Design an ALU and explain its operations.
5. Demonstrate and express different parts of PC trainer kit and its functionalities.

Course Articulation Matrix

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

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DEPARTMENT OF INFORMATION TECHNOLOGY

OBJECT ORIENTED PROGRAMMING LAB- II

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

List of experiments

Python

1. Programs on basics of python.(variable, datatype, string)
2. Program on list, tuples and sets.
3. Programs on programming control structure used in python.
4. Implementation of array.
5. Program on function.
6. Program on class and object.
7. Mini-project group project.

Course Outcome

1. Able to implement basics of python programming
2. Apply the concepts of conditional statement and loops to implement programs.
3. Define function to construct modular program to solve complex problem.
4. Analyseand implement programs using using classes and objects
5. Implementpython programming to solve real-life problem statement.

Course Articulation Matrix

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

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA

DEPARTMENT OF INFORMATION TECHNOLOGY

5^{th}

SEMESTER

OPERATING SYSTEM

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

Module – I **(06 Lectures)**

Introduction: What is and 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 **(08 Lectures)**

Process Management: Process concept, process scheduling, Operation on process, Cooperating Processes, Inter process communication, thread, Threads Scheduling: Basic concepts, scheduling algorithms.

Module – III **(12 Lectures)**

Deadlocks: System model, Deadlock Characterization Methods for Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection, recovery from Deadlock, starvation

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

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

Module – IV (06 Lectures)

File – system Interface: file concept, Access Methods Directory implementation, Recovery.

Module –V **(08 Lectures)**

I/O systems: Overview, I/O Hardware, Application of I/O interface, Kernel I/O – subsystem Transforming I/O requests to Hardware operations. 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 Silverschatz and Peter Bear Galvin, John wiley& Sons, Inc.

REFERENCE BOOKS:

1. D.M Dhamdhere: Operating systems - A concept based Approach, 3rd Edition, Tata McGraw- Hill, 2012.
2. P.C.P. Bhatt: Introduction to Operating Systems Concepts and Practice, 3rd Edition, PHI, 2010.
3. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 2011.
4. William Stallings, Operating Systems: Internals and Design Principles, 8th edition Pearson Education Limited, 2014 ISBN: 1292061944, 9781292061948

Course Outcomes

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

CO1	Explore the structure, architectural components and concepts of different operating system.
CO2	Understand and realize the important theoretical foundations including Process management, process scheduling, thread scheduling and Analyze and design the applications to run in parallel either using process or thread models of different OS.
CO3	To understand the concepts and implementation of deadlock, memory management and virtual memory management strategies in OS.
CO4	Understand File – system Interface, file concept, Access Methods, Directory implementation, Recovery policies and algorithms in OS
CO5	Understand I/O systems, Secondary storage Structure: Disk scheduling, Disk management, Swap space management, Disk Reliability in OS and Conceptualize the components involved in designing a contemporary OS

1. **Course Articulation Matrix**

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

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	2	3	1	-	1	-	-	-	2	-

WEB TECHNOLOGY

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

Module I (8 Lectures)

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 (8 Lectures)

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 (8 Lectures)

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 (8 Lectures)

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 (8 Lectures)

Server Side Programming: Introduction to Common Gateway Interface (CGI), Active Server Pages and PHP for accessing database.
Internet applications: FTP, Telnet, Email, Chat. **World Wide Web:** HTTP protocol. Search Engines. E-commerce, Internet telephony, and virtual reality over the web, etc. Intranet and extranet, firewall.

Text Books:

1. Web Design the Complete Reference, Thomas A. Powell, Tata McGrawHill. 2nd Edition 2002.
2. Computer Networking: A Top-Down Approach Featuring the Internet, Kurose and Ross. 6th Edition 2017

Reference Books:

1. HTML The Complete Reference, Thomas Powell, Tata McGrawHill.3nd Edition 2001.
2. JavaScript the Complete Reference, Second Edition, Thomas Powell, Fritz Schneider. Tata McGrawHill.3rd Edition 2012.

Course Outcome:

1. Analyse internet architecture.
2. Implement HTML web page using basic HTML tags, CSS, forms,dynamic HTML.
3. Implement dynamic HTML using JavaScript Language to perform functionalities at client side.
4. Develop graphical user interface applications for user interaction.
5. Organise and implement web server for the management and delivery of information.

Course Articulation Matrix

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

DESIGN AND ANALYSIS OF ALGORITHMS

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

MODULE – I **(10 Lectures)**

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 **(10 Lectures)**

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 **(8 Lectures)**

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

MODULE–V **(6Lectures)**

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.Coremen, C.E.Leiserson, R.L. Rivest, C. Stein "Introduction to Algorithms"3rd Edition, The MIT Press

Reference Books

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

Course Outcomes

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

CO1	analyze the performance of algorithms and use asymptotic notations
CO2	explore the Greedy strategy to solve various problem
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

1. **Course Articulation Matrix**

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

OPERATING SYSTEMS LAB

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

- Study of Unix/Linux Commands.(2 classes)
- Write a program to allocate blocks of memory.
- Write a program to implement best fit algorithm in paging memory.
- Write a program to implement the bit vector for free space management.
- Write a program to implement first fit and best fit algorithm in paging memory.
- Write a program to implement worst fit algorithm in paging memory.
- Write a program to create a unique file name by the user or by the system.
- Write a program to implement DEKKERS ALGORITHM for mutual exclusion problem.
- Write a program to implement DINING PHILOSOPHER problem.
- Write a program for FCFS, Priority, SJF and Round Robin CPU scheduling algorithm.
- Write a program for FIFO page replacement algorithm.
- Write a program for LRU page replacement algorithm.
- Write a program for Optimal page replacement algorithm.
- Write a program to implement paging scheme.
- Write a program to implement producer-consumer problem of IPC.
- Write a program for to create two processes and wait for them to complete.
- Write a program to make packaging and sending as in IPC.
- Write a program to illustrate the function of a dispatcher.
- Write a program to implement deadlock avoidance algorithm.

Course Outcomes

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

CO1	Study of Linux/UNIX commands
CO2	Conceptualize the process state
CO3	Implementation of different scheduling algorithms
CO4	Implementation of different page replacement algorithms
CO5	Demonstration of dead lock and live lock.

1. **Course Articulation Matrix**

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

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	2	3	1	-	1	-	-	-	2	-

WEB TECHNOLOGY LAB

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

List of Experiment

1. Study of Basic HTML Tags.
2. Write HTML code to include following in a page
   - Various size of text, paragraph, alignment
   - Create any Ordered and Unordered list
   - Text and background colouring
3. Write HTML code to include Image in the page, image as background, links , a link to new page
4. Implementation of table, check box and selection box in the web page.
5. Implementation of table in the web page.
6. Implementation of form in the web page.
7. Write an HTML page with JavaScript to implement if-else, loop, switch.
8. Install of Apache web server, Tomcat application server locally, Install MySQL, PHP and configure.
9. Write PHP code for accessing form data and response.
10. Write PHP code to store and retrieve data from database.

Course outcome

1. Implementbasic HTML web page.
2. Implement HTML web page using basic HTML tags, CSS, forms, dynamic HTML.
3. Implement dynamic HTML using JavaScript Language to perform functionalities at client side.
4. Develop graphical user interface applications for user interaction.
5. Organise and implement web server for the management and delivery of information.

Course Articulation Matrix

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

DESIGN AND ANALYSIS OF ALGORITHMS LAB

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

- **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 Outcomes

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

CO1	Implement different elementary problems of tress and graphs.
CO2	Apply divide and conquer techniques to solve problem.
CO3	Demonstrate the Greedy strategy to solve various problem
CO4	Apply dynamic programming to get the optimal solution.
CO5	Analyze deterministic and nondeterministic algorithms to solve complex problems

1. **Course Articulation Matrix**

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

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA

DEPARTMENT OF INFORMATION TECHNOLOGY

6^{th}

SEMESTER

COMPILER DESIGN

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

Module – I: Compiler Overview and Lexical Analysis (8 Lectures)

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 (8 Lectures)

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 (8 Lectures)

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, quadruples, triples, indirect triplet, abstract syntax trees, Declarations, Assignment statements, Boolean expressions, Case statements, Back patching, Procedure calls.

Module – IV : Symbol Table and Error Handler (8 Lectures)

Symbol tables, use of symbol tables. Activation record, scope information in symbol table, Runtime Environment: storage organization, stack allocation, access to non-local data, heap management, parameter passing mechanisms. Error Handler, Classification of errors, error recovery strategies.

Module – V: Optimization and Code generation (8 Lectures)

Machine independent code optimization: Common sub expression elimination, constant folding, copy propagation, dead code elimination, strength reduction, loop optimization,basicblocks,data flow analysis.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,2nded, Pearson,2007.
2. Principles of compiler design, V. Raghavan, 2nded, TMH, 2011.
3. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003

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.

Course Outcome:

At the end of the course students are able to:

1. Define the phases of compiler and its working
2. Express the features of modern compiler.
3. Demonstrate the application of regular language and context free languages in the construction of compiler
4. Analyze and implement the optimization process in compiler
5. Develop their own compiler using modern tools

Course Articulation Matrix

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

SOFTWARE ENGINEERING

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

Module I **(8 Lectures)**

Introduction - Evolution, Software Development Projects, Exploratory Style of Software Development. **Software Life Cycle Models**- Basic concepts, Waterfall Model and its extensions, Rapid Application Development, Agile Development Models, Spiral Model, Comparison of different life cycle models.

Module II

(10 Lectures)

Software Project Management- Software Project Management Complexities, Responsibilities of a Software Project Manager, Project Planning, Metrices for project size estimation, Project Estimation Techniques, Empirical Estimation Techniques, COCOMO, Staffing Level Estimation, Scheduling, Organization and team structures, Staffing, Risk Management, Software Configuration Management. **Requirement Analysis & Specification**- Requirement Gathering, Requirement Analysis, Software Requirements Specification.

Module III

(8 Lectures)

Software Design- Characteristics of good design, Cohesion and Coupling, Layered arrangement of modules. **Function-Oriented Software Design**- Structured Analysis, Developing DFD, Structured Design, Detailed Design, Design Review. **Object Modelling Using UML**- UML, UML Diagrams- Use Case, Class Diagram, Object Diagram, Sequence Diagram, Collaboration, Activity and State Chart.

Module IV

(8 Lectures)

Coding- Standards & Guidelines, Code Review, Software Documentation **Testing-** Basic Concepts, Unit Testing, Black Box Testing, White Box Testing, Debugging, Integration Testing, System Testing

Module V **(6 Lectures)**

Software Reliability and Quality Management- Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model **Computer Aided Software Engineering**- CASE Environment, CASE support in Software Life Cycle **Software Maintenance**- Characteristics of Software Evolution, Types of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models **Software Reuse**- Introduction, Issues in Reuse, Reuse Approach

TEXT BOOK:

Rajib Mall, "Fundamental of Software Engineering", 4th Edition, PHI

REFERENCE BOOK:

Roger S. Pressman, "Software Engineering: A practitioner's approach", McGraw Hill.

COURSE OUTCOME

1. To analyze the fundamental principles of software engineering, life cycle models and their appropriate applications.
2. To plan the project management and requirement analysis techniques
3. To transform a specification into a design, and identify the components to build thearchitecture for a given problem using an appropriate methodology.
4. To evaluate appropriate testing plans at different levels of software development
5. To demonstrate the maintenance activities and quality control to ensure good quality software

Course Articulation Matrix

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

COMPILER DESIGN LAB

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

1. Introduction to Lex programming. Regular expression for Lex program. Implementation of Lexical analyzer using JLex, flex or lex or other lexical analyzer generating stools. Implement the DFA, NFA and regular expression.
2. Introduction to YACC programming. Convert the BNF rules into Yacc form and write code to generate abstract syntax tree.
3. Design top-down parser for the given language
4. Design bottom-up parser for the given language
5. Implement code optimization techniques
6. Generating machine code from intermediate forms

LEX ProgramsSample:

1. Write a Lex specification file to change all instances of Monday to Friday from a string.
2. Write a Lex specification file to change all characters in the input to '*'.
3. Write a Lex specification file to show a file in double spacing.
4. Write a Lex specification file to remove newline characters from a file.
5. Write a Lex specification file to remove every line starting with 'a' from input file.
6. Write a Lex specification file to read a file and add line numbers to it.
7. Write a Lex specification file to extract comments from a C source file.
8. Write a Lex specification file to eliminate all comments from a C source file.

YACC Programs Sample:

1. Program to test the validity of a simple expression involving operators +,-,* and /.
2. Program to recognise the nested IF control statements and display the number of levels of nesting.
3. Program to recognize valid arithmetic expression that uses operators+,-,*and /.
4. Program to recognize a valid variable.
5. Evaluate the arithmetic expression +,-,*,/
6. Program to recognize the string 'abbb','ab','a' using grammar (a^nb^n,n>=0).
7. Program to recognize the grammar(a^b,n>=10).

Course Outcome:

At the end of the course students are able to:

1. Design and develop lexical analyser for given language using modern tools
2. Implement BNF rules into YACC form to generate various parsers
3. Construct machine code from the intermediate code forms
4. Incorporate optimization techniques to generate efficient codes
5. Implement symbol table of a compiler

Course Articulation Matrix

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

SOFTWARE ENGINEERING LABORATORY

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

The following are supposed to be carried out on any application development project

1. Formation of Problem Statement and list of actors
2. Requirement Analysis - Functional Requirements, Non-Functional Requirements, Goals of Implementation, Priority Table
3. Software Requirement Specification (SRS) document.
4. Entity Relationship Model
5. Data Flow Diagram and Structure Chart Diagram.
6. Use Case Diagram and Use Case Specification Document
7. Class Diagram and Object Diagram
8. Sequence Diagrams
9. Activity Diagram, State Chart Diagram & Collaboration Diagram
10. Test Coverage Metrics

COURSE OUTCOME

1. Develop SRS document, design document, test cases and software configuration management and risk management related document.
2. Apply function oriented and object oriented software design using tools like rational rose.
3. Implement perform unit testing and integration testing.
4. Apply various white box and black box testing techniques
5. Analyze to track the progress of a project using Openproj/ other software tool.

Course Articulation Matrix

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

COMPUTER GRAPHICS AND MULTIMEDIA LAB

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

1. Express the fundamental concepts of graphics.
2. Implement basic geometrical objects using scan conversion.
3. Design two dimensional graphics by applying two dimensional transformations.
4. Design three dimensional graphics by analysing three dimensional transformations.
5. Analyze and implement curve generation.

Course Articulation Matrix

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

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA, ODISHA

DEPARTMENT OF INFORMATION TECHNOLOGY

7^{th}

SEMESTER

ARTIFICIAL INTELLIGENCE

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

Module-I **(8 Lectures)**

Introduction to Artificial Intelligence, Goals of AI, Applications of AI, Intelligent systems, types of intelligence, 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 **(8 Lectures)**

Knowledge and Reasoning: Formalized symbolic logic, Propositional logic, first order predicate logic, wffconversionto clausal form, inference rules, the resolution principle, Dealing with inconsistencies anduncertainties, fuzzy logic.

Module – III **(8 Lectures)**

Probabilistic Reasoning Structured knowledge, graphs, frames and related structures, Knowledge organization and management.

Module – IV **(8 Lectures)**

Natural Language processing, overview of linguistic, Grammars and Languages, basic parsing techniques, Expert system Architecture, features of expert system, Rule based system, forward chaining, backward chaining, architecture of expert system, limitations of expert system, applications of expert system

Module – V **(8 Lectures)**

Overview of different forms of learning, Learning Decision Trees, Artificial Neural network (ANN), structures of ANN, types of ANN, working of ANNs, applications of neural networks

Text Book:

1. Artificial Intelligence, Dan W Patterson, Prentice Hall of India (1999) Chapter-1, 4,5,7,9,10,11,12,13,15.
2. E.Rich and K.Knight, Artificial Intelligence, - TMH

Reference Books:

1. Artificial Intelligence, Nils J.Nilsson, ELSEVIER.

Course Outcome:

On completion of the course students will be able to

1. Analysethe various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Acquire the knowledge of real world Knowledge representation.
4. Analyse and design a real world problem for implementation and understand the dynamic behaviour of a system.
5. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 01	3	3	3	3	3	3	1	1	1	-	2	1
CO 02	3	3	3	3	3	3	1	1	2	-	3	2
CO 03	3	3	3	3	3	3	1	1	2	-	3	2
CO 04	3	3	3	3	3	3	1	1	2	-	3	2
CO 05	3	3	3	3	3	3	1	1	2	-	3	2

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
Course	3	3	3	3	3	3	1	1	2	-	3	2

CYBER SECURITY

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

Module-I:

(8 Lectures)

Cyber Security Basics, Security Principles, Cyber Attacks and their Classification, Vulnerability Assessment, Intrusion Detection and Intrusion Prevention Systems, User Authentication Methods, Bio-metric Authentication Methods

Module II: **(8 Lectures)**

Standard Security Models: Information Security, Network Security, Operating System Security ; Web Security:mail Security, Mobile Device Security, Cloud Security

Module III: **(8 Lectures)**

IoT Security: Cyber Physical System Security, Social Media Security; Virtual Currency: Block Chain Technology, Security Auditing

Module IV: **(8 Lectures)**

Cyber Crimes- Types-Data Frauds, Analysis of Crimes-Human Behavior- Stylometry-Incident Handling, Investigation Methods-Criminal Profiling- Cyber Trails, Digital Forensics-History-Challenges-Branches of Digital Forensics, Digital Forensic Investigation Methods-Reporting-Management of Evidence

Module V: **(8 Lectures)**

Cyber Law-Basics-Information Technology Act 2000-Amendments, Evidentiary value of E-mails/SMS, Cyber crimes and Offences dealt with IPC-RBI Act-IPR in India, Jurisdiction of Cyber Crime, Creating awareness and Healthy practices

Text Book:

1. Lester Evans, Cybersecurity: An Essential Guide to Computer and Cyber Security for Beginners, Including Ethical Hacking, Risk Assessment, Social Engineering, Attack and Defense Strategies, and Cyberwarfare, Kindle Edition
2. K. Jaishankar. Cyber Criminology: Exploring Internet Crimes and Criminal Behavior, CRC Press

References:

1. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf
2. http://docshare04.docshare.tips/files/21900/219006870.pdf
3. http://index-of.co.uk/Hacking-oleccion/Insider%20Attack%20&%20Cyber%20Security%20-%20Beyond%20the%20Hacker.pdf
4. http://www.uou.ac.in/sites/default/files/slm/FCS.pdf

Course Outcomes:

After successful completion of the course, the students will be able to:

1. Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.
2. Design, develop, test and evaluate secure software.
3. Develop policies and procedures to manage enterprise security risks.
4. Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.
5. Interpret and forensically investigate security incidents.

Course Articulation Matrix

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

6.

ARTIFICIAL INTELLIGENCELAB

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

List of Experiments:

1. Study of PROLOG and programs using PROLOG.
2. Write a program menu driven program for member concatenation, permutation, add and delete functions
3. Write a program for the union of two given lists
4. Write program for intersection of two given lists
5. Write program to find the factorial of a given number
6. Program for Depth first search
7. Program for Bredth first search
8. Write a program to solve 8-queen's problem
9. Solve 8- puzzle problem using best first search
10. Write a program to solve travelling salesman problem.
11. Write a program to solve monkey banana problem

Course Outcome:

On completion of the course students will be able to

1. Study of PROLOG and implementation of programs using PROLOG
2. Implement programs on set operations.
3. Implement BFS and DFS
4. Implement 8-queen problem
5. Apply salesman problem

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 01	3	3	3	3	3	3	1	1	2	-	3	2
CO 02	3	3	3	3	3	3	1	1	2	-	3	2
CO 03	3	3	3	3	3	3	1	1	2	-	3	2
CO 04	3	3	3	3	3	3	1	1	2	-	3	2
CO 05	3	3	3	3	3	3	1	1	2	-	3	2

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
Course	3	3	3	3	3	3	1	1	2	-	3	2

8th

SEMESTER

PROFESSIONAL ELECTIVE – V & VI

PROFESSIONAL ELECTIVE - I

FORMAL LANGUAGE AND AUTOMATA THEORY

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

Module I: Introduction and Preliminaries **(8 Lectures)**

Introduction to formal languages, Set, Relations Functions, Alphabet,Strings, Language, Operations, Methods of proof: Induction, Pigeonhole principle, Diagonalization principle; Applications of Theory of computation, Hierarchy of Languages, Grammars, Normal forms: Chomsky Normal Form (CNF), Weak CNF, Strong CNF, Greibach Normal form

Module II:Finite Automata: **(10 Lectures)**

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, minimisation of FSM, Finite Automata with output- Moore and Mealy machines and conversion of Mealy to Moore and vice-versa.

Module III: Regular Expression and Languages: **(8 Lectures)**

Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expression, 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: **(8 Lectures)**

Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings.Ambiguity in context free grammars. Reduction of Context Free Grammars. 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, interconversion. Introduction to DCFL and DPDA. DPDA Vs NPDA.

ModuleV: Turing Machine and its Computational Complexity: **(6 Lectures)**

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. "An introduction to Formal Languages and Automata", Peter Linz, Narosa.
3. 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. Formal Language and automata theory- H.S. Behera, J. Nayak and H. Pattnayak, Vikas Publishing House Pvt. Ltd.

Course Outcome:

At the end of thiscourse students will be able to:

1. Define various automaton used for recognizing the languages.
2. Classify the hierarchy of languages
3. Demonstrate their understanding of key notions, such as algorithm, computability, decidability, and complexity through problem solving.
4. Analyse and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.
5. Prove the basic results of the Theory of Computation

Course Articulation Matrix

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

INFORMATION THEORY & CODING

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

Module I **(10 Lectures)**

INFORMATION THEORY: - Concept of amount of information -units, Entropy -marginal, conditional and joint entropies -relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels.

Module II **(6 Lectures)**

DISCRETE CHANNELS: - Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, repetition of symbols, Binary unsymmetric channel, Shannon theorem.

Module III **(8 Lectures)**

SOURCE CODING: - Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes, Kraft's inequality, Coding efficiency and redundancy, Noiseless coding theorem. Construction of basic source codes: - Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding.

Module IV **(8 Lectures)**

CODES FOR ERROR DETECTION AND CORRECTION: - Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes. Cyclic codes: - Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes.

Module V **(8 Lectures)**

CONVOLUTIONAL CODES: - Encoding- State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterby algorithm, Sequential decoding – Stackalgorithm.

INTERLEAVING TECHNIQUES:- Block and convolutional interleaving, Coding and interleaving applied to CD digital audio system -CIRC encoding and decoding, interpolation and muting.

Text Book:

1. RanjanBose ,Information Theory, Coding and Cryptography 2nd Edition:, Tata McGraw-Hill, New Delhi, 2008

References

3. Simon Haykin,Communication Systems: John Wiley & Sons. Pvt. Ltd.
4. Taub& Schilling, Principles of Communication Systems: Tata McGraw-Hill
5. Das, Mullick& Chatterjee, Principles of Digital Communication: Wiley Eastern Ltd.

Course Outcomes·

Upon completion of this course, students should be able to:

1. Calculate the information content of a random variable from its probability distribution.
2. Relate the joint, conditional, and marginal entropies of variables in terms of their coupled probabilities.
3. Define channel capacities and properties using Shannon's Theorems.
4. Construct efficient codes for data on imperfect communication channels.
5. Demonstrate the discrete concepts to continuous signals on continuous channels.

Course Articulation Matrix

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

WIRELESS SENSOR NETWORKS

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

Module I **(8 Lectures)**

Characteristics Of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Module II **(8 Lectures)**

Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contentionbased protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Module III **(8 Lectures)**

Routing And Data Gathering Protocols: Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Module IV **(8 Lectures)**

Embedded Operating Systems: Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components - Programming in Tiny OS using NesC, Emulator TOSSIM.

Module V **(8 Lectures)**

Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE

802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

TEXT BOOKS

1. KazemSohraby, Daniel Minoli and TaiebZnati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

REFERENCE BOOKS

1. K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349
2. Philip Levis, " TinyOS Programming" 3.Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd.

Course Outcomes:

After completing this course the students should be able to:

1. Define and demonstrate various Wireless Sensor Network characteristic, challenges and node architecture.
2. Analyse MAC protocols in Sensor network.
3. Write and evaluate routing protocols in Wireless Sensor Network.
4. Express wireless sensor operating system and develop wireless sensor based applications.
5. Apply and incorporate the application of WSN.

Course Articulation Matrix

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

CRYPTOGRAPHIC FOUNDATION

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

Module-I **(8 Lectures)**

Introduction to Security: Definition, Goal and Challenges, OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Techniques, Model for Network Security,

Module-II **(8 Lectures)**

Mathematics of Cryptography: Integer Arithmetic, Modular arithmetic, Matrices, Linear Congruence, Algebraic Structures: Group, Ring, Field, Galois Field, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Stream and Block Cipher, Steganography.

Module-III **(8 Lectures)**

Modern Symmetric Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers, Data Encryption Standard (DES): DES Structure, DES Analysis, Multiple DES, Security of DES, Advanced Encryption Standard (AES), AES Transformation functions, Analysis of AES, Use of Modern Block Ciphers: ECB, CBC, CFB, OFB, CTR, Use of Stream Ciphers: RC4, Key Management, Key Generation.

Module-IV **(8 Lectures)**

Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing of Primality, Shinese Remainder Theorem, Exponentiation and Logarithm, RSA Algorithm, Elgamal Cryptosystem, Elliptic Curve Cryptography, Diffe-Hellman Key Exchange.

Module-V **(8 Lectures)**

Message Integrity and Message authentication: Application of Cryptographic Hash Functions, Two Simple Hash functions, Requirements and security, Secure Hash Algorithm (SHA), Message Authentication Requirements, Message authentication functions, Message Authentication Codes (MAC), Security of MAC, Digital Signature, Digital Signature Standards.

Text Book:

1. B. A. Forouzan, *Cryptography & Network Security*, McGraw Hill, Special Indian Edition, 2007.
2. 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:

At the end of thiscourse students will be able to:

1. Define principles of security and security services.
2. Identify security threats and determine efforts to counter them
3. Apply knowledge of computing and mathematics for developing efficient security algorithms.
4. Write code for relevant cryptographic algorithms.
5. Evaluate cryptographic primitives and their implementations for correctness, efficiency, and security.

Course Articulation Matrix

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

ICT FORDEVELOPMENT

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

Module-I **(8 Lectures)**

From the Origins of ICTD to Big Data and Development, history of ICTD, Factors driving ICT projects: unevenness in 'development', digital divides, use of big data for development, opportunities and challenges of big data analysis for development. Development Theory, Critiques of ICTD

Module-II **(8 Lectures)**

Development in the Network Society: potentials for economic change in the globalised economy by focusing on digital divides, value chain disintermediation and e-commerce within the context of ICTD, dynamics of digitally-driven production

Module-III **(8 Lectures)**

Social Inclusion: measures of development and social inclusion policies (in education, health, poverty, gender), technical solutions to meet social inclusion goals, success and failures of the application of mobile phone technology as means to achieve social inclusion and development goals

Module-IV **(8 Lectures)**

ICTs and Low Income Groups: ICTs altering local information systems and markets of low income groups and drive development, exploring rural market information, financial inclusion, low income groups as consumers and public sector reform

Module-V **(8 Lectures)**

Knowledge Economies and Development in the Global: knowledge activities emerging such as IT and impact sourcing, online microwork and technology innovation hubs and their impacts, Digital Labour and Development: potential for ICT facilitated labour, Issues of job quality, casualization, informality, value capture and bargaining power, global third wave of labour commodification

Text Book:

1. Richard Heeks, Information and Communication Technology for Development (ICT4D).
2. C Vrasidas, ICT for Education, Development, and Social Justice

Course Outcomes

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

CO1	Have a familiarity with key debates in ICTD
CO2	Have a sophisticated understanding of the potential for the internet
CO3	Learn how ICTs alter the practice of development
CO4	Formulate well-grounded research questions on ICTD topics
CO5	Link development theory and ICTD practice

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**

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

MOBILE COMPUTING

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

Module – I **(8 Lectures)**

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 **(8 Lectures)**

Mobile Network Layer : 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 **(8 Lectures)**

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 **(8 Lectures)**

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 **(8 Lectures)**

Pervasive web application architecture, Device Independent example applications.

Text Book:

1. Mobile Communication, J.Schiller, Pearson
2. Mobile computing, Talukdar&Yavgal.
3. Mobile and Personal Communication Systems and Services", Raj Pandya, Prentice Hall of India, 2001.

Course Outcomes:

After completing this course, the students should be able to:

1. Define and write Wireless Communication Technologies.
2. Demonstrate basic concepts of the architecture and protocols of Mobile communication.
3. Express different Wireless Communication Architectures.
4. Analyse GSM architecture and protocols.
5. Incorporate pervasive and device independent applications.

Course Articulation Matrix

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

PROFESSIONAL ELECTIVE - II

COMPUTER GRAPHICS AND MULTIMEDIA SYSTEMS

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

Module-I **(8 Lectures)**

Introduction to computer graphics-Overview of graphics system, mathematical foundations and applications.Graphics System- Cathode Ray Tube,Random scan and Raster scan systems, Colour CRT Monitors. Output primitives – Scan conversion: Points & lines, Line drawing algorithms- DDA algorithm and Bresenham's line algorithm, Circle generation algorithm- Mid Point Circle algorithm;Polygons- Types- Convex and Concave, Inside and outside tests of polygon – even-odd method, winding number method, polygon filling algorithms- Boundary fill algorithm andFlood fill algorithm, scan line polygon fill algorithm. Anti-Aliasing

Module-II **(8Lectures)**

Two dimensional geometric transformations: translation, rotation, scaling, reflection and shear; Matrix representations & homogeneous coordinates, transformations between coordinate systems; composite transformations. Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to- viewport coordinate transformation. Clipping operations – point, line (Cohen Sutherland) and polygon clipping (Sutherland Hodgman) algorithms.

Module-III **(8Lectures)**

Three dimensional transformations: translation, rotation, scaling, reflection and shear. Projections- parallel and perspective, Mathematical Description of Projections. Three dimensional object representation- Curve design, blending function and its types, Continuity, Bezier curves.

Module-IV **(8Lectures)**

Visible Surface Detection Methods-hidden lines and surfaces, Back face detection, Depth comparison, Z-buffer algorithm, A buffer algorithm. Illumination- Basic Illumination Models, Transparency. Shading models- Gouraud Shading, Phong Shading.

Module-V **(8Lectures)**

Multimedia – Introduction, Basic elements of multimedia, categorization – linear vs non-linear, hypertext and hypermedia; Animation – Introduction and Keyframe Animation Technique, Morphing

Text Books:

1. Donald Hearn and Pauline Baker– "Computer Graphics (C version 2nd Ed.)" – Pearson Education
2. Mukherjee- "Fundamentals of Computer Graphics & Multimedia", PHI

Reference Books:

1. Z Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2ndEd.)" – TMH
2. Buford J. K. – Multimedia Systems
3. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles (2nd Ed.) – Pearson Education.
4. W. M. Newman, R. F. Sproull – "Principles of Interactive Computer Graphics"

Course Outcome

1. To express the fundamental concepts of graphics.
2. Design two dimensional graphics by applying two dimensional transformations.
3. Design three dimensional graphics by analysing three dimensional transformations.
4. Demonstrate knowledge of rendering techniques.
5. To define concepts of multimedia systems.

Course Articulation Matrix

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

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

MICROPROCESSORS AND MICROCONTROLLERS

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

Module I: **(8 Lectures)**
Architecture of Microprocessors General definitions of mini computers, microprocessors, micro controllers and digital signal processors. Overview of 8085 microprocessor, Addressing modes.

Module II: **(8 Lectures)**
Assembly language of 8085 Description of Instructions. Addressing modes, Assembly directives. Assembly software programs with algorithms, Interrupts, Interfacing with RAMs, ROMs along with the explanation of timing diagrams.

Module III: **(8 Lectures)**
Overview of 8086 microprocessor, Registers, Signals and pins of 8086 microprocessor, Addressing modes, Interrupts.

Module IV: **(8 Lectures)**
Architecture of Micro controllers Overview of the architecture of 8051 microcontroller. Assembly directives. Assembly software programs with Algorithms.

Module V: **(8 Lectures)**
Interfacing with 8051 interfacing with keyboards, Interfacing with peripheral ICs like 8255, 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, Pearson Education.
2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers.
3. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH.
4. Ajit Pal, "Microprocessors Principles and Applications", TMH

Course Outcomes

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

CO1	Describe the architecture and organization of 8085 and 8086 microprocessor.
CO2	Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and microcontroller
CO3	Compare accepted standards and guidelines to select appropriate Microprocessor (8085 & 8086) and Microcontroller to meet specified performance requirements.
CO4	Designing of microprocessors/microcontrollers-based systems.
CO5	Plan circuits for various applications using microcontrollers

1. **Course Articulation Matrix**

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

MP&MC LAB

1. Addition of two 8-bit numbers, sum 8 bits
2. Subtraction of two 8-bit numbers, difference 8 bits
3. Addition of two 8-bit numbers, sum 16 bits.
4. Decimal addition of two 8-bit numbers, sum 16 bits.
5. Addition of two 16-bit numbers, sum 16 bits or more.
6. Find one's complement of an 8-bit number and 16-bit number.
7. Find two's complement of an 8-bit number and 16-bit number.
8. Find multiplication of two numbers using multiple addition.
9. Find division of two numbers using repeated subtraction.
10. Find square from lookup table.
11. Find the largest number in a data array.
12. To arrange a series of numbers in ascending or descending order.
13. Sum of a series of two 8-bit numbers, sum 8 bits
14. Sum of a series of two 8-bit numbers, sum 16 bits
15. 8-bit multiplication, product 16 bit
16. Programs on multibyte addition, subtractions etc.
17. To find the square root of a number.

Course Outcomes

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

CO1	Design and implement ALP programs on 8085 microprocessor.
CO2	Design and implement ALP programs on 8086 microprocessor.
CO3	Design interfacing circuits with 8086.

CO4	Design and implement programs on 8051 microprocessor
CO5	Design interfacing circuits with 8051

1. **Course Articulation Matrix**

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

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	2	3	1	-	1	-	-	-	2	-

PROFESSIONAL ELECTIVE - III

SOFT COMPUTING

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

Module I: **(5 Lectures)**

Neural Network Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks, perception model, feed forward neural network, Back propagation, Adaline,

Module II: **(5 Lectures)**

Widrow-Hoff's Adaline model, Madaline, Unsupervised learning neural network: Hopfield neural network, Competitive learning, self-organizing feature map, Reinforcement learning: Q-learning, Temporal difference learning.

Module III: **(10 Lectures)**

Fuzzy Logic Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, membership functions, Fuzzy set theory and operations, Extension principle of fuzzy set, fuzzy inference, Fuzzy implications, fuzzy relation, fuzzy reasoning , fuzzy c-means clustering , fuzzy inference Engine on VLSI architecture, Defuzzification techniques

Module IV: **(10 Lectures)**

Evolutionary Computing: Fundamentals of genetic algorithms: Encoding, Fitness functions, Reproduction Genetic Modeling: Cross cover, Inversion and deletion, Mutation operator, Bit-wise operators, Bitwise operators used in GA. Convergence of Genetic algorithm. GA as an alternative to back propagation, Applications of GA in navigational planning of robots, Real life Problems.

Module V: **(10 Lectures)**

Hybrid Systems Hybrid Systems: Neuro-fuzzy synergism, weakly coupled Neuro-fuzzy system, Tightly coupled Neuro Fuzzy System, fuzzy-GA synergism, Neuro-GA, Adaptation of neural learning algorithm using GA

Text Books:

1. Computational Intelligence Principles, Techniques and Applications, Amit Konar, Springer publication.
2. Neural Networks, Fuzzy Logic, and Genetic Algorithm (synthesis and Application) S.Rajasekaran, G.A. VijayalakshmiPai, PHI
3. Principles of Soft Computing S.N.Sivanandam&S.N.Deepa,Wiley-India Edition

Reference Books:

1. Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI
2. Soft-computing, D.K.Pratihar,AlphaScie

Course Outcomes:

Learner will be able to…

1. Analyse and differentiate between learning and programming and demonstrate practical applications of Neural Networks (NN).
2. Analyse and differentiate about different types of neural networks and its applications related to various domains.
3. State, define, analyse and apply the concepts of fuzzy logic, knowledge representation using fuzzy logic, approximation reasoning, fuzzy inference system, fuzzy logic control and other machine intelligent application of fuzzy logic.
4. Organize, Relate and Apply optimization techniques in computer engineering fields and other domains.
5. Demonstrate the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its various applications.

Course Articulation Matrix

	PO 01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 01	3	3	3	3	3	3	1	-	-	-	2	-
CO 02	3	3	3	3	3	3	1	-	-	-	2	-
CO 03	3	3	3	3	3	3	1	-	-	-	2	-
CO 04	3	3	3	3	3	3	1	-	-	-	2	-
CO 05	3	3	3	3	3	3	1	-	-	-	2	-

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
Course	3	3	3	3	3	3	1	-	-	-	2	-

HUMAN-COMPUTER INTERFACE

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

Module I **(08 Lectures)**

Introduction to human computer interaction, Input-output channels, human memory, Thinking, Emotion, cause of emotion, characteristics of emotion Basic Components of Emotion, regulation and control of Emotion, biological basis of Emotion, emotion learning.

Module II **(08 Lectures)**

Mathematical modelling of emotional dynamics, controlling emotion by artificial means, effect of emotion modelling on Human machine interaction, Emotion dynamics and stability analysis, text entry devices, device for virtual reality and 3D interaction, models of interaction, frameworks and HCL.

Module III **(08 Lectures)**

System Modeling and Stability, Stability Analysis of Dynamics by Lyapunov Energy Functions, Stability Analysis of Fuzzy Systems, Mamdani Type Fuzzy Systems, Takagi-Sugeno Type Fuzzy Systems, Stability Analysis of T-S Fuzzy Systems, Emotional Dynamics and Stability Analysis.

Module IV **(08 Lectures)**

Emotion Processing by the Human Brain, Role of Medial Frontal Cortex in Self-regulation of Emotion, Anterior Cingulate Cortex as a Self-regulatory Agent, Neural Circuitry Underlying Emotional Self-regulation, EEG Conditioning and Affective Disorders.EEG Prediction by Adaptive Filtering: LMS Filter, EEG Prediction by NLMS Algorithm.

Module V **(08 Lectures)**

RLS Filter for EEG Prediction, Emotion Clustering by Neural Networks, Application in Human-Machine Interactive Systems: Input Interfaces, Output Interfaces, Embodiment of Artificial Characters, Application in Multi-agent Co-operation of Mobile Robotics, Detection of Anti-social Motives from Emotional Expressions, Emotion Recognition from Voice Samples.

Text Books

1. Emotional Intelligence: A Cybernetic Approach, ArunaChakraborty and Amit Konar, springer
2. Dix A. et al., Human-Computer Interaction. Harlow, England: Prentice Hall

Reference Books

1. B. Shneiderman, C. Plaisant, M. Cohen, and S. Jacobs, Designing the User Interface: Strategies for Effective Human-Computer Interaction, Addison-Wesley,
2. Y. Rogers, H. Sharp, and J. Preece, Interaction Design: Beyond Human-Computer Interaction, John Wiley & Sons

Course Outcomes

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

CO1	Describe typical human–computer interaction (HCI) models and styles, as well as various historic HCI paradigms
CO2	Discuss tasks and dialogs of relevant HCI systems based on task analysis and dialog design.
CO3	Analyze System Modelling and Stability, Stability Analysis of T-S Fuzzy Systems.
CO4	Implement EEG Prediction by Adaptive Filtering, Machine Interactive Systems.
CO5	Develop Emotion Recognition from Voice Samples.

3. Course Articulation Matrix

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

NETWORK SECURITY

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

Module I **(8 Lectures)**

Overview: Computer Security concepts, The OSI Security architecture, Security attacks. Security services, Security Mechanisms, Network Security model, Review of Symmetric and Asymmetric key cryptography

Module II **(8 Lectures)**

Security at Application Layer: E-Mail Architecture, E-Mail Security, PGP, Application of PGP, MIME, S/MIME, Application of S/MIME

Module III **(8 Lectures)**

Security at Transport Layer: Web Security issues, Secure Socket Layer (SSL): Architecture, services, Four Protocols, SSL Message format, Transport layer security (TLS), TLS protocols, HTTPS

Module IV **(8 Lectures)**

Wireless Network Security: IEEE 802.11 wireless LAN overview, IEEE 802.11i Wireless LAN security, Wireless application protocol overview, wireless transport layer security, WAP End-to-End security

Module V **(8 Lectures)**

Security at the Network Layer: IP Security overview, IP Security (IPSec) modes, AH and ESP protocol, IPv4 and IPv6, AH versus ESP, services provided by IPSec, Security association, Security policy, Internet Key Exchange (IKE), ISAKMP

Text Books:

1. Cryptography and Network Security – by AtulKahate – TMH.
2. Data Communications and Networking- by BehourzAForouzan

Reference Book:

1. Cyber Security Operations Handbook – by J.W.Rittiaghouse and WilliamM.Hancok – Elseviers.

Course Outcomes:

At the end of the course students should be able to

1. Memorize the principles of Security
2. Identify the security issues in the network and resolve it.
3. Implement different security algorithm
4. Evaluate security mechanisms using rigorous approaches, including theoretical
5. Analyse the vulnerabilities in any computing system and hence be able to design a security solution.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	2	-	-	-	3
CO2	3	3	3	3	3	-	-	2	-	-	-	3
CO3	3	3	3	3	3	-	-	2	-	-	-	3
CO4	3	3	3	3	3	-	-	2	-	-	-	3
CO5	3	3	3	3	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**
Course	3	3	3	3	5	-	-	2	-	-	-	3

CELLULAR AUTOMATA THEORY

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

Module -I **(8 Lectures)**

INTRODUCTION:Cellular Automata, Applications of Cellular Automata: Initial phase of development, CA based model, New phase of Development in CA: Polynomial Algebraic Characterization of CA Behaviour, Matrix Algebraic Characterization of CA

Module -II **(8 Lectures)**

CHARACTERIZATION of CA: Group CA, Characterization of the State-Transition Behaviour, Group Properties of CA, A Class of Null Boundary Group CA, Group Properties of Periodic Boundary CA (PBCA) with Rules 90 and 150, Analysis of Intermediate Boundary CA (IBCA), Phase Shift of PN-Sequences Generated by CA, Programmable CA (PCA),

Module-III **(8 Lectures)**

Non group CA, General Characterization of Linear Nongroup CA, Characterization of Linear Multiple-Attractor Cellular Automata, Characterization of Complemented Additive CA, Behaviour of Complemented CA Derived from Multiple-Attractor Linear CA, Characterization of D1*CA

Module –IV **(8 Lectures)**

CA AS A UNIVERSAL PATTERN GENERATOR, Pseudo exhaustive Pattern Generation, On-Chip Deterministic Test Pattern Generation, Exhaustive Two-and Three-Pattern Generation Capability of a CA

Module –V **(8 Lectures)**

CA-BASED ERROR CORRECTING CODE, Review of Error Correcting Codes, Design of Random Bit Error Correcting Codes, CA-Based Byte Error Correcting Code, CA Array-Based Diagnosis of Board-Level Faults, DESIGN OF CA-BASED CIPHER SYSTEM, Permutation Groups, Permutation Representation of CA States, Definition of Fundamental Transformations, PCA-Based Block Cipher Scheme, Stream Cipher Strategy

Text Books:

1. Chaudhuri, Parimal Pal. *Additive cellular automata: theory and applications*. Vol. 1. John Wiley & Sons, 1997.

References:

1. Wolfram, Stephen. *A new kind of science*. Vol. 5. Champaign: Wolfram media, 2002.

Course Outcomes:

After completing this course the students should be able to:

1. Memorize the basic concepts of Cellular Automata.
2. Describe the characterization of Cellular Automata
3. Apply cellular Automata to make independent and critical assessments.
4. Relate concept of Cellular automata to solve real world problems
5. Identify, formulate and solve complex problems autonomously in the field of science and engineering.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	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 for this Course

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

INTERNET OF THINGS

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

Module I **(8 Lectures)**

Introduction: Definition – Foundations – Challenges and Issues - Identification - Security. Components in internet of things: Control Units – Sensors – Communication modules –Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks –Mobile Internet – Wired Communication-IoT Platform Overview-Raspberry pi-Arduino boards.

Module II **(6 Lectures)**

IoT Protocols: Protocol Standardization for IoT-M2M and WSN Protocols-SCADA and RFID Protocols-Issues with Iot Standardization-Protocols-IEEE 802.15.4-BACNet ProtocolZigbee,Architecture - Network layer – APS Layer – Security.

Module III **(10 Lectures)**

Resource Management in the Internet of Things: Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object – Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.

Module IV **(8 Lectures)**

Case Study and IoT Application Development: IoT applications in home-infrastructuresecurityIndustries- IoT electronic equipment. Use of Big Data and Visualization in IoTIndustry 4.0 concepts - Sensors and sensor Node –Interfacing using Raspberry Pi/Arduino-Web Enabled Constrained Devices.

Module V **(8 Lectures)**

Web of Things: Web of Things versus Internet of Things-Architecture Standardization for WoT-Platform Middleware for WoT- WoT Portals and Business Intelligence-Cloud of Things:Grid/SOA and Cloud Computing-Cloud Standards –Cloud of Things Architecture-Open Source e-Health sensor platform. Develop schemes for the applications of IOT in real time scenarios.Design business Intelligence and Information Security for WoT.

Text Books:

1. Honbo Zhou, ”The Internet of Things in the Cloud:A Middleware Perspective” — CRC Press-2012.
2. Dieter Uckelmann, Mark Harrison, “Architecting the Internet of Things”, Springer-2011.
3. ArshdeepBahga, Vijay Madisetti, “Internet of Things (A Hands-On-Approach)”, VPT, 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

References:

1. Luigi Atzori, Antonio Lera, Giacomo Morabito, “The Internet of Things: A Survey”, Journal on Networks, Elsevier Publications, October, 2010.

Course Outcomes

After completing this course the students should be able to:

1. Define the fundamental concepts of IoT.
2. Analyze and evaluate different Protocols used in IoT.
3. Analyze and evaluate the data received through sensors in IoT.
4. Plan and managedifferentresources used in IoT for specific application.
5. Design and develop cost effective solutions using IoT

Course Articulation Matrix

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

DIGITAL IMAGE PROCESSING

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

Module-I **(8 Lectures)**

What Is Digital Image Processing? The Origins of Digital Image Processing. Examples of Fields that Use Digital Image Processing. Fundamental steps in Digital Image Processing. Components of an Image Processing System. Image Sampling and Quantization. Some Basic Relationships between Pixels. Linear and Nonlinear Operations.

Module-II **(8 Lectures)**

Spatial Domain Filtering : Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.

Filtering in the Frequency domain: Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering. Discrete Wavelet Transform

Module-III **(8 Lectures)**

Image Enhancement: Contrast Intensification, Smoothing, Image Sharpening

Image Restoration: Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections

Multivalued Image Processing: Colour Image Processing, Colour Image Enhancement

Module-IV **(8 Lectures)**

Image Compression: Encoder-Decoder model, Types of redundancies, Lossy and lossless compression, Entropy of an information source, Shannon's 1st Theorem , Transform Domain Compression, JPEG Compression, Block Truncation Compression, Vector Quantization, , Huffman Coding, Arithmetic Coding, Transform coding, Run-length coding, Block coding, Quad Tree coding, Contour Coding

Module-V: **(8 Lectures)**

Image Segmentation: Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation

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, Wiley
2. Vipul Singh, Digital Image Processing With Matlab&LabView, Reed Elsevier India Pvt Ltd, 2013

Course Outcomes

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

CO1	Describe the concepts of image formation and the role human visual system plays in perception of gray and color image data.
CO2	Interpret various types of images, intensity transformations and spatial filtering.
CO3	Implement various signal processing algorithms and techniques in image enhancement and image restoration.
CO4	Develop engineering skills and intuitive understanding of the tools used in Image compression
CO5	Implementing various algorithms for image segmentation.

1. **Course Articulation Matrix**

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

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	2	3	3	3	1	1	-	2	-	2

PATTERN RECOGNITION

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

Module-I (10 Lectures)

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

PROBABILITY: Introduction, probability of events, random variables, Joint distributions and densities, moments of random variables, estimation of parameters from samples, minimum risk estimators.

Module-II (10 Lectures)

STATISTICAL DECISION MAKING: Introduction, Bayes Theorem, multiple features, conditionally independent features, decision boundaries, unequal costs of error, estimation of error rates, leavingone- out technique. Characteristic curves, estimating the composition of populations.

Module-III (10 Lectures)

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-IV (5 Lectures)

UNSUPERVISED LEARNING AND CLUSTERINGS: Unsupervised Bayesian learning, data decryption and clustering, criterion functions and clustering, Hierarchical clustering, Online clustering, component analysis.

Module-V (5 Lectures)

ARTIFICIAL NEURAL NETWORKS: Introduction, networks without hidden layers. Networks with hidden layers, the back Propagation algorithms, Hopfield nets, an application.

TEXT BOOKS:

1. Pattern Classification Duda R. O., and Hart P E., and Stork D G., Wiley Publishers
2. Pattern Recognition and Image Analysis, Earl Gose, Richard J and Steve J, PHI
3. Pattern recognition (Statistical, structural and Neural Approaches), Robert Schalkoff

Course Outcome

1. Construct the fundamentals of pattern recognition, learning techniques and various approaches.
2. Analyse decision making technique for various problems with high dimensional data.
3. Demonstratethe classification techniques for various problems.
4. Incorporate unsupervised learning for clustering and apply it to different datasets.
5. Implement with neural networks that can learn from available examples.

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	-

BIOINFORMATICS

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

Module-I **(8 Lectures)**

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 **(8 Lectures)**

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

Module-III **(8 Lectures)**

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 **(8 Lectures)**

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 **(8 Lectures)**

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 Outcomes:

At the end of the course students will be able to

1. Describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge.
2. Analyze the application of bioinformatics and biological databases.
3. Explain the major steps in pairwise and multiple sequence alignment, explain the principle for, and execute pairwise sequence alignment by dynamic programming.
4. Predict the secondary and tertiary structures of protein sequences.
5. Use the different computational tools for automation of complex problem solving in real research problems.

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO01	3	3	3	3	3	3	3	1	-	2	-	3
CO02	3	3	3	3	3	3	3	1	-	2	-	3
CO03	3	3	3	3	3	3	3	1	-	1	-	2
CO04	3	3	3	3	3	3	3	1	-	2	-	2
CO05	3	3	3	3	3	3	3	1	-	3	-	2

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
COURSE	3	3	3	3	3	3	3	1	-	2	-	2

PROFESSIONAL ELECTIVE - IV

E-COMMERCE & ERP

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

Module-I **(8 Lectures)**

Introduction – E-Commerce vs. Physical Commerce, Different Types of E-commerce with examples, Perspectives, Scenarios & Examples of E-Commerce, Advantages, Disadvantages & Myths about E-Commerce, Overview to INTERNET &WWW:Basic network architecture,layeredmodel,Next Generation Internet, Web system architecture,URL,HTTP: request, response,Generation of dynamic web pages, Cookies.

Module-II **(8 Lectures)**

Client side programming:Important Factors in web programming, Web page Design & Production, HTML – Overview, Structure, Text Formatting, Links, Tables, Images, Frames, Form, Java Script, **Server side programming**: 3-Tier Model, CGI, ASP, Java servelet, Database Connectivity: Relational database System, JDBC Perspectives, and brief overview to Session Tracking

Module-III **(8 Lectures)**

Basic cryptography for enabling e-commerce – Security concerns & requirements, Encryption(Private & Public key), RSA, Streamand block Cipher, Message Digest, Digital Signature & its Standard, Authentication,**internet security:** – IPSec protocol, Firewalls, Different types of Firewalls, **Advance technologies for e-commerce**: Introduction to mobile agents, Brief overview to WAP, XML, Data Mining.

Module-IV **(8 Lectures)**

Internet payment systems: Characteristics of payment system, 4'C payment method, SET Protocol, digital signature generation and verification, e-Cash, e-Check, Micropayment Systems, Overview to Smartcard &Mondex, **Consumer oriented e-commerce**: Traditional vs. e-Retailing and their key success factors; e-Retailing - Benefits, Features & Models, **Business oriented e-commerce**: Features of B2B e-Commerce, Business Models, **E-services**: Categories, Web enabled Services, Matchmaking Services, e-Entertainment,

Module-V **(8 Lectures)**

Enterprise Resource Planning (ERP): Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign , Knowledge Engineering and Data Warehouse.Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials, Management, Quality Management Sales & Distribution ERP Package. ERP Market: ERP Market Place, SAP AG, People Soft, BAAN, JDEdwards, Oracle Corporation. ERP-Present and Future: Enterprise Application Integration (EAI).ERP and E-Commerce, ERP and Internet, Future Directions in ERP.

Text Book:

1. E-Commerce Fundamentals & Applications by Henry Chan, Raymond Lee, Tharam Dillon, John Wiley & Sons, Ltd.

Reference Book:

1. E-Commerce, MM Oka, EPH
2. Kalakotia, Whinston: Frontiers of Electronic Commerce, Pearson Education.
3. BhaskarBharat : Electronic Commerce – Technologies & Applications, TMH
4. Loshin Pete, Murphy P.A.: Electronic Commerce, Jaico Publishing Housing
5. Enterprise Resource Planning :Fundamentals of Design and Implementation
6. By Ganesh, K., Mohapatra, S., Anbuudayasankar, S.P., Sivakumar, P., Springer

Course Outcome

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

1. Analyse the foundations and importance of E-commerce and basic network architecture of internet,WWW
2. Demonstrate of client side and serverside programming tools for building E-Commerce applications
3. DemonstrateBasic cryptography,internet security and advance technologies for enabling e-commerce
4. Analyse the impact and use of Internet payment systems,Consumer oriented e-commerce, Business oriented e-commerce andE-services
5. Evaluateand discuss global E-commerce issues, characterize current trends in ERP system development andinvestigate how e-commerce has affected the way people buy goods and services

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

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

FAULT TOLERANT SYSTEMS

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

Module I – INTRODUCTION **(6 Lectures)**

Definition of fault tolerance, Redundancy, Applications of fault-tolerance, Fundamentals of dependability. Reliability, availability, safety

ModuleII- IMPAIRMENTS **(6 Lectures)**

Faults, errors and failures, Means: fault prevention, removal and forecasting

Module III- DEPENDABILITY EVALUATION **(8 Lectures)**

Common measures: failures rate, mean time to failure, mean time to repair, etc. Reliability. block diagrams ,Markov processes.

Module IV- REDUNDANCY **(10 Lectures)**

Hardware redundancy, Redundancy schemes, Evaluation and comparison, Applications, Information redundancy ,Codes: linear, Hamming, cyclic, unordered, arithmetic, etc., Encoding and decoding techniques ,Applications , Time redundancy

Module V- PROGRAMMING **(10 Lectures)**

Software fault tolerance, Specific features, Software fault tolerance techniques: N-version. programming, recovery blocks, self-checking software, etc.

Text Books

1. Anderson, T., and P.A. Lee, Fault-Tolerant Principles and Practices, Prentice-Hall
2. Hwang, K., and F.A. Briggs, Computer Architecture and Parallel Processing, McGraw-Hill. Jalote, P.
3. Fault-Tolerance in Distributed Systems, ISBN 0-13-301367-7, Prentice-Hall,

Reference Book

1. Johnson, B.W., Design and Analysis of Fault-Tolerant Systems, Addison Wesely
2. Leveson, Nancy G., Safeware, system safety and computers, Addison Wesely.
3. Pradhan, D.K., Fault-Tolerant Computing — Theory and Techniques, (2 Volumes), Prentice-Hall.

Pradhan, Dhiraj K., Fault-Tolerant Computer System Design, ISBN 0-13-057887-8, Prentice-Hall**Course**

Course Outcomes:

At the end of the course students will be able:

1. To acquire the knowledge of different types of redundancy and its application for the design of computer systems being able to function correctly even under presence of faults and data errors.
2. To acquire the knowledge of different types of Terminology and definitions, Design techniques for fault-tolerance, Analysis of fault-tolerant system, Project management and development processes, System examples.
3. To acquire the knowledge of how fault-tolerant systems are used in applications that require high dependability, such as safety-critical control systems in vehicles and airplanes, or business-critical systems for e-commerce, automatic teller machines and financial transactions.
4. To acquire the knowledge of how to calculate reliability of a system. Use of tools for reliability modelling
5. To acquire the knowledge of the various methods for SW fault tolerance. NVP, recovery blocks, run-time checks, problem of predicate detection.

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO01	3	3	3	3	3	3	3	1	-	2	-	2
CO02	3	3	3	3	3	3	3	2	-	2	-	2
CO03	3	3	3	3	3	3	3	1	-	3	2	2
CO04	3	3	3	3	3	3	3	2	-	2	-	1
CO05	3	3	3	3	3	3	3	2	-	2	-	1

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
COURSE	3	3	3	3	3	3	3	2	-	2	1	1

MACHINE LEARNING

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

Module I **(10 Lectures)**

INTRODUCTION, CONCEPT LEARNING AND DECISION TREES

Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning– Representation – Algorithm – Heuristic Space Search.

Module II **(8 Lectures)**

NEURAL NETWORKS AND GENETIC ALGORITHMS

Neural Network Representation – Problems – Perceptrons – Multilayer Networks andBack Propagation Algorithms – Advanced Topics – Genetic Algorithms – HypothesisSpace Search – Genetic Programming – Models of Evolution and Learning.

Module III **(6 Lectures)**

UNSUPERVISED LEARNING

Clustering K-means, EM. Mixture of Gaussians, Factor analysis, PCA (Principal components analysis), ICA (Independent components analysis);

Module IV **(8 Lectures)**

BAYESIAN AND COMPUTATIONAL LEARNING

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum DescriptionLength Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity forFinite and Infinite Hypothesis Spaces – Mistake Bound Model.

Module V **(8 Lectures)**

INSTANT BASED LEARNING AND LEARNING SET OF RULES

Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – LearningFirst Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction –Inverting Resolution

Text Book:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

References:

1. EthemAlpaydin, “Introduction to Machine Learning”, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.

Course Outcomes:

Upon completion of this course, students should be able to:

1. Have a good understanding of the fundamental issues of machine learning.
2. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
3. Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
4. To design machine learning algorithms effective enough to be novel and practically significant.
5. To design and implement various machine learning algorithms in a range of real-world applications.

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO01	3	3	2	-	-	-	-	-	-	-	-	-
CO02	3	3	3	3	3	-	-		3	-	3	2
CO03	3	3	3	3	2	-	-	-	3	-	-	-
CO04		3	3	3	3	-	-	-	3	-	3	2
CO05	3	3	3	3	3	-	-	-	3	-	3	-

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
COURSE	3	3	3	3	3	-	-	-	3	-	3	2

OBJECT ORIENTED ANALYSIS AND DESIGN

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

Module I **(12 Lectures)**

Introduction to Object Technology – Complexity, The Object Model, Classes and Objects, Classification. OOAD Methods - Object Oriented Design by Booch, Rumbaugh's Object Modelling Technique, Coad/ Yourdon's Object Oriented Analysis, Shlaer/ Mellor's Object Oriented Structured Analysis (OOSA) / Object Oriented Design Language (OODLE), Object Oriented Software Engineering (OOSE) by Jacobson.

Module II **(6 Lectures)**

Object Modelling using UML- The Notation, Analyzing and Designing problems using UML Diagrams.

Module III **(8 Lectures)**

Process - Principles, The Macro Process, The Micro Process. Object Oriented Testing – Testing Object Oriented Systems, Challenges in Object Oriented Testing, Testing Approaches, Integration Testing of Object Oriented Programs.

Module IV **(6 Lectures)**

Software Quality Assurance & Metrics - Software Quality, Quality Assurance, Quality Factors, Object Oriented Metrics. Benefits & Risks of Object Oriented Development.

Module V **(8 Lectures)**

Design Patterns- Introduction, Overview of Common Design Patterns, Creational Design Patterns, Structural Design Patterns, Behavioral Design Patterns.

Text Books:

1. Grady Booch, "Object-Oriented Analysis & Design with Applications", Pearson.
2. E Gamma, R Helm, R Johnson and J Vlissides, " Design Patterns- Elements of Reusable Object Oriented Software", Pearson.

References:

1. Satzinger, Jackson, Burd, "Object-Oriented Analysis & Design with the Unified Process", Course Technology Inc.
2. Craig Larman. "Applying UML and Patterns – An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education.

Course Outcomes:

3. At the end of this course, students will be able to:
4. CO 1: Analyze the different facets of object oriented methodologies.
5. CO 2: Design applicable solutions in one or more domains using UML.
6. CO 3: Implement object oriented software development and testing process.
7. CO 4: To apply quality measures to ensure good quality software.
8. CO 5: Relate the concepts of design patterns to facilitate software design.

Course Articulation Matrix

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

SIMULATION AND MODELING

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

Module I **(10 Lectures)**

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 **(10 Lectures)**

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 **(5Lectures)**

Discrete System Simulation: Discrete Events, Representation of Time, generation of arrival patterns, fixed time step versus next event simulation, Simulation of Telephone System, Inventory control system etc as the case studies.

Module IV **(5Lectures)**

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 **(10 Lectures)**

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,

Books:

1. System Simulation – Geoffrey Gordon, 2nd Edition, PHI
2. System Simulation with Digital computer – NarsinghDeo, PHI
3. Discrete-Event System Simulation-Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, P. Shahabudeen

Course Outcomes:

After completing this course the students should be able to:

1. Define and write System, Model & Simulation and their types, Simulation Languages like GPSS.
2. Develop Random Numbers, Random Variates, incorporate Output Analysis, Variance reduction Techniques, Validation Processes, Block Building and coding in GPSS.
3. Apply the concept of Input generation according to a distribution pattern matching to the Real life Systems and the method of Monte Carlo method of Computation for solving Problems.
4. Analyse existing Random Number Generation Techniques, Distribution of Random Variates and Testing Processes.
5. Evaluate various Random Number Generation Techniques efficiency through the existing Testing procedures.

Course Articulation Matrix

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

ROBOTICS

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

Module-I **(08 Lectures)**

BASIC CONCEPTS: Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues- Various manipulators – Sensors - work cell - Programming languages.

Module-II **(08 Lectures)**

DIRECT AND INVERSE KINEMATICS: Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

MODULE-III **(08Lectures)**

MANIPULATOR DIFFERENTIAL MOTION AND STATICS: Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

Module-IV **(08Lectures)**

PATH PLANNING: Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

Module-V **(08Lectures)**

DYNAMICS AND CONTROL: Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2005.
2. JohnJ.Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.

REFERENCES:

1. AshitavaGhoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.AppuKuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.
5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, " Embedded Systems & Robotics" – Projects using the 8051 Microcontroller", Cengage Learning, 2009.

Course Outcomes:

After successful completion of the course, the students will be able to:

1. Express various robot structures and their workspace.
2. Perform the kinematic and dynamic analysis of robot system.
3. Analyze the singularity issues associated with the operation of robotic systems.
4. Plan joint trajectory for motion planning.
5. Design control laws for a simple robot.

Course Articulation Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	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 for this Course

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

SOFTWARE PROJECT MANAGEMENT

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

Module I **(8 Lectures)**

Introduction to Software Project Management and its importance, Software Projects Versus Other Types of Project, Contract Management and Technical Project Management, Activities,Plans, Methods, and Methodologies, Categorizing Software Projects, Stakeholders, Management and control. **Project Evaluation–** Business Case, Project Portfolio Management, Evaluation of Individual Projects, Cost Benefit Evaluation Techniques, Risk Evaluation.

Module II **(12 Lectures)**

Project Planning- Introduction to Step Wise Project Planning, **Selection of an Appropriate Project Approach-** Choosing Methodologies and Technologies, Software Process Model-Choice of Process Model, Waterfall Model, Spiral Model, Software Prototyping, Incremental Delivery, Rapid Application Development, Agile Methods, Extreme Programming, Scrum Model, Selection of appropriate process model. **Software Effort Estimation-** Introduction, Problems with Over- and Under- Estimates, Software Effort Estimation Techniques, Bottom Up and Top Down approach, Expert Judgement, Estimating by Analogy, Albrecht Function Point Analysis, Function Point Mark II, COCOMO II, Cost Estimation.

Module III **(6 Lectures)**

Activity Planning- Introduction, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Models. **Risk Management-** Categories of Risk, Framework for Dealing with Risk – Risk Identification, Risk Assessment, Risk Planning, Risk Management, Application of PERT Technique.

Module IV **(6 Lectures)**

Resource Allocation- Nature of Resources, Identifying Resources Requirements, Scheduling Resources, Cost Schedules, Scheduling Sequence. **Monitoring and Control -** Creating the Framework, Collecting the Data, Review, Project termination review, Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting the Project Back to Target, Change Control.

Module V **(8 Lectures)**

Managing Contracts- Types, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance. **Managing People**- Selecting the Right Person for The Job,Motivation, The Oldham- Hackman Job Characteristics Model. **Working in Teams**- Becoming A Team, Decision Making, Organization and Team Structures, Leadership.

Text Book:

1. B.Huges,M.Cotterell, Rajib Mall- Software Project Management, TMH, 6th Edition New Delhi. 2018

Reference Books:

1. Ashfaque Ahmed- Software Project Management- CRC Press.
2. P.Jalote- Software Project Management in Practice, Pearson Education, New Delhi.

Course Outcome:

1. To understand the fundamentals of project management and evaluation of a project.
2. To understand project planning by selecting an appropriate approach and determine a basis of estimate.
3. To apply activity planning and assess the risk.
4. To apply resource allocation and monitoring activities.
5. To understand contracts and human resource management.

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO01	3	3	3	3	3	3	3	1	3	3	3	2
CO02	3	3	3	3	3	3	3	2	2	3	2	3
CO03	3	3	3	3	3	2	3	2	2	2	3	3
CO04	3	3	3	3	2	3	3	1	3	3	2	3
CO05	2	3	3	3	2	3	3	2	3	3	3	2

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
COURSE	3	3	3	3	3	3	2	2	3	3	2	2

PROFESSIONAL ELECTIVE - V

ADVANCED OPERATING SYSTEMS

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

Module – I **(6Lectures)**

Overview: What is a Distributed computing system, Evolution of Distributed Computing Systems, Distributed Computing Systems models, Issues in Designing a Distributed Operating System, Introduction to distributed Computing Environment (DCE).

Module – II **(10Lectures)**

Message Passing :overview, Desirable Features of Good Message-Passing System, Issues in IPC by Message Passing, Synchronization, Buffering, Multidatagram Messages, Encoding and Decoding of Message Data, Process Addressing , Failure Handling , Group communication.

Remote Procedure Calls:-Overview, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Parameter-Passing Semantics , Call Semantics, Communication protocols for RPCs. Client-Server Binding, Exception handling

Module – III **(8Lectures)**

Distributed Shared Memory: Overview, General Architecture of DSM Systems, Design and Implementation issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Heterogeneous DSM, Advantages of DSM.

Module – IV **(8 Lectures)**

Synchronization: Introduction, Clock Synchronization, Event ordering, Mutual Exclusion, Deadlock, Election Algorithms.

Resources Management : Introduction , Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load Balancing Approach, Load sharing Approach

Process Management: Introduction, Process Migration, Threads

Module –V **(8Lectures)**

Distributed file Systems: Overview, Desirable Features of a good Distributed file Systems, File Models, File Accessing Models, File-Sharing Semantics, File-Caching Schemes, File Replication, Naming:Introduction, Desirable Features of a Good Naming Systems, Fundamentals Terminologies and Concepts, System-Oriented Names, Object-Locating Mechanisms, Human-Oriented Names, Name Caches, Naming and Security.

Security: Introduction, Potential Attacks to Computer Systems, Cryptography, Authentication, Access control, Digital Signatures

Text Books:

1. Distributed Operating System – Concept & Design, by – P.K.Sinha, PHI

Reference Books:

1. Operating System Concepts & Design, Milan Milenkovic, TMH**.**
2. Operating System, H.M.Beitel, Pearsons.

Course Outcomes:

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

1. Explore the structure and concepts, various design issues like transparency, flexibility etc in distributed operating systems.
2. **U**nderstand and realize the important theoretical foundations including message passing, Synchronization, Encoding and Decoding of Message Data, Failure Handling, Group communication, RPC, Parameter-Passing Semantics, Client-Server Binding, Exception handling in distributed system.
3. Analyze General Architecture of DSM Systems, Design and Implementation issues of DSM, Consistency Models, Replacement Strategy, Thrashing, Heterogeneous DSM in Distributed system.
4. Analyze important theoretical foundations including Process Synchronization, Concurrency and Event ordering, Mutual Exclusion, Deadlock, Election algorithm, Resource management and process management in distributed system.
5. Implement basic issues in developing distributed file systems and security

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO01	3	3	2	3	1	-	1	-	-	-	2	2
CO02	3	3	2	3	1	-	1	-	-	-	2	2
CO03	3	3	2	3	1	-	1	-	-	-	2	2
CO04	3	3	2	3	1	-	1	-	-	-	2	2
CO05	3	3	2	3	1	-	1	-	-	-	2	2

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
COURSE	3	3	2	3	1	-	1	-	-	-	2	2

VLSI DESIGN

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

Module – I **(8 Lectures)**

VLSI physical design: VLSI design cycle, Physical design cycle, *Design styles*: Full custom, Standard cell, Gate arrays, FPGA, *System Packaging styles*: Die package style, PCB, Multichip modules, Wafer scale integration, design rules.

Design and Fabrication: Fabrication materials, Transistor fundamentals, Fabrication processes.

Module – 2 **(6 Lectures)**

Partitioning: Levels of partitioning, *Partitioning Algorithms*: Kernighan-Lin algorithm, F-M algorithm, Goldberg-Burstein algorithm, Component replication, Ratio cut.

Module – 3 **(6 Lectures)**

Floor planning: Floor plans, Floor planning problems, *Sliceable floor plans*: Slicing trees, Normalized postfix notations, Rectangular Dualization, *Non-Sliceable floor plans*: Z-cuts, Sequence pair, O-tree, Corner block list, Twin binary sequence.

Module – 4 **(8 Lectures)**

Placement: Levels of placement, objectives, placement for hi-performance systems, *Methods for VLSI placement*: Cluster growth, Partitioning based VLSI placement algorithm, Simulated Annealing, Simulated Evolution, Force-Directed method.

Module – 5 **(12 Lectures)**

Routing: Objectives, Constraints, Design specifications, Steps of routing, Phases of routing.

Global routing: Grid graph model, Checker's board model, Channel intersection graph model, *Global routing algorithms*: Maze routing algorithms, Lee's algorithm, Souk up's algorithm, Line probe algorithm.

Detailed routing: Routing region, Routing models, Terminologies, HCG, VCG, *Two layer channels routing algorithms*: Left edge algorithm, Constraint graph based routing algorithms, Greedy channel router.

Text:

1. Algorithms for VLSI Physical Design Automation.
   By Naveed A. Sherwani, Springer.

References:

1. VLSI Design
   By D. Das, Oxford University press
2. An Introduction to VLSI Physical Design.
   By M. Sarrafzadeh and C. K. Wong, McGraw-Hill.
3. Algorithms for VLSI design automation.
   By S. H. Gerez, Wiley.

Course Outcomes:

After completing this course, the students should be able to:

1. Organize different Design and Packaging style of VLSI physical design.
2. Understand different levels of partitioning.
3. Demonstrate the Floor planning concepts for VLSI design.
4. Analyze the levels and methods of placement.
5. Formulate different Routing problems.

Course Articulation Matrix

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

PARALLEL COMPUTING

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

Module – I **(8 Lectures)**

Introduction: Need for High Performance Computer, Motivation for Parallelism, Methods to achieve High Performance, Parallel Programming Platforms- Control structure of parallel platform, Pipelining, Superscalar Architecture, Super Pipelined Architecture, VLIW Architecture, Pipelining vs. Parallelism.

Module – II **(5 Lectures)**

Basic Multiprocessor Architecture: Flynn's Classification, UMA, NUMA, Distributed Memory Architecture, Array Processor, Vector Processors.

Module – III **(7 Lectures)**

Interconnection Networks for Parallel Computer: Static Interconnection Networks, Network Topologies, Evaluation of Static Network, Dynamic Interconnection Networks, Evaluation of Dynamic Network, Routing Mechanism for Interconnection Network.

Module – IV **(10 Lectures)**

Designing Parallel Algorithms: Temporal Parallelism, Data Parallelism, Task Decomposition, Concurrency, Granularity selection, Inter-Task Dependency, Dependency Graph, Parallel Algorithm Models, Models of Computation, Performance Metrics of Parallel Algorithm, Amdahl's Law.

Module – V **(10 Lectures)**

Parallel Programming: Sorting, Searching, Matrix Multiplication, Data dependency and Loop Optimizations, Message Passing Programming, Shared Memory Programming, Data Parallel Programming, Performance evaluation of Parallel Computer.

Text Book

1. A. Grama, A. Gupta, G. Karypis, V. Kumar, Introduction to Parallel Computing, Pearson.
2. M. J. Quinn, Designing Efficient Algorithms for Parallel Computers, McGraw-Hill

References:

1. V. Rajaraman, C. S. R. Murthy, Parallel Computers Architecture and Programming, PHI.
2. W. P. Petersen, P. Arbenz, Introduction to Parallel Computing, Oxford University Press.
3. B. Wilkinson, M. Allen, Parallel Programming, Pearson.
4. H. Attiya, J. Welch, Distributed Computing Fundamentals, Simulations and Advanced Topics, Wiley.
5. T. G. Lewis, Parallel Programming: A Machine-Independent Approach, IEEE Computer Society Press.
6. M. R. Bhujade, Parallel Computing, New Age.

Course Outcomes:

At the end of the course students will be able to

CO1	Calculate performance of the system and acquire knowledge about high performance computer and pipeline architecture
CO2	Select different particular processor architecture for their design issues.
CO3	Perform the performance evaluation of various interconnection networks..
CO4	Design efficient parallel algorithms for efficient parallel processing
CO5	Design optimized parallel programming for their requirements.

1. **Course Articulation Matrix**

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

REAL TIME SYSTEMS

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

Module - I **(8 Lectures)**

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modeling timing constraints Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA.

Module - II **(10 Lectures)**

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP.Important features of PCP. Some issues in using a resource sharing protocol, Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization.

Module – III **(10 Lectures)**

Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system,POSIX, A survey of contemporary Real-time operating systems. Benchmarking real-time systems. Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases.

Module - IV **(8 Lectures)**

Real-time Communication: Examples of applications requiring real-time communication, Basic concepts, Real-time communication in a LAN. Soft Real-time communication in a LAN. Hard real-time communication in a LAN. Bounded access protocols for LANs. Performance comparison, Real-time communication over packet switched networks.

Module – V **(4 Lectures)**

Qos framework, Routing, Resource reservation, Rate control, Qos model

Text Books:

1. Real-time Systems Theory and Practice by Rajib Mall, Pearsons Publication.

Reference Books:

1. J.W.S.Liu, "Real-Time Systems", Pearson Education, 2000
2. Alan Burns, Andy Wellings, "Real-Time Systems and Programming Languages 3/e", Addison Wesley.
3. Raymond A.Buhr and Donald L.Baily, "Introduction to Real-Time Systems", Prentice Hall. 4. Nissanke, "Real-Time System", Prentice Hall.

Course Outcomes:

At the end of the course students will be able to

CO1	Summarize the issues in real time computing
CO2	Explain and give examples of real time operating systems.
CO3	Solve scheduling problems and can apply them in real time applications in industry.
CO4	Design an RTOS and will be able to interpret the feasibility of a task set to accomplish or not.
CO5	Analyze the situation of fault occurrence and will be able to apply solutions accordingly.

3. Course Articulation Matrix

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

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

4. 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	-	1	-	-	-	2	1

DATA ANALYTICS

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

Module -I **[8Lectures]**

Inferential Statistics Inferential Statistics through hypothesis tests Permutation & Randomization Test

Regression & ANOVA Regression ANOVA(Analysis of Variance)

Machine Learning: Introduction and Concepts

Differentiating algorithmic and model based frameworks Regression : Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification

Module -II **[8Lectures]**

Supervised Learning with Regression and Classification techniques -1

Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Regression, Classification Trees, Support Vector Machines

Supervised Learning with Regression and Classification techniques -2

Ensemble Methods: Random Forest Neural Networks Deep learning

Module -III **[8Lectures]**

Unsupervised Learning and Challenges for Big Data Analytics

Clustering

Associative Rule Mining

Challenges for big data anlalytics

Module -IV **[8Lectures]**

Prescriptive analytics

Creating data for analytics through designed experiments Creating data for analytics through Active learning Creating data for analytics through Reinforcement learning

Module -V **[8Lectures]**

Case studies on:

Retail Location Analysis: Analysis report detailing results of data cleaning, EDA, variable selection for optimal retail location, description of multi-variate regression model with location recommendation

Market Research (Factor Analysis): Research report on survey design and how it facilitates factor analysis. Include discussion on validity and reliability, defining constructs/dimensions/ and sampling design

Automated Medical Diagnosis: Analysis report detailing results of EDA, variable selection for automated medical diagnosis (decision tree) model. Presentation of findings.

Text Book:

1. Hastie, Trevor, et al. the elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger. The Applied statistics and probability for engineers. John Wiley & Sons, 2010

References:

1. Predictive Analytics, Data Mining and Big Data: Myths, Misconceptions and Methods (Business in the Digital Economy),Author: Finlay, S.,Publisher: Palgrave Macmillan; 2014 edition
2. Storytelling with Data: A Data Visualization Guide for Business Professionals Author: Cole NussbaumerKnaflic Publisher: John Wiley & Sons; 1 edition, Publication Date: 20 November 2015
3. Data Mining and Business Analytics with R, by Johannes Ledolter; Publisher: Wiley (2013), ISBN-13: 978-1118447147; Available in Johns Hopkins online library: https://catalyst.library.jhu.edu/catalog/bib_4637122
4. An Introduction to Statistical Learning with Application in R, by Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani; Publisher: Springer (2013); ISBN-13: 978-1461471370;Available in Johns Hopkins online library: https://catalyst.library.jhu.edu/catalog/bib_6591386
5. Elements of Statistical Learning: Data Mining, Inference, and Prediction, by Trevor Hastie, Robert Tibshirani and Jerome Friedman, but it requires some mathematical sophistication and goes beyond the material we will be covering. The book is free at https://web.stanford.edu/~hastie/Papers/ESLII.pdf

Course Outcomes:

At the end of the course students will be able to

CO1- Organize sufficient relevant data, conduct data analytics
CO2- Demonstrate a sophisticated understanding of the concepts and methods for decision making using data analytics skills
CO3- Incorporate advanced techniques to conduct thorough and interpret the results
CO4- Develop substantial understanding of the real problems
CO5- Apply data analysis methods to address business problems from real world case studies

Course Articulation Matrix

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

COMPUTER VISION

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

Module-I: **[8Lectures]**

Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis.

Module-II: **[8Lectures]**

Edge detection, Edge detection performance, Hough transform, corner detection, Segmentation, Morphological filtering, Fourier transform

Module-III: **[8Lectures]**

Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing

Module-IV: **[8Lectures]**

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semisupervised Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA, and Non-parametric methods.

Module-V **[8Lectures]**

Miscellaneous: Applications: CBIR, CBVR, Activity Recognition, computational photography, Biometrics.

Text Books:

1. Szeliski, R., Computer Vision: Algorithms and Applications, Springer-Verlag London Limited (2011), 1st Edition.
2. Forsyth, A., D. and Ponce, J., Computer Vision: A Modern Approach, Pearson Education (2012) 2nd Edition.

References:

1. Hartley, R. and Zisserman, A., Multiple View Geometry in Computer Vision Cambridge University Press (2003) 2nd Edition.
2. Fukunaga, K., Introduction to Statistical Pattern Recognition, Academic Press, Morgan Kaufmann (1990) 2nd Edition.
3. Gonzalez, C., R. and Woods, E., R. Digital Image Processing, Addison- Wesley (2018) 4th Edition.

Course Outcomes

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

CO1	Analyze the fundamental problems of computer vision.
CO2	Implement various techniques and algorithms used in computer vision.
CO3	Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
CO4	Demonstrate awareness of the current key research issues in computer vision.
CO5	Design and implement various algorithms for digital image processing and computer vision.

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

CLOUD COMPUTING

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

Module I **[8Lectures]**

- Overview of Computing Paradigm
  - Recent trends in Computing
    Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing
  - Evolution of cloud computing
    Business driver for adopting cloud computing

- Introduction to Cloud Computing
  - Cloud Computing (NIST Model)
    Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers
  - Properties, Characteristics & Disadvantages
    Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing
  - Role of Open Standards

Module II **[8Lectures]**

- Cloud Computing Architecture
  - Cloud computing stack
    Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services
  - Service Models (XaaS)
    - Infrastructure as a Service(IaaS)
    - Platform as a Service(PaaS)
    - Software as a Service(SaaS)
  - Deployment Models
    - Public cloud
    - Private cloud
    - Hybrid cloud
    - Community cloud

Module III **[8Lectures]**

Infrastructure as a Service(IaaS)

- Introduction to IaaS
  IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM)
- Resource Virtualization
  - Server
  - Storage
  - Network
    Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service)
- Examples
  - Amazon EC2
    Renting, EC2 Compute Unit, Platform and Storage, pricing, customers
  - Eucalyptus

Platform as a Service(PaaS)

- Introduction to PaaS
  What is PaaS, Service Oriented Architecture (SOA)
- Cloud Platform and Management
  - Computation
  - Storage
- Examples
  - Google App Engine
  - Microsoft Azure
  - SalesForce.com's Force.com platform

Software as a Service(PaaS)

- Introduction to SaaS
- Web services
- Web 2.0
- Web OS
- Case Study on SaaS

Module IV **[8Lectures]**

Service Management in Cloud Computing

- Service Level Agreements(SLAs)
- Billing & Accounting
- Comparing Scaling Hardware: Traditional vs. Cloud
- Economics of scaling: Benefitting enormously
- Managing Data
  - Looking at Data, Scalability & Cloud Services
  - Database & Data Stores in Cloud
  - Large Scale Data Processing

Module V **[8Lectures]**

Cloud Security

- Infrastructure Security
  Network level security, Host level security, Application level security
- Data security and Storage
  Data privacy and security Issues, Jurisdictional issues raised by Data location
- Identity & Access Management
- Access Control
- Trust, Reputation, Risk
- Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

Case Study on Open Source & Commercial Clouds

- Eucalyptus
- Microsoft Azure
- Amazon EC2

Text Books

- *Cloud Computing Bible*, Barrie Sosinsky, *Wiley-India*, 2010
- *Cloud Computing: Principles and Paradigms*, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, *Wile*, 2011

Reference Books

- *Cloud Computing: Principles, Systems and Applications, Editors:* Nikos Antonopoulos, Lee Gillam, *Springer*, 2012
- *Cloud Security: A Comprehensive Guide to Secure Cloud Computing*, Ronald L. Krutz, Russell Dean Vines, *Wiley-India*, 2010

Course Outcomes:

At the end of the course students will be able to

CO1	Understand the trade-offs between deploying applications in the cloud and over the local infrastructure
CO2	Deploy applications over commercial cloud computing infrastructures such as Amazon Web Services, Windows Azure, and Google AppEngine
CO3	Analyze the performance, scalability, and availability of the underlying cloud technologies and software
CO4	Identify security and privacy issues in cloud computing
CO5	Solve a real-world problem using cloud computing through group collaboration

1. **Course Articulation Matrix**

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

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	3	2	-	1	-	-	-	2	-

PROFESSIONAL ELECTIVE - VI

ADVANCED COMPUTER ARCHITECTURE

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

Module I: **(8 Lectures)**

Quantitative Principles of Computer Design: Task of a Computer Designer, Measuring and Reporting Performance, Benchmarks and metrics, Flynn's classification: SISD, SIMD, MISD, MIMD, Parallel Processing: Definition, Theory of Parallelism. Parallel Computer Models, Parallelism in Uni-processor computers, Implicit Parallelism vs. explicit parallelism, Levels of parallelism. Soft ware Parallelism, Hardware Parallelism, Overview of RISC and CISC architecture. System Performance attributes of parallel Computers.

Module II: **(7 Lectures)**

Instruction Set Principles and Examples: Classification of Instruction Set Architectures, Instruction Formats and Semantics, Memory Addressing Modes, Operations in the Instruction Set, Encoding and Instruction Set, Role of Compilers.

Module III: **(8 Lectures)**

Advanced Pipelining and Instruction-Level Parallelism: Basic Pipeline Operations, Data and Control Pipeline Hazards, Instruction-Level Parallelism, Dynamic Instruction Scheduling and Branch Prediction.

Module IV: **(7 Lectures)**

Memory-Hierarchy Design: Cache Design Issues, Performance Evaluation, Virtual Memory Memory coherence techniques.

Module V: **(10 Lectures)**

Multiprocessor Systems and Applications, Centralized Shared-Memory Architectures, Distributed Shared-Memory Architectures, Parallel Interconnection Systems: Static and Dynamic Networks, Linear Array, Ring, Star, Tree, Mesh, Systolic Array, Chordal ring, Completely connected network, Cube connected cycles, Torus, K-ary-n cube, Barrel shifter, single stage interconnection network, Multistage Interconnection Networks, Control Structure, Node degree, diameter, Bisection width, symmetric, functionality, Network Latency, Bandwidth, Scalability, Data routing functions:- Permutation, Perfect shuffle exchange, Hypercube Routing function.

Text Books:

1. Computer Architecture – A quantitative approach By J.L Hennessy and D.A.Patterson, Morgan Kaufmann
2. Advanced Computer Architecture, by Kai Hwang Mc Graw Hill.

Reference Books:

1. Introduction to Parallel Computing, 2nd Edition, Pearson Education by AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar.

Course Outcomes:

After completing this course, the students should be able to:

1. Define and write concept of parallelism, Models, Instruction format. Addressing Modes, Cache Coherence.
2. Conceptualize and understand Models of Parallelism, Memory Hierarchy, it's design and efficiency,
3. Express & analyze Causes and Resolution of Hazards in pipelining, Cache Improvements, Interconnection Network and Routing.
4. Analyse memory design issues and enhancements.
5. Plan parallel structures.

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	-	-	-	-	-	-	-	-
CO 2	3	3	3	3	-	-	-	-	-	-	-	-
CO 3	3	3	3	3	-	-	-	-	-	-	-	-
CO 4	3	3	3	3	-	-	-	-	-	-	-	-
CO 5	3	3	3	3	-	-	-	-	-	-	-	-

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
Course	3	3	3	3	-	-	-	-	-	-	-	-

DATA MINING

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

Module – I (8Lectures)

Data Mining overview, Data Warehouse and OLAP Technology, Data Warehouse Architecture, Steps for the Design and Construction of Data Warehouses, A Three-Tier Data Warehouse Architecture, OLAP , Data Preprocessing – Data Integration and Transformation, Data Reduction, Data Mining Primitives, KDD

Module – II (8Lectures)

Mining Association Rules in Large Databases, Association Rule Mining, Market Basket Analysis: Association Rule Mining, Basic Concepts, Association Rule Mining A Road Map, Mining Association Rules from Frequent Item sets, Mining Multilevel Association Rules from Transaction Databases, Multilevel Association Rules, Association Mining to Correlation Analysis,

Module – III (8Lectures)

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back propagation, A Multilayer Feed-Forward Neural Network, MLP, RBFN, Association Rule Mining, Other Classification Methods, k-Nearest Neighbour Classifiers, Genetic Algorithms, Prediction, Linear and Non Linear Regression, Classifier Accuracy,

Module – IV (8Lectures)

Cluster Analysis – What Is Cluster Analysis, Types of Data in Cluster Analysis,A Categorization of Major Clustering Methods, Classical Partitioning Methods: k-Means and k-Medoids, Partitioning Methods in Large Databases: k-Medoids, Hierarchical Methods, Agglomerative and Divisive Hierarchical Clustering, Clustering High-Dimensional Space, Model-Based Clustering Methods, Statistical Approach, Neural Network Approach, LVQ, SOM,

Module – V (8Lectures)

Multidimensional Analysis and Descriptive Mining of Complex Data Objects: Multidimensional Analysis and Descriptive Mining ofComplex, Data Objects, Mining Spatial Databases, Mining Multimedia Databases, MiningTime-Series and Sequence Data,Mining Text Databases, Mining the World Wide Web. Applications and Trends in Data Mining – Data Mining Applications, Data Mining System Products,Social Impacts of Data Mining.

BOOKS:

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

Course Outcome

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

1. Analyse the basic principles, concepts and applications of Data Mining and data warehousing, Data Pre-processing and Data Mining Primitives
2. Apply Association Rule Mining, Multilevel Association Rules, and Correlation Analysis.
3. Apply a wide range of estimation, prediction and classification, MLP, RBFN and GeneticAlgorithms.
4. Apply a wide range of Clustering algorithm and different approaches of Neural Network, LVQ, SOM for data clustering
5. Ability to do Conceptual, Logical, and Physical design of Data Warehouses with OLAP applications with applying the current trends of data mining techniques such as text mining, and other current issues and explore Multidimensional Analysis and Descriptive Mining of Complex Data Objects.

Course Articulation Matrix

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	3	3	3	3	1	1	-	-	2	1
CO 2	3	3	3	3	3	3	1	1	-	-	2	1
CO 3	3	3	3	3	3	3	1	1	-	-	2	1
CO 4	3	3	3	3	3	3	1	1	-	-	2	1
CO 5	3	3	3	3	3	3	1	1	-	-	2	1

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

Program Articulation Matrix row for this Course

	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
Course	3	3	3	3	3	3	1	1	-	-	2	1

NEURAL NETWORK AND DEEP LEARNING

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

Module I: **(8 Lectures)**

Introduction to Artificial Neural Networks, Artificial Neuron Model and Linear Regression, Gradient Descent Algorithm, Nonlinear Activation Units and Learning Mechanisms, Learning Mechanisms-Hebbian, Competitive, Boltzmann, Associative memory, Associative Memory Model, Condition for Perfect Recall in Associative Memory

Module II: **(9 Lectures)**

V.C. Dimensions: Typical Examples, Importance of V.C. Dimensions Structural Risk Minimization, Single-Layer Perceptions, Unconstrained Optimization: Gauss-Newton's Method, Linear Least Squares Filters, Least Mean Squares Algorithm, Perceptron Convergence Theorem, Bayes Classifier & Perceptron: An Analogy, Bayes Classifier for Gaussian Distribution

Module III: **(9 Lectures)**

Solution of Non-Linearly Separable Problems Using MLP,Sigmoid Neurons, Heuristics For Back-Propagation, Multi-Class Classification Using Multi-layered Perceptron, Radial Basis Function Networks: Cover's Theorem, Radial Basis Function Networks: Separability& Interpolation, Posed Surface Reconstruction, Solution of Regularization Equation: Greens Function, Use of Greens Function in Regularization Networks

Module IV: **(8 Lectures)**

History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, ThresholdingLogic,Perceptrons, Perceptron Learning Algorithm, Gradient Descent,Feedforward Neural Networks, FeedForward Neural Networks, Backpropagation.
Principal Component Analysis and its interpretations, Singular Value Decomposition.
Autoencoders and relation to PCA, Regularization in autoencoders, De-noising autoencoders, Sparseautoencoders, Contractive autoencoders.

Module V: **(6 Lectures)**

Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Learning Vectorial Representations of Words, Recurrent Neural Networks, Backpropagation through time, Encoder Decoder Models, Attention Mechanism, Attention over images.

Text Books:

1. Neural Networks and Deep Learning, Springer, Charu C. Agrawal
2. Neural Networks and Deep Learning, Michael Nielsen

Reference Books:

1. Neural network and learning machine, Simon Haykin
2. Neuro Fuzzy and Soft Computing, J. S. R. JANG,C.T. Sun, E. Mitzutani, PHI
3. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms,NikhilBuduma, Nicholas Locascio
4. Artificial Neural Networks by B. Yagna Narayan, PHI

Course Outcomes

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

CO1	Describe Artificial Neuron model and Linear Regression. Explain, Describe and Design inference systems. Understand various learning mechanism
CO2	Understand V.C. dimension, use of different types of optimization techniques, understand Bayes Classifier
CO3	Understand Non-linear Separable problem and solutions. understand Radial Base Function(RBF) and Greens equation for solution of regularization equation
CO4	Study the history of Deep Learning and Learn concept of PCA, Feed forward neural network and back propagation algorithm
CO5	To become familiar with different types of Neural Network, encoder-decoder model and attention mechanism.

1. **Course Articulation Matrix**

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

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	2	3	3	-	1	-	-	-	2	-

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INTRUSION DETECTION SYSTEMS

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

Module – I **(10 Lectures)**

INTRODUCTION: Basic Concepts of Security, Introduction to Intrusions, Need of Intrusion Detection, Taxonomy of Intrusion Detection Systems (IDSs), Theoretical Background of Intrusion Detection, Case Study of Representative Intrusion Detection Systems. HOST-BASED INTRUSION DETECTION: Host Vulnerability and Exploits – Denial of Service (DoS), Gaining Unauthorized Access to Host, Case Study of Research in Host-Based Intrusion Detection Systems.

Module – II **(8 Lectures)**

NETWORK-BASED INTRUSION DETECTION: Network Vulnerabilities and Attacks – ARP Attacks, IP Attacks, ICMP Attacks, UDP Attacks, TCP Attacks, DNS Attacks, Case Study of Research in Network-Based Intrusion Detection Systems.

Module – III **(8 Lectures)**

DATABASE AND APPLICATION-SPECIFIC INTRUSION DETECTION: Limitations of Existing Intrusion Detection Systems, Requirements of Application-Specific and Database Intrusion Detection, Case Study of Research in Application-Specific and Database IDS. MISUSE DETECTION: Principles of Misuse Detection, Advantages & Limitations of Misuse Detection, Misuse Detection Techniques, Case Study of Research in Misuse Detection Systems.

Module – IV **(8 Lectures)**

ANOMALY DETECTION: Principles of Anomaly Detection, Advantages & Limitations of Anomaly Detection, Anomaly Detection Techniques, Case Study in Research in Anomaly Detection Systems

Module – V **(8 Lectures)**

HYBRID INTRUSION DETECTION: Principle of Hybrid Intrusion Detection, Advantages of Hybrid Model, Case Study of Research in Hybrid Intrusion Detection Systems.

Reference Books:

1. Matt Bishop, “Computer Security: Art and Science”, Addison-Wesley Professional, 2003.

2. R. D. Pietro & L. V. Mancini, "Intrusion Detection Systems", Handbook of Advances in Information Security, Springer, 2008.
3. Carl Endorf, Eugene Schultz and Jim Mellander, "Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
4. Stephen Northcutt, Judy Novak, "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.

Course Outcomes:

At the end of the course students will be able to

1. State the function of an Intrusion Detection System.
2. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
3. Analyze intrusion detection alerts and logs to distinguish attack types from false alarms
4. Discover rouge wireless access points, rouge sniffers and rouge VPNs on a network
5. Implement procedures to secure network systems, to monitor and evaluate audit logs and to set administrative alerts

Course Articulation Matrix

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

NATURAL LANGUAGE PROCESSING

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

Module I: **(10 lectures)**

Introduction and Course Overview, Natural Language and Formal Language, Basic Text Processing, N-grams and Language Models.

Module II: **(10 lectures)**

POS Tagging, HMMs and POS,Syntax, Parsing and Evaluation of POS taggers, Text Similarity, Vector Space model, Dimensionality Reduction

Module III: **(08 lectures)**

Representing Meaning, Semantic Analysis, Word Sense Disambiguation, Machine Learning Approaches to NLP.

Module IV: **(06 lectures)**

Text Classification, Summarization, Information Extraction, Information Retrieval and Question Answering.

Module V: **(06 lectures)**

Machine Translation, Sentiment Analysis, Discourse Analysis.

Text Books:

1. Jurafsky and Martin. Speech and Language Processing, Prentice Hall, 2009.
2. Manning and Schűtze. Foundations of Statistical Natural Language Processing, MIT Press, 1999

Reference Books:

1. Bird, S., Klein, E., Loper, E. (2009). Natural Language Processing with Python. Sebastopol, CA: O'Reilly Media.

Course Outcomes

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

CO1	Understand text processing and language models.
CO2	Understand the different NLP techniques such as parsing, tagging etc.
CO3	Learning semantic analysis and machine learning approaches.
CO4	Study of different application such as IE, IR, text classification etc.
CO5	Study of applications machine translation, sentiment analysis etc.

1. **Course Articulation Matrix**

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

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	2	3	3	-	1	-	-	-	2	-