NOIDA INTERNATIONAL UNIVERSITY

SCHOOL OF ENGINEERING & TECHNOLOGY

EVALUATION SCHEME & SYLLABUS

FOR

BACHELOR OF TECHNOLOGY

Computer Science & Engineering
Computer Science & Engineering-AIML
Computer Science & Engineering-Data Science

(4 Year Course)

W.E.F Session 2023-2024 onwards

MUKESH KUMAR PARASHAR

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Course Curriculum

FOR B.TECH-CSE/CSE-AIML/CSE-DS COURSES
(Effective from Academic session 2023-2024)

Introduction-B.Tech in Computer Science Engineering, which is commonly known as Computer Science Engineering, is undoubtedly one of the most sought after specializations of engineering. B.Tech in Computer Science Engineering (CSE) is an academic program of the duration of four years which integrates the field of Computer Science and Computer Engineering. The program primarily lays emphasis on the basics of computer programming and networking while also comprising a plethora of topics.

B.Tech in Computer Science Engineering Artificial Intelligence & Machine Learning , which is commonly known as Computer Science Engineering with AIML, is undoubtedly one of the most sought after specializations of engineering. B.Tech in AIML is an academic program of the duration of four years which integrates the field of Artificial Intelligence and Machine Learning. The program primarily lays emphasis on the basics of AIML based programming and Analysis while also comprising a plethora of topics.

B.Tech in Computer Science Engineering Data Science , which is commonly known as Computer Science Engineering with DS, is undoubtedly one of the most sought after specializations of engineering. B.Tech in DS is an academic program of the duration of four years which integrates the field of Data Science. The program primarily lays emphasis on the basics of DS based programming and Data Analysis while also comprising a plethora of topics.

Program Educational Objectives (PEOs)

The Department of Computer Science & Engineering& Information Technology has developed and maintained a well-defined set of educational objectives and desired program outcomes. Educational objectives of the program cater to the requirements of the stakeholders such as students, parents, employers, alumni, faculty etc. The program educational objectives are as follows:

- **PEO**1: Provide graduates with a strong foundation in mathematics, science and engineering fundamentals to enable them to devise and deliver efficient solutions to challenging problems in Electronics, Communications and allied disciplines.
- **PEO**2: Impart analytic and thinking skills to develop initiatives and innovative ideas for R&D, Industry and societal requirements.
- **PEO**3: Provide sound theoretical and practical knowledge of CS/AIML/DS Engineering, managerial and entrepreneurial skills to enable students to contribute to the well-being of society with a global outlook.
- **PEO**4: Inculcate qualities of teamwork as well as social, interpersonal and leadership skills and an ability to adapt to evolving professional environments in the domains of engineering and technology.
- **PEO**5: Motivate graduates to become good human beings and responsible citizens for the overall welfare of the society.

Program specific outcome (PSO)

- PSO1: Theoretical Computer Science: Students at the time of graduation will be able to apply fundamental knowledge of theoretical computer science and critically analyze problems to provide computer based solutions for engineering applications.
- PSO2: Hardware and software systems: Students at the time of graduation will be able to design cost effective hardware/software systems and components for engineering/social applications using the knowledge of hardware and/or software architecture, programming and development.
- PSO3: Technology: Students at the time of graduation will be able to apply appropriate technology to find solutions for complex problems.

- PSO4: Research Capability: Students at the time of graduation will be able to apply domain knowledge and expertise for enhancing research capability to transform innovative ideas into reality

Program outcomes (POs)

Engineering Graduates will be able to:

- **PO**1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO**2. **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.
- **PO**3. **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.
- **PO**4. **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.
- **PO**5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and information technology tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO**6. **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.
- **PO**7. **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.
- **PO**8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO**9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO**10. **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.
- **PO**11. **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.
- **PO**12**. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Credit System-Credit requirement for award of B.Tech:

- Every semester shall offer a minimum of **20 credits** and a maximum of 25.
- Credits for the Project or Thesis can vary from 10 to 15.
- The total number of credits for the B. tech Degree Course could vary from a **minimum of 176** credits to a **maximum of 181** credits.
- All courses of study put together would engage the students for a **minimum of 26 periods** or hours of study a week and a **maximum of 30 periods** or hours a week.

Under the Choice based credit system, which is a student or learner centric system, the courses of study in the B.Tech Degree course shall be as under:

a) Professional Core (PC) Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
b) Basic Sciences and Engineering Science (BS and ES) Course: A course which informs the Professional

core and should compulsorily be studied.

c) Elective Course: Generally a course which can be chosen from a pool of courses and are of two types:
   (i) Professional Elective (PE) which may be very specific or specialized or advanced or supportive to thediscipline or subject of study or which provides an extended scope
   (ii) Open Elective (OE) which enables an exposure to some other discipline or subject or domain ornurtures the candidate‘s proficiency or skill

The Weightage in terms of Credits for each of the above in the prescribed curriculum of the institution shall be as follows:

S.no.	Credit Breakups	Credits
1	Humanities and Social Sciences including Management courses	8
2	Basic Science courses	25
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	25
4	Professional core courses	73
5	Professional Elective courses relevant to chosen specialization/branch	10
6	Open subjects – Electives from other technical and /or emerging Subjects	17
7	Project work, seminar and internship in industry or else where	21
8	Mandatory Courses	0
9	Value Added Course	2
		*181

**Minor variation is allowed as per need of the respective disciplines.*

While calculating credits the following guidelines shall be adopted, namely: -

- 1 Hr. Lecture (L) per week 1 credit
- 1 Hr. Tutorial (T) per week 1 credit
- 1 Hr. Practical (P) per week 0.5
- 2 Hours Practical (Lab)/week 1 credit

Credit distribution in each semester (158 credits to 8 semesters)

Semester	Credits		
	Theory	Practical	Total
1st	14	8	22
2nd	14	8	22
3rd	16	6	22
4th	17	8	25
5th	18	4	22
6th	18	6	24
7th	15	9	24
8th	10	10	20
Total	122	59	181

Course coding system

Every course coded as follows:

BSC	:	Basic Science Courses
ESC	:	Engineering Science Course
MC	:	Mandatory Courses
HSMC	:	Humanities and Social Sciences including Management
PCC	:	Program core courses
PEC	:	Program Elective courses
OEC	:	Open Elective courses
VAC	:	Value Added Course

Bachelor of Technology-CSE/CSE-AIML/CSE-DS

First Semester

S.No	Course Code	Subject				Evaluation Scheme					
						Internal Assessment			External Assessment	Total	Total Credits
			L	T	P	CA	TA	Total			
1	BSC0101	Mathematics –I	3	1	0	20	20	40	60	100	4
2	BSC0102	Chemistry-I	3	1	0	20	20	40	60	100	4
3	ESC0102	Programming for Problem Solving	4	0	0	20	20	40	60	100	4
5	HSMC0101	English	2	0	0	20	20	40	60	100	2
PRACTICALS											
1	BSC0102P	Chemistry-I Lab	0	0	2	-	-	40	60	100	2
2	ESC0102P	Programming for Problem Solving Lab	0	0	3	-	-	40	60	100	3
3	ESC0103P	Engineering Graphics and Design Lab	0	0	3	-	-	40	60	100	3
										Total	**22**

SECOND SEMESTER

S.No	Course Code	Subject				Evaluation Scheme					
						Internal Assessment			External Assessment	Total	Total Credits
			L	T	P	CA	TA	Total			
1	BSC0201	Physics	3	1	0	20	20	40	60	100	4
2	BSC0202	Mathematics –II	3	1	0	20	20	40	60	100	4
3	ESC0201	Basic Electrical Engineering	4	0	0	20	20	40	60	100	4
4	BSC0203	Environmental Studies	2	0	0	20	20	40	60	100	2
PRACTICALS											
1	BSC0201P	Physics Lab	0	0	2	-	-	40	60	100	2
3	ESC0201P	Basic Electrical Engineering Lab	0	0	3	20	20	40	60	100	3
2	ESC0202P	Workshop/Manufacturing Practices Lab	0	0	3	-	-	40	60	100	3
										Total	**22**

THIRD SEMESTER

S.No	Course Code	Course Title	Evaluation Scheme								
			L	T	P	CA	TA	Int.	Ext.	Total	Total Credits
1	BSC0301	Discrete Mathematics	3	0	0	20	20	40	60	100	3
2	ESC0302	Analog and Digital Circuits	3	0	0	20	20	40	60	100	3
3	PCCCSE0301	Data Structure & Algorithms	3	0	0	20	20	40	60	100	3
4	PCCCSE0302	IT Workshop (Matlab)	2	0	0	20	20	40	60	100	2
5	PCCCSE0303	Cloud Computing	3	0	0	20	20	40	60	100	3
6	HSMC0301	Status of Women in Society	2	0	0	20	20	40	60	100	2
	PRACTICALS										
1	ESC0302P	Analog and Digital Circuits Lab	0	0	2	20	20	40	60	100	2
2	PCCCSE0301P	Data Structure & AlgorithmsLab	0	0	2	20	20	40	60	100	2
3	PCCCSE0302P	IT Workshop (MATLAB) Lab	0	0	2	20	20	40	60	100	2
										Total	**22**
FOURTH SEMESTER											
1	PCCCSE0401	Computer Based Numerical & Statistical Techniques	3	0	0	20	20	40	60	100	3
2	PCCCSE0402	Computer Organization & Architecture	3	0	0	20	20	40	60	100	3
3	PCCCSE0403	Operating Systems	3	0	0	20	20	40	60	100	3
4	PCCCSE0404	Design &Analysis of Algorithms	3	0	0	20	20	40	60	100	3
5	HSMC0401	Humanities –II (Human Values)	2	0	0	20	20	40	60	100	2
6	PCCCSE0405	Core Java	3	0	0	20	20	40	60	100	3
	PRACTICALS										
1	PCCCSE0402P	Computer Organization & Architecture Lab	0	0	2	20	20	40	60	100	2
2	PCCCSE0403P	Operating Systems Lab	0	0	2	20	20	40	60	100	2
3	PCCCSE0404P	Design &Analysis of Algorithms Lab	0	0	2	20	20	40	60	100	2
4	PCCCSE0405P	Core Java Lab	0	0	2	20	20	40	60	100	2
										Total	**25**

FIFTH SEMESTER

S.No	Course Code	Course Title	Evaluation Scheme								
			L	T	P	CA	TA	Int.	Ext.	Total	Total Credit
1	PCCCSE0501	Software Engineering	3	0	0	20	20	40	60	100	3
2	PCCCSE0502	Database Management Systems	3	0	0	20	20	40	60	100	3
3	PCCCSE0503	Formal Language & AutomataTheory	3	0	0	20	20	40	60	100	3
4	PCCCSE0504	Object Oriented Programming	3	0	0	20	20	40	60	100	3
5	PEC-CS*	Elective I	3	1	0	20	20	40	60	100	4
6	HSMC0501	Soft skills and interpersonal Communication	2	0	0	20	20	40	60	100	2
	PRACTICALS										
1	PCCCSE0502P	Database Management SystemsLab	0	0	2	20	20	40	60	100	2
2	PCCCSE0504P	Object Oriented Programming Lab	0	0	2	20	20	40	60	100	2
										Total	**22**

SIXTH SEMESTER

1	PCCCSE0601	Compiler Design	3	0	0	20	20	40	60	100	3
2	PCCCSE0602	Computer Networks	3	0	0	20	20	40	60	100	3
3	PEC-CS*	Elective II	3	0	0	20	20	40	60	100	3
4	PEC-CS*	Elective III	3	0	0	20	20	40	60	100	3
5	OEC0601	Operation Research	3	1	0	20	20	40	60	100	4
6	VAC0601	Value Added Course (VAC)	2	0	0	20	20	40	60	100	2
	PRACTICALS										
1	PCCCS0601P	Compiler Design Lab	0	0	2	20	20	40	60	100	2
2	PCCCS0602P	Computer Networks lab	0	0	2	20	20	40	60	100	2
3	PCCMEP0601	Project –I(Micro-Project)	0	0	2	20	20	40	60	100	2
										Total	**24**

SEVENTH SEMESTER

S.No	Course Code	Course Title	Evaluation Scheme								
			L	**T**	**P**	**CA**	**TA**	**Int. Total**	**Ext.**	**Total**	**Total Credits**
1	PEC-CS*	Elective IV	4	0	0	20	20	40	60	100	4
2	PEC-CS*	Elective V	4	0	0	20	20	40	60	100	4
3	PEC-CS*	Elective VI	4	0	0	20	20	40	60	100	4
4	OEC0701	Organizational Behavior & Industrial Psychology	3	0	0	20	20	40	60	100	3
	PRACTICALS										
1	PCCCSEP0701	Project-II(Mini-Project)	0	0	5	20	20	40	60	100	5
2	PCCINTCSE0701	Internship & Seminar	0	0	4	20	20	40	60	100	4
										Total	**24**

EIGHTH SEMESTER

S.No	**Course Code**	**Course Title**	**Evaluation Scheme**								
			L	**T**	**P**	**CA**	**TA**	**Int. Total**	**Ext.**	**Total**	**Total Credits**
1	OECCSE0801	Cyber Law & Ethics	4	1	0	20	20	40	60	100	5
2	OECCSE0802	Software Project Management	4	1	0	20	20	40	60	100	5
PRACTICALS											
1	PCCCSEP0801	Project III (Major Project)	0	0	10	10	100	100	200	300	10
										Total	**20**

LIST OF ELECTIVES

Thread 1: Theory & Algorithms		
Elective(s)	**Subject Code**	**Subject Name**
Elective I	PEC-CS-T 501	Graph Theory
Elective II	PEC-CS-T 601	Advanced Algorithms
Elective III	PEC-CS-T 602	Parallel & Distributed Algorithms
Elective IV	PEC-CS-T 701	Computational Complexity
Elective V	PEC-CS-T 702	Computational Complexity
Elective VI	PEC-CS-T 703	Queuing Theory & Modeling
Additional Subject (can replace with any elective from the same thread): Theory Of Computation		

Thread 2: Systems		
Elective(s)	**Subject Code**	**Subject Name**
Elective I	PEC-CS-S 501	Advanced Computer Architecture
Elective II	PEC-CS-S 601	Internet of Things
Elective III	PEC-CS-S 602	Distributed Systems
Elective IV	PEC-CS-S 701	Embedded Systems
Elective V	PEC-CS-S 702	Advanced Operating Systems
Elective VI	PEC-CS-S 703	Low Power Circuit & Systems
Additional Subject (can replace with any elective from the same thread): Fault Tolerant Computing		

Thread 3: Artificial Intelligence and Machine Leaning & Data Science

Elective(s)	**Subject Code**	**Subject Name**
Elective I	PEC-CS-D 501	Artificial Intelligence
Elective II	PEC-CS-D 601	Machine Learning
Elective III	PEC-CS-D 602	**Data Mining
Elective IV	PEC-CS-D 701	Soft Computing
Elective V	PEC-CS-D 702	Speech and Natural Language Processing
Elective VI	PEC-CS-D 703	**Data Analytics

Thread 4: Applications

Elective(s)	**Subject Code**	**Subject Name**
Elective I	PEC-CS-A 501	Digital Image Processing
Elective II	PEC-CS-A 601	Digital Signal Processing
Elective III	PEC-CS-A 602	**Blockchain Technology
Elective IV	PEC-CS-A 701	Human Computer Interaction
Elective V	PEC-CS-A 702	Electronic Design Automation
Elective VI	PEC-CS-A 703	Computer Graphics

DETAILED 4-YEAR CURRICULUMCONTENTS

Undergraduate Degree in Engineering &Technology

BRANCH/COURSE: COMPUTER SCIENCE AND ENGINEERING
COMPUTER SCIENCE AND ENGINEERING-AIML
COMPUTER SCIENCE AND ENGINEERING-DS

AND

INFORMATION TECHNOLOGY

Course Code: BSC0101 **Course Name:** Mathematics-I

Course Credit Hour: 4hr **Total Contact Hour:** 48hrs

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Description:

- In this course we apply to differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions and discuss the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- We shall also learn the tool of power series and Fourier series for learning advanced Engineering Mathematics and deal with functions of several variables that are essential in most branches of engineering and the essential tool of matrices and linear algebra in a comprehensive manner

Course Contents:

Unit 1: Calculus: (6 lectures)

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

Unit 2: Calculus: (6 lectures)

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

Unit 3: Sequences and series: (10 lectures)

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

Unit 4: Multivariable Calculus (Differentiation): (8 lectures)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Unit 5: Matrices (10 lectures)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Course Learning Outcomes (CLOs):

- CLO-1: Apply to differential and integral calculus to notions of curvature and to improper integrals and its applications in engineering problems
- CLO-2: Fundamental to application of analysis to Engineering problems by mean value theorems.
- CLO-3: Apply the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- CLO-4: Discuss problem and application of Multivariable Calculus.
- CLO-5: Apply tool of matrices and linear algebra in a comprehensive manner

Text books:

(i) Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
(ii) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
(iii) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Edition, Pearson,

Reference books:

(i) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,

(ii) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

Online links for study & reference materials:

https://www.classcentral.com/course/swayam-engineering-mathematics-i-13000

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: BSC0102 **Course Name:** Chemistry-I

Course Credit Hour: 4hr **Total Contact Hour:** 48hr

Course Objective:

The objectives of the course are…

1. To develop the interest among the students regarding chemistry and their applications in engineering. The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the fields such as chemical, mechanical, civil, environmental, electrical and electronics engineering etc.
2. To emphasize on learning microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
3. To understand principles of different spectroscopic techniques and its applications. Bulk properties and processes will be analyzed using thermodynamic considerations.
4. To outline periodic properties, stereochemistry, chemical reactions and synthesis.
5. To teach of experiments illustrating the principles of chemistry that have been learnt so far, as well as others relevant to the study of science and engineering.
6. To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
7. To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.

Course Description:

- The course introduces fundamental concepts chemistry including Atomic and molecular structure, Spectroscopic techniques and applications, Intermolecular forces and potential energy surfaces , Use of free energy in chemical equilibrium, Periodic properties, Stereochemistry and Stereochemistry . This subject also laid down the groundwork for subsequent studies in the fields such as chemical, mechanical, civil, environmental, electrical and electronics engineering etc.

Course Contents:

Module 1: Atomic and molecular structure

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

Module 2: Spectroscopic techniques and applications

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

Module 3: Intermolecular forces and potential energy surfaces

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

Module 4: Use of free energy in chemical equilibria

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

Module 5: Periodic properties

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Module 6: Stereochemistry

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

Module 7: Organic reactions and synthesis of a drug molecule

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

Course Learning Outcomes (CLOs):

The course will enable the student to:

- **CLO-1**: Students will learn to apply concepts from physics and methods from mathematics to derive and understand the properties of chemical systems that arise from quantum mechanical models for the structure of atoms and molecules.
- **CLO-2**: Student will achieve advanced knowledge about the interactions of electromagnetic radiation and matter and their applications in spectroscopy.
- **CLO-3**: Student can explain how intermolecular forces determine physical properties of molecules; especially boiling point, melting point and viscosity.
- **CLO-4**: Student can answer why chemical reactions occur? the driving force(s) that are responsible for physical and chemical changes.
- **CLO-5**: Student can apply the knowledge of periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity while planning use of any material for industrial purpose.
- **CLO-6**: Distinguish between different kinds of isomers, cis/trans or E/Z, superimposable, chiral/achiral, define enantiomers, levorotatory or dextrorotatory, racemic mixture, Distinguish between enantiomers and diastereomers, Understand the relationship between biological properties of pairs of enantiomers or diastereomer.

  The properties of a compound are not only determined by the functional groups that it contains, but also by the spatial arrangements of the atoms in the molecule. Stereochemistry is the branch of chemistry that is concerned with the three-dimensional structures of molecules.

  After studying this unit I should be able to diastereomer
- **CLO-7**: Student can list major chemical reactions that are used in the synthesis of molecules.

Text books:

- B. H. Mahan, " University chemistry", Addison-Wesley Publishing Company.
- M. J. Sienko and R. A. Plane, "Chemistry: Principles and Applications", McGraw- -ill International.
- C. N. Banwell, "Fundamentals of Molecular Spectroscopy", McGraw Hill Education.

Reference books:

- B. L. Tembe, Kamaluddin and M. S. Krishnan, "Engineering Chemistry" (NPTEL).
- K. P. C. Volhardt and N. E. Schore, " Organic Chemistry: Structure and Function" Freeman.

Online links for study & reference materials:

https://nptel.ac.in/courses/104/103/104103071/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: HSMC0101 **Course Name:** English

Course Credit Hour: 2hr **Total Contact Hours:** 20hr

Course Objective:

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Description:

- This course introduces the fundamental of communication skills, writing skills presentation skills and interview skills. Topic includes introduction to Grammar, speaking skills, Writing Skills, Presentation skills, Interview skills.

Course Contents:

Unit 1: Vocabulary Building (4 lectures)

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

Unit 2: Basic Writing Skills (4lectures)

Sentence Structures, use of phrases and clauses in sentences Importance of proper punctuation Creating coherence Organizing principles of paragraphs in documents Techniques for writing precisely

Unit 3: Identifying Common Errors in Writing (4 lectures)

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions Redundancies Clichés

Unit 4: Nature and Style of sensible Writing (4 lectures)

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion Writing Practices Comprehension Précis Writing Essay Writing

Unit 5: Oral Communication (4 lectures)(This unit involves interactive interaction)

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

Course Learning Outcomes (CLOs):

- CLO-1: Develop the vocabulary building and basic grammar concepts.
- CLO-2: Inculcate speaking skills and listening skills.
- CLO-3: Develop the writing skills.
- CLO-4: Understand technical writing skills.
- CLO-5: Demonstrate all skills in presentation and interviews.

Text books:

- Raman, Singh – Business communication – Oxford Press
- Spoken English for India, R.K. Bansal & J.B. Harrison, Orient Longman, Delhi.
- Objective English, Tata Mc. Graw Hill Publishing Company Ltd., New Delhi.
- Practical English Usage. Michael Swan. OUP. 1995.
- Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

Reference books:

- English Phonetics & Phonology, P. Roach, Cambridge University Press, London
- Common Errors in English, Abul Hashem, Ramesh Publishing House, new Delhi.
- Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
- Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Online links for study & reference materials:

- https://nptel.ac.in/courses/109/106/109106094/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: ECS0102 **Course Name:** Programming for Problem Solving

Course Credit Hour: 4hr **Total Contact Hour:** 48hr

Course Objective:

- The course aims to provide exposure to problem –solving through programming. It aims to train the student to the basic concept of the C –programming language. This course involves a lab component which is designed to give the student hands –on experience with the concept.

Course Description:

- This course introduces the fundamental concepts of computer and programming and provides comprehensive introduction to programming in C. Topic includes introduction to programming, Arrays, Basic Algorithms, Functions, Recursion, Structure and Pointers.

Course Contents:

Unit 1: Introduction to Programming

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

Unit 2: Arithmetic expressions and precedence

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Unit 3: Arrays

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

Unit 4: Basic Algorithms

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

Unit 5: Function

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

Unit 6: Recursion

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

Unit 7: Structure

Structures, Defining structures and Array of Structures.

Unit 8: Pointers

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

Unit 9: File handling (only if time is available, otherwise should be done as part of the lab)

Course Learning Outcomes (CLOs):

On completion of the course students will be able to:

- **CLO-1**: Formulate simple algorithms for arithmetic and logical problems.
- **CLO-2:** Test and execute the programs and correct syntax and logical errors.
- **CLO-3:** Implement conditional branching, iteration and recursion.
- **CLO-4:** Use arrays, pointers and structures to formulate algorithms and programs.
- **CLO-5:** Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Text books:

1. Byron Gottfried, Schaum's Outline of Programming with C, Third Edition, McGraw-Hill.
2. E.Balaguruswamy, Programming in ANSI, Tata McGraw- Hill.
3. Yashavant Kanetkar, Let Us C, BPB Publications.

Reference books:

- Brian W. Kernighhan and Dennis Ritchie, The C Programming Language, Prentice Hall of India

Online links for study & reference materials:

https://nptel.ac.in/courses/106/104/106104128/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Lab Code: ESC0102P **Lab Name:** Programming for Problem Solving Lab

Course Credit Hour: 3hr **Total Contact Hour:** 06hr/Week

List of Experiments:

Problems based on if-then-else structure:

1. If the three sides of the triangle are entered through the keyboard, write a program to check whether the triangle is isosceles or equilateral.
2. In a company an employee is paid under: If his basic salary is less then Rs.1500, then HRA=10% of basic salary and DA=90% of basic salary .If his salary is either equal to or above Rs 1500, then HRA=Rs 500 and DA= 98% of basic salary. If the employee's salary is input through the keyboard write a program to find his gross salary.
3. The current year and year in which the employee joined the organization are entered through the keyboard. If the no of years for which the employee has served the organization is greater than 3 then a bonus of Rs.2500/- is given to the employee. If the years of service are not greater than three, then the program should do nothing. Write a program to perform the said task.
4. Write a program to check whether a triangle is valid or not when the three angles of the triangle are entered through the keyboard. A triangle is valid if the sum of all the three angles is equal to 180 degree.
5. If cost price and selling price of item is input through the keyboard, write a program to determine whether the seller gas made profit or incurred loss. Also determine how much profit he made or loss he incurred.
6. In a company worker efficiency is determined on the basis of the time required for a worker to complete a particular job. If the time taken by the worker is between 2-3 hours, then the worker is said to be highly efficient. If the time required by the worker is between 3-4 hours, then the worker is ordered to improve speed. If the time taken is between 4-5 hours, the worker is given training to improve his speed, and if the time taken by the worker is more than 5 hours, then the worker has to leave the company. If time taken by the worker is input through the keyboard, write a program to find the efficiency of the worker.

Problems based on while loop and for loop:

1. Write a program to print the cube of any number provided by the user.
2. Make a program to calculate the simple interest for 3 sets of p, n, r using while and for loop.
3. Write a program to print the sum of all the digits from 1 to 10 using while loop.
4. Write a program to print the digit from 1 to100 using while and for loop.
5. Using for loop print the following pattern

   R=1 c=1 sum=2
   R=1 c=2 sum=3
   R=2 c=1 sum =3
   R=2 c=2 sum=4
6. Write a program to print the following pattern
7. Write a program to print the square and cube of any given number**.**
8.

```
*****      *       1
*****      **      12
*****      ***     123
*****      ****    1234
           *****   12345
```

Problems based on 1-D Array, Array Manipulation, 2-D Array and String Operations:

1. Write a program to perform following operations on String(s) using a well-defined library function:
   - Find the length of the string.
   - Concatenate two strings
   - Compare two given strings
   - Copy the content of string to another string
2. Write a program to find average marks obtained by a class of 30 students in a test.
3. Write a program to find the maximum marks obtained by a student in 5 subjects.
4. Write a program to pick up the largest number from any 5 row by 5 column matrix.
5. Twenty five numbers are entered from the keyboard into an array. Write a program to find out how many of them are positive, how many of them are negative and how many of them are zeros.
6. Write a program to store n elements in an array and print all elements.
7. Write a program to compute the sum of all elements in an array.
8. Write a program to print the elements of an array in reverse order.

Problems based on Structures:

1. Write a program to enter name, price and page number of three books using structure.
2. Write a program to enter roll number and average marks of 3 students using structure.
3. Create a structure to specify data of customer in a bank. The data to be stored is: Account number, Name, Balance in Account. Assume maximum of 200 customers in the bank. Write a program to print name and account number of each customer with balance below Rs. 100.
4. A record contains name of cricketer, his age, number of test matches that he has played and the average runs that he has scored. Create an array of structures to hold records of 20 such cricketers.
5. There is a structure called employee that holds information like employee code, name, and year of joining. Write a program to create an array of structures and enter some data into it. Then ask the user to enter current year. Display the names of those employees whose tenure is more than 3 years according to given year.

Problems based on Function, Pointer, Call by Value and Call by Reference

1. Write function which receives a float and an integer from main (), find the product of these two and returns the product which is printed through main ().
2. Write a function that receives marks received by a student in 3 subjects and returns the average and percentage of these marks. Call this function from main and print the result in main.
3. Find the smallest number in an array.
4. Any year is entered through the keyboard. Write a function to determine whether the year is a leap year or not.
5. Write a function that receives 5 integers and returns the sum, average of these numbers. Call this function from main () and print the result in main ().

6. Write a program to add two numbers using pointers**.**
7. Write a program to store n elements in an array and print all elements using pointer.
8. Write a program to read array elements and print array addresses using pointer.
9. Write a program to compute the sum of all elements in an array using pointer.
10. Write a program to print the elements of an array in reverse order using pointer.

Problems based on Recursion, recursive functions, file handling operations and numerical method problems:

1. Write a program to writes records to a file using structure.
2. Write a program for reading a string from the file and display them on screen.
3. Write a program to copy the content of one file to another file.
4. Write a program to display contents of a file on screen.
5. Write a program to count Chars, space, tabs and new lines in a file.
6. Write a program to calculate factorial of any inputted number with recursion and without recursion.
7. Write a program to calculate Fibonacci Series using recursive call.
8. Write a program to calculate Ackerman Function for any two non-negative integers using recursion.

Lab Code: BSC0102P **Lab Name:** Chemistry-1 Lab

Course Credit Hour: 2hr **Total Contact Hours:** 04hr/Week

List of Experiments:

- Determination of Alkalinity in given water sample.
- Determination of Total hardness, Permanent hardness and Temporary Hardness of given Water Sample by using EDTA as standard solution.
- Determination of available chlorine in Bleaching powder.
- Determination of chloride Contents in given Water sample by using Mohr's Method.
- Determination of Iron Content in the given Ore by using external Indicator.
- pH metric titration.
- Viscosity of an addition polymer like Polyester by Viscometer.
- Determination of heat of neutralization of Hydrochloric acid and Sodium hydroxide.
- Determination of amount of dissolve Oxygen in water.
- Separation of metal ions by paper chromatography.

Course Code: BSC0201 **Course Name:** Physics

Course Credit Hour: 4hr **Total Contact Hour:** 48hr

Course Objective: At the completion of this course, a student will be able to

1. Know about the development of modern Physics and the theoretical formulation of quantum mechanics.
2. Know the applications of quantum mechanics in solving physical problems.

Course Description: This course will analyze the applications of mathematics to the problems in physics & develop suitable mathematical method for such application & for formulation of physical theories.

Course Contents:

Unit I: Wave nature of particles and the Schrodinger equation (8 Lectures)

Introduction to Quantum mechanics Wave nature of particles
Time independent and time dependent Schrodinger equation for wave function Born interpretation
Probability current Expectation values
Free particle wavefunction and wave packets Uncertainty principle

Unit II: Mathematical Preliminaries for Quantum Mechanics (4 Lectures)

Complex numbers Linear vector spaces Inner product Operators Eigen value problems Hermitian operators Hermite polynomials Legendre`s equation Spherical harmonics

Unit III: Applying the Schrodinger equation (**15 Lectures)**

Solution of stationary state Schrodinger equation for one dimensional problem Particle in a box Particle in attractive delta function potential Square well potential Linear harmonic oscillator

Numerical solution of stationary state Schrodinger equation for one dimensional problem for different potentials Scattering from a potential barrier and tunneling Examples like alpha decay, field ionisation and scanning tunnelling microscope Three dimensional problems: particle in three-dimensional box and related examples Angular momentum operator Rigid rotor Hydrogen atom ground state, orbitals, interaction with magnetic field spin Numerical solution stationary state Schrodinger equation for spherically symmetric potentials

Unit IV: Introduction to Molecular Bonding (4 Lectures)

Particle in double delta function potential Molecules (Hydrogen molecule, valence bond and molecular orbitals picture) Singlet/triplet states Chemical bonding Hybridization

Unit V: Introduction to Solids (7 Lectures)

Free electron theory of metals Fermi level, density of states Application of white dwarfs and neutron stars Bloch theorem for particles in a periodic potential Kronig-Penney model and origin of energy bands Numerical solution for energy in one dimensional periodic lattice by mixing plane waves

Course Learning Outcomes (CLOs):

After successful completion of this paper, the student will be well-versed in

- **CLO1.** Concepts of basis and operators
- **CLO2.** Both Schrodinger and Heisenberg formulations of time development and their applications
- **CLO3.** Solution of stationary state Schrodinger equation for one dimensional problem
- **CLO4.** Concepts of Molecules (Hydrogen molecule, valence bond and molecular orbitals picture)
- **CLO5.** Kronig-Penney model and origin of energy bands

Text Books

- Eisberg and Resnik, Introduction to Quantum Physics

Reference Books

- D. J. Grriffiths, Quantum Mechanics
- Richard Robinett, Quantum Mechanics
- Daniel McQuarrie, Quantum Chemistry

Online links for study & reference materials:
https://nptel.ac.in/courses/122/106/122106034/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: BSC0202 **Course Name:** Mathematics -II

Course Credit Hour: 4hr **Total Contact Hour:** 48hrs

Course Objective:

- The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Description:

- Applying the mathematical tools for need in evaluating multiple integrals and their usage, solutions of differential equations that model physical processes and the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Course Contents:

Unit 1: Multivariable Calculus (Integration): (10 lectures)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Unit 2: First order ordinary differential equations: (6 lectures)

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

Unit 3: Ordinary differential equations of higher orders: (8 lectures)

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

Unit 4: Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm)

Unit 5: Complex Variable – Integration: (8 lectures)

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

Course Learning Outcomes (CLOs):

- CLO-1: Evaluation of areas and volumes, Center of mass and Gravity.

- CLO-2: Solution of first order ordinary differential equations by various methods.
- CLO-3: Solution of ordinary differential equations of higher orders.
- CLO-4: Differentiation of Vector calculus.
- CLO-5: Integration of Vector Calculus.

Text books:

- Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Edition, Pearson,

Reference books:

- Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,
- D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
- W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, Wiley India

Online links for study & reference materials:

https://nptel.ac.in/courses/122/107/122107036/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: ESC0201 **Course Name:** Basic Electrical Engineering

Course Credit: 4hr **Total Contact Hour:** 48hr

Course Objective:

- To introduce concept of D.C. circuits and A.C. circuits.
- To make the students understand and working of machines, transformer and components used for low voltage installation.

Course Description:

- This course introduces the fundamental concepts of circuits, machines and low voltage installation.

Course Contents:

Unit 1: DC Circuits

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

Unit 2: AC Circuits

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

Unit 3: Transformers

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

Unit 4: Electrical Machines

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

Unit 5: Power Converters

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Unit 6: Electrical Installations

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

Course Learning Outcomes (CLOs):

At the end of this course, students will demonstrate the ability

- CLO-1: Analyze basic electric and magnetic circuits.
- CLO- 2: working principles of electrical machines and power converters.
- CLO-3 :Understand the basic concept of components of low-voltage electrical Installations.

Text books:

- D. P. Kothari and I. J. Nagrath, " Basic Electrical Engineering", Tata McGraw Hill.
- D. C. Kulshreshtha, " Basic Electrical Engineering", McGraw Hill.

Reference books:

- L. S. Bobrow, " Fundamentals of Electrical Engineering", Oxford University Press.
- E. Hughes, "Electrical and Electronics Technology", Pearson.
- V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/108/108108076/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: BCS0203 **Course Name:** Environmental Studies

Course Credit Hour: 2hr **Total Contact Hour:** 20hr

Course Objective:

- The Compulsory course on Environmental Science at Undergraduate level (AECCI) aims to train students to cater to the need for ecological citizenship through developing a strong foundation on the critical linkages between ecology-society-economy.

Course Description:

- Graduates will evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental model.

Course Contents:

Unit 1: Introduction to Environmental Studies

- Multidisciplinary nature of environmental studies
- Scope and importance; Concept of sustainability and sustainable development

Unit 2: Ecosystem

- Definition and concept of Ecosystem -Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem

Physical (energy flow), Biological (food chains, food web, ecological succession) and Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological pyramids and homeostasis

- Types of Ecosystem – Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries) – their importance and threats on them with relevant examples from India Ecosystem services (Provisioning, Regulating, Cultural and Supporting). Basics of Ecosystem restoration

Unit 3: Natural Resources

- Land resources and landuse change Land degradation, soil erosion and desertification
- Forest resources and causes of deforestation; impacts of mining and dam building on environment, forests, biodiversity and tribal populations
- Water resource: Use and over exploitation of surface and ground water, floods, drought conflicts over water (international & inter-state)
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs
- Case studies: National Solar Mission, Cauvery river water conflict etc

Unit 4: Biodiversity and Conservation

- Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India
- India as a mega-biodiversity nation; Endemic and endangered species of India; IUCN Red list; biodiversity hotspots
- Value of biodiversity: Ecological, economic, social, ethical, aesthetic and informational value of biodiversity with examples; sacred groves and their importance with example
- Current mass extinction crisis; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasion with emphasis to Indian biodiversity

- Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; Biosphere reserves; Keystone and Flagship species; Species reintroduction and translocation

Unit 5: Environmental pollution

- Environmental pollution (Air, water, soil, thermal and noise): causes, effects and controls; Air and water quality standards
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste
- Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues etc

Unit 6: Global Environmental Issues and Policies

- Climate change, Global warming, Ozone layer depletion, Acid rain and impacts on human communities and agriculture
- International agreements: Earth Summit, UNFCCC, Montreal and Kyoto protocols and Convention on Biological Diversity (CBD)
- Sustainable Development Goals and India's National Action Plan on ClimateChange Environment legislation in India: Wildlife Protection Act, 1972; Water (Prevention and Control of Pollution) Act, 1974; Forest (Conservation) Act 1980, Air (Prevention & Control of Pollution) Act, 1981; Environment Protection Act, 1986; Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 200

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare
- Resettlement and rehabilitation of project affected persons; case studies
- Disaster management: floods, earthquake, cyclones and landslides
- Environmental movements: Chipko movement, Silent valley movement, Bishnois of Rajasthan, Narmada BachaoAndolan etc
- Environment justice: National Green Tribunal and its importance
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi, Swachh Bharat Abhiyan)

Field work/ Practicals

- Field visit to any of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/ Yamuna river and its floodplains etc. or any nearby lake or pond, explaining the theoretical aspects taught in the classroom
- Visit to any biodiversity park/ reserve forests/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, explaining the theoretical aspects taught in the classroom
- Visit to a local polluted site (Urban/Rural/Industrial/Agricultural), Wastewater treatment plants
- Study of common plants, insects, birds and basic principles of identification
- Organize a seminar/ conference/ workshop/ panel discussion on relevant topics for enhancing awareness, capacity building and critical reasoning among students

Course Learning Outcomes (CLOs):

The course will empower the undergraduate students by helping them to:

- CLO-1 Gain in-depth knowledge on natural processes that sustain life, and govern economy.
- CLO-2: Predict the consequences of human actions on the web of life, global economyand quality of human life.
- CLO-3: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.

- CLO-4: Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones..
- CLO-5: Adopt sustainability as a practice in life, society and industry.

Text books:

- William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003
- William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, Mc Graw Hill 2014 UGC DOCUMENT ON LOCF ENVIRONMENTAL SCIENCE 24
- Rogers PP, Jalal, KF, Boyd JA, An introduction to sustainable development, Earthscan

Reference books:

- Roosa SA, Sustainable Development Handbook, CRC Press 2008
- Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014
- Robbins P., Hintz J., Moore S.A., Environment and Society: A critical introduction, Wiley Blackwel 2014

Online links for study & reference materials:

https://www.hzu.edu.in/bed/E%20V%20S.pdf

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Lab Code: BSC0201P **Lab Name:** Physics Lab

Course Credit Hour: 2hr **Total Contact Hour:** 4hr/Week

List of Experiments:

- Four Probe Setup
- Stefan`s Law
- Diode Valve Characteristics
- Frequency of A.C Mains
- Band Gap in a Semi-Conductor Diode
- P-N Junction Diode Characteristics
- Zener Diode Characteristics
- Transistor Common-Base Configuration
- Transistor Common-Emitter Configuration

Lab Code: ESC0202P **Lab Name:** Workshop/Manufacturing Practice Lab

Course Credit Hour: 3hr **Total Contact Hour:** 6hr/Week

List of Experiments:

- Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods
- CNC machining, Additive manufacturing
- Fitting operations & power tools
- Electrical &Electronics
- Carpentry
- Plastic molding, glass cutting
- Metal casting
- Welding (arc welding & gas welding), brazing

Lab Code: ESC0201P **Lab Name:** Basic Electrical Engineering Lab

Course Credit Hour: 3hr **Total Contact Hour:** 6hr/Week

List of Experiments:

- Basic safety precautions. Introduction and use of measuring instruments – poltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- To verify KCL and KVL in D.C.circuit
- To verify Superposition theorem
- To Verify The venin's Theorem
- To find resonance in series R-L-C circuit.
- Transformers: Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement).
- Torque Speed Characteristic of separately excited dc motor.
- Three-phase induction motors. Direction reversal by change of phase-sequence of connections.
- Demonstration of Components of LT switchgear.

Course Code: BSC0301 **Course Name:** Discrete Mathematics

Course Credit Hour: 3hr **Total Contact Hour:** 40hrs

Course Objective:

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to use mathematically correct terminology and notation, construct correct direct and indirect proofs, use division into cases in a proof, use counter examples and apply logical reasoning to solve a variety of problems.

Course Description:

This course provides wide knowledge ofDiscrete Mathematics. Topics included: Basic of Sets, Relation and function, Principal of mathematical induction, counting technique, propositional logics, algebraic structure and graphs and tree with their applications.

Course Contents:

Unit 1: Sets, Relation and Function (8 hours)

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

Unit-2: Principles of Mathematical Induction& Basic Counting Technique (8 hours)

The Well-Ordering Principle, Recursivedefinition, The Division algorithm: Prime Numbers, The Greatest Common Divisor:Euclidean Algorithm, The Fundamental Theorem of Arithmetic.Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

Unit 3: Propositional Logic (8 hours)

Syntax, Semantics, Validity and Satisfiability, Basic Connectives andTruth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules ofInference, The use of uantifiers. **Proof Techniques:** Some Terminology, Proof Methodsand Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof ofNecessity and Sufficiency.

Unit 4: Algebraic Structures and Morphism (10 hours)

Algebraic Structures with one Binary Operation,Semi Groups, Monoids, Groups, CongruenceRelation and Quotient Structures,Free and Cyclic Monoids and Groups, Permutation Groups,Substructures, NormalSubgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domainand Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra,Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Unit 5: Graphs and Trees (8 hours)

Graphs and their properties, Degree, Connectivity, Path, Cycle,Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring mapsand Planar Graphs,Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph,definition properties and Example, rooted trees, trees and sorting, weighted trees and prefixcodes, Bi-connected component and Articulation Points, Shortest distances.

Course Learning Outcomes (CLOs):

CLO-1: For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives.

CLO-2: For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference.

CLO-3: For a given a mathematical problem, classify its algebraic structure.

CLO-4: Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

CLO-5: Develop the given problem as graph networks and solve with techniques of graph theory.

Text books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill

2. Susanna S. Epp, Discrete Mathematics with Applications,Wadsworth Publishing Co. Inc.

3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, Tata McGraw – Hill.

Reference books:

1. Discrete Mathematics, Tata McGraw – Hill
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill.
3. Norman L. Biggs, Discrete Mathematics, Oxford University Press.

Online links for study & reference materials:

https://nptel.ac.in/courses/106/106/106106094/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: ESC0302 **Course Name:** Analog & Digital Circuits

Course Credit: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To understand Diodes and their application.
- To analyze BJT and understand the various application.
- To understand characteristics of op amp and MOSFET.
- To understand concepts of non linear application of OP amp.

Course Description:

This course emphasizes on the fundamental of Analog electronics. The course includes basic devices structure, application and working. This course gives an understanding of analog circuits.

Course Contents:

Unit 1: Diode circuits

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Unit 2: BJT circuits

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common- collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Unit 3: MOSFET circuits

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Unit 4: Differential, multi-stage and operational amplifiers

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Unit 5: Linear applications of op-amp

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.

Unit 6: Nonlinear applications of op-amp

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- At the end of this course, students will demonstrate the ability to
- Understand the characteristics of transistors.
- Design and analyze various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

Text books:

- S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
- J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifiertheory and applications", McGraw Hill U. S., 1992.
- J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988., "Digital Logic and Computer Design", PHI Publications, 2002

Reference books

- P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
- P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated

Circuits", John Wiley & Sons, 2001.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/102/108102112/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PCCCSE0301 **Course Name:** Data Structure & Algorithms

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To enable them to write algorithms for solving problems with the help of fundamental data structures.

Course Description:

- Study of advanced programming topics focused on logical structures of data as well as the design, implementation and analysis of algorithms operating on these structures.
- Topics include linked lists, stacks, trees, queues, graphs and analysis of efficiency. Also covers searching, sorting and hashing techniques.

Course Contents:

Module 1: Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Module 2: Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 3: Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.
Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Module 4: Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.
Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Course learning outcomes:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.

5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

Suggested books:

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.

Suggested reference books:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition byMarkAllen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer" , 2nd Impression by R. G. Dromey, Pearson Education.

Online links for study & reference materials:

1. NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PCCCSE0302 **Course Name:** IT Workshop (MATLAB)

Course Credit Hour: 2hr **Total Contact Hour:** 40hr

Course Objective

- To Impart the Knowledge to the students with MATLAB software.
- To provide a working introduction to the MATLAB technical computing environment.
- To introduce students the use of a high-level programming language using MATLAB.

Course Description:

- The course covers the basic concepts and techniques of MATLAB computing environment from both theoretical and practical perspective. The material includes Introduction to Matlab, Historical Background, Applications and scope of MATLAB, Commands, Data types, Operators, Data and Data Flow, Matlab Advanced Plotting and Mathematical Modeling.

Course Contents:

Unit-1

Introduction to Matlab, Historical Background, Applications, Scope of MATLAB, Importance of MATLAB for Engineers, Features, MATLAB Windows (Editor, Work Space, Command History, Command Window). Operations with Variables, Naming and Checking Existence, Clearing Operations, Commands, Data types, Operators.

Unit-II

Data And Data Flow In Matlab Vectors, Matrix Operations & Operators, Reshaping Matrices, Arrays, Colon Notations, Numbers, Strings, Functions, File Input-Output, Importing and Exporting of data.

Unit-III

Matlab Programming Conditional Statements, Loops, Writing Script Files, Error Correction, Saving Files, Worked out Examples.

Unit-IV

Matlab Advanced Plotting, Graphics, Creating Plot & Editing Plot, GUI (Graphical User Interface). Matlab-Algebra, Calculus, Differential, Integration, Polynomials, solving a system of linear equations.

Unit-V

Simulink Introduction, Importance, Model Based Design, Tools, Mathematical Modeling, Converting Mathematical Model into Simulink Model, Running Simulink Models, Importing Exporting Data, Solver Configuration, Masking Block/Model.

Course Learning Outcomes (CLOs): On completion of the course students will be able to

- **CLO-1**: Understand the introduction of MATLAB environment.
- **CLO-2**: Understand and apply the operation of MATLAB in data flow operations.
- **CLO-3**: Write the various MATLAB programming scripts.
- **CLO-4**: Plot graphs of linear and polynomial equations using various MATLAB functions.
- **CLO-5:** Perform mathematical modeling, importing and exporting of data using Simulink.

Text books:

- Rudra Pratap , Getting Started With Matlab: A Quick Introduction For Scientists And Engineers , OXFORD University Press.
- Y. Kirani Singh, B.B. Chaudhuri , Matlab Programming ,PHI Publication

Reference Books:

- Y. Yang ,Wenwu Cao, Tae-Sang Chung, John Morris ,Applied Numerical Methods Using MATLAB , PHI Publication.

Online links for study & reference materials:

https://nptel.ac.in/courses/103/106/103106118/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: HSMC0301 **Course Name**: Status of Women in Society

Course Credit Hour: 2hr **Total Contact Hour**: 20hr

Course Objectives (COs):

- Understand the historical, cultural, and contemporary factors shaping women's status. Analyze women's roles and challenges, fostering critical thinking and advocacy for gender equality.

Course Description:

- This course explores the status of women, delving into historical, cultural, and modern perspectives while equipping students with critical thinking skills to address gender-related issues and promote equality.

Course Contents:

Unit 1: Introduction to Women's Studies
Definition and scope of Women's Studies, Historical development and significance, Intersectionality: Understanding diverse experiences

Unit 2: Historical Perspectives
Women's roles in pre-industrial societies, Notable women in history, Impact of religion and culture on women's status

Unit 3: Women's Movements and Social Change
Key figures and events in women's rights movements, Achievements and ongoing challenges (excluding sexual topics), Women's role in social and political reform.

Unit 4: Contemporary Issues and Challenges
Gender pay gap and workplace discrimination, Violence against women, Women's representation in leadership roles and decision-making

Unit 5: Intersectionality and Global Perspectives
Intersectionality and its importance in understanding women's experiences, Challenges faced by women of diverse backgrounds (excluding explicit content), Global perspectives on women's status in different cultures

Course Learning Outcomes (CLOs):

On completion of the course students will be able to:
CLO1: Develop a deep understanding of the social, historical, and cultural factors that have shaped the status of women in society.
CLO2: Demonstrate critical thinking and analytical skills when examining issues related to gender and women's experiences.
CLO3: Recognize and evaluate the significance of intersectionality in understanding the multifaceted nature of women's identities and challenges.
CLO4: Apply theoretical frameworks and concepts from Women's Studies to analyze real-world situations and propose solutions for achieving gender equality.

Text Books

1. Recasting Women, Essays in Colonial History by Kumkum Sangari and Sudesh Vaid
2. Status of Women in India Ancient, Medieval, and Modern Periods by Dr. Neelam
3. Changing Status and Role of Women in Indian Society by C. Chakrapani, S. Vijaya Kumar

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PCCCSE0303 **Course Name:** Cloud Computing
Course Credit Hour: 3Hr **Total Contact Hour:**40hr

Course Objective:

- Identify the technical foundations of cloud systems architectures.
- Analyze the problems and solutions to cloud application problems.
- Apply principles of best practice in cloud application design and management.
- Identify and define technical challenges for cloud applications and assess their importance

Course Description: This course provides a hands-on comprehensive study of Cloud concepts and capabilitiesacross the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and Business Process as a Service (BPaaS). IaaS topics start with a detailed study the evolution of infrastructure migration approaches from VMWare/Xen/KVM virtualization, toadaptive virtualization, and Cloud Computing / on-demand resources provisioning.

Course Contents:

Unit I INTRODUCTION

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity inCloud – On-demand Provisioning.

Unit II CLOUD ENABLING TECHNOLOGIES

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels ofVirtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU –Memory – I/O Devices –Virtualization Support and Disaster Recovery.

Unit III CLOUD ARCHITECTURE, SERVICES AND STORAGE

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public,

Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – CloudStorage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

Unit IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods

Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –Software-as-a-ServiceSecurity – Security Governance – Virtual Machine Security – IAM –Security Standards.

Unit V CLOUD TECHNOLOGIES AND ADVANCEMENTS

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment forGoogle App Engine – – Open Stack – Federation in the Cloud – Four Levels of Federation –Federated Services and Applications – Future of Federation.

Course Learning Outcomes (CLOs):

CO1: Understand the fundamental principles of distributed computing.

CO2: Understand how the distributed computing environments known as Grids can be built from lower-level services.

CO3: Understand the importance of virtualization in distributed computing and how this has enabled the developmentof Cloud Computing.

CO4: Analyze the performance of Cloud

Computing.CO5: Understand the concept of

Cloud Security.

Text books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing totheInternet of Things", Morgan Kaufmann Publishers, 2012.

2. Rittinghouse, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management andSecurity,CRC Press, 2017.

3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing, Tata Mcgraw Hill, 2013.

4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009.

5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud:Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

Reference books:

1. Barrie Sosinsky: "Cloud Computing Bible", Wiley-India, 2010
2. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski: "Cloud Computing: Principles and Paradigms",Wiley, 2011
3. Nikos Antonopoulos, Lee Gillam: "Cloud Computing: Principles, Systems and Applications", Springer, 2012
4. Ronald L. Krutz, Russell Dean Vines: "Cloud Security: A Comprehensive Guide to Secure CloudComputing", Wiley-India, 2010
5. Tim Mather, Subra Kumara swamy, Shahed Latif, Cloud Security and Privacy: An Enterprise Perspective onRisks and Compliance, O'Reilly Media, 2009.

Online links for study & reference materials:

https://www.ncertbooks.guru/computer-graphics-notes/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

ESC0302P	Analog & Digital Circuit Lab	0L:0T:2P	2 credits

List of Experiments

1. To study the characteristics of P-N junction diode.
2. To study a half wave and full wave rectifier circuit.
3. To study the V-I characteristics of zener diode
4. To study the zener diode as constant voltage regulator.
5. Determine the input output characteristics of BJT in CB, and CE configuration.
6. Determine the input output characteristics of FET in CS & CD configuration.
7. To study of BJT as single stage amplifier and determination of Ai, Av, Ri, Ro.
8. To study the opamp as an inverting & non-inverting amplifier.
9. To use the opamp as an adder, subtractor, integrator & differentiator.
10. To design a ramp and a square wave generator.
11. To study of (i) Wein bridge oscillator (ii) Phase shift oscillator.
12. To design low pass, high pass and band pass filters using op-amp and plot their frequency response.

PCCCSE0301P	Data Structure & Algorithms Lab	0L:0T: 2P	2 credits

LIST OF EXPERIMENTS

Write programs in C for following:

1. Write a program to demonstrating Linear Search
2. Write a program to demonstrating Binary Search
3. Write a program to demonstrating Bubble Sort
4. Write a program to demonstrating Selection Sort
5. Write a program to demonstrating Insertion Sort
6. Write a program to demonstrating Merge Sort
7. Write a program to demonstrating Quick Sort
8. Write a program to demonstrating all operations on String without using standard library file
9. Write a program to demonstrating Single Linked List
10. Write a program to demonstrating Stack operations using array/Linked List
11. Write a program to demonstrating Queue operations using Linked list/Array
12. Program for demonstrating Binary Search Tree Using Linked List/Array

PCCCSE0302P	IT Workshop (Matlab) Lab	0L:0T: 2P	2 credit

LIST OF EXPERIMENTS

1. Write a Program in M File to find the roots of a Quadratic Equation.
2. Consider the Matrix A=

   [1 2 3 5 4 4 5 6 1 3 7 8 9 2 2]

   Write a MATLAB Code to obtain the following matrix

   [7 8 2 2 4 5 1 3 1 2 5 4]

3. W.A.P in MATLAB to solve the following linear equation:

   $3x^4 + x^3 + 6x^2 + x + 4 = 0$

   $x^4 + 3x^3 + 2x^2 + 41 = 0$

4. W.A.P to plot the following two functions for 30 Data Points from 0 to 2π by using Plot Command.
5. W.A.P to display the AND,OR & NOT Program
6. W.A.P. in MATLAB to convert Centigrade values to Fahrenheit values. The Values of the the temp in Centigrade will be taken as input from the user.
7. W.A.P to create a recursive function to find the factorial of a number.
8. W.A.P in MATLAB to show the use of the following operators

   (i) All operator (ii) any operator
9. Create a MATLAB Code to create the chessboard on a white background.
10. W.A.P in MATLAB to make a ribbon plot of the following function

    Z = 20 + Cos (0.5 * x) + 20 * Sin(0.5 * y)

Course Code: PCCCSE0401 **Course Name:** Computer Based Numerical & Statistical Techniques

Course Credit Hour: 3hr **Total Contact Hour:** 40hrs

Course Objective:

A good Engineer has to have an excellent background of Mathematics. Numerical and statistical techniques are one of the essential tools for learning Technology. This course is tofamiliarisethe students with statistical and numerical techniques needed in problem-solving and industrial applications.

Course Description:

This course provides an introduction to numbers and accuracy and wide knowledge of methods for solving transcendental equation, Interpolation, numerical integration and differentiation, solution of differential equation and statistical technique with their applications.

Course Contents:

Unit 1: (8 hours)

Introduction: Numbers and their accuracy, Computer Arithmetic, Mathematical preliminaries, Errors and their Computation, General error formula, Error in a series approximation.

Solution of Algebraic and Transcendental Equation: Bisection Method, Iteration method, Method of false position, Newton-Raphsonmethod, Methods of finding complex roots, Muller‟s method, Rate of convergence ofIterative methods, Polynomial Equations.

Unit 2: (10 hours)

Interpolation: Finite Differences , Difference tables Polynomial Interpolation:Newton's forward and backward formula Central Difference Formulae: Gauss forwardand backward formula, Stirling‟s, Bessel‟s, Everett‟s formula.Interpolation with unequal intervals: Langrange‟s Interpolation, Newton Divideddifference formula, Hermite‟s Interpolation

Unit 3: (12 hours)

Numerical Integration and Differentiation: Introduction, Numerical differentiationNumerical Integration: Trapezoidal rule, Simpson‟s 1/3 and 3/8 rule, Boole‟s rule,Waddle‟s rule.

Solution of differential Equations: Picard‟s Method, Euler‟s Method, Taylor‟sMethod, Runge-Kutta Methods, Predictor Corrector Methods, Automatic Error Monitoringand Stability of solution.

Unit 4: (10 hours)

Statistical Computation: Frequency chart, Curve fitting by method of least squares,fitting of straight lines, polynomials, exponential curves etc, Data fitting with Cubicsplines, Regression Analysis, Linear and Non-linear Regression, Multiple regression,Statistical Quality Control methods.

Course Learning Outcomes (CLOs):

CLO-1: Recognize the error in the number generated by the solution.

CO2. Compute solution of algebraic and transcendental equation by numerical methods.

CLO-3: Apply method of interpolation and extrapolation for prediction.

CLO-4:Evaluation of numerical differentiation and integration.

CLO-5: To find solution of differential equation.

CLO-6: Computation of statistical technique.

Text books:

1. Grewal B S, "Numerical methods in Engineering and Science", Khanna Publishers, Delhi.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,

Reference books:

(i) Numerical Method Principles, analysis and algorithms ,Srimamta Pal (Oxford Higher ed).
(ii) Rajaraman V, "Computer Oriented Numerical Methods", PHI, 3rd edition.

Online links for study & reference materials:

https://nptel.ac.in/courses/122/106/122106033/

Assessment method:(Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PCCCSE0402 **Course Name:** Computer Organization & Architecture

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- How Computer Systems work & the basic principles
- Instruction Level Architecture and Instruction Execution
- The current state of art in memory system design
- How I/O devices are accessed and its principles.
- To provide the knowledge on Instruction Level Parallelism
- To impart the knowledge on microprogramming
- Concepts of advanced pipelining techniques.

Course Description:

- This course provides students with a solid understanding of fundamental architectural techniques used to build today's high-performance processors and systems.
- Course topics include pipelining, superscalar, out of order execution, multithreading, caches, virtual memory, and multiprocessors.

Course Contents:

Module 1:Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTLinterpretation ofinstructions, addressing modes, instruction set. Case study – instruction sets of some commonCPUs.
Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating pointarithmetic.

Module 2:Introduction to x86 architecture.CPU control unit design: hardwired and microprogrammed design approaches, Case study – design of a simple hypotheticalCPU.Memory system design: semiconductor memory technologies, memory organization. Peripheral devices and their characteristics:Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process statetransitions, I/O device interfaces – SCII, USB

Module 3: Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.Parallel Processors:Introduction to parallel processors, Concurrent access to memory and cachecoherency.

Module 4: Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, writepolicies.

Course learning outcomes:

1. "Computer Organization and Design: The Hardware/Software Interface" , 5th Edition by David A. Patterson and John L. Hennessy,Elsevier.
2. "Computer Organization and EmbeddedSystems" , 6th Editionby CarlHamacher, McGraw Hill HigherEducation.

Suggested reference books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance" , 10th Edition by William Stallings, PearsonEducation.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, PearsonEducation.

Online links for study & reference materials:

1. NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PCCCSE0403 **Course Name:** Operating Systems

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To learn the mechanisms of OS to handle processes and threads and theircommunication
- To learn the mechanisms involved in memory management in contemporaryOS
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
- To know the components and management aspects of concurrency management

Course Description:

- Covers the classical internal algorithms and structures of operating systems, including CPU scheduling, memory management, and device management.
- Considers the unifying concept of the operating system as a collection of cooperating sequential processes.
- Covers topics including file systems, virtual memory, disk request scheduling, concurrent processes, deadlocks, security, and integrity.

Course Contents:

Module 1: Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS OperatingSystem.

Module 2: Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

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

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Module 3: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer/Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Module 4: Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Module 5: Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation–Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Pageallocation– Hardware support for paging, Protection and sharing, Disadvantages ofpaging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal,

First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).

Module 6:I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms.

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

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Course learning outcomes:

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement file management system.
4. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Suggested books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia StudentEdition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall ofIndia.

Suggested reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt,Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall ofIndia
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly andAssociates

Online links for study & reference materials:

1. NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PCCCSE0404 **Course Name :** Design & Analysis of Algorithm

Course Credit Hour: 3hr **Total Contact Hour :** 40hr

Course Objective:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

Course Description :

Algorithms are the soul of computing. It can be roughly described as creating "recipes" (well defined sequences of computational steps) for getting "things" (computational problems specifying an input-output relation) "successfully" (correctly) "done" (in finite steps and time). This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness.

Course Contents :

Module 1:
Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Module 2:
Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch- and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Module 3:
Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Module 4:
Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

Module 5:
Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – PSPAC

Course Learning Outcomes (CLOs):

CLO-1: For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

CLO-2: Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

CLO-3: Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

CLO-4: Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.

CLO-5: Develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

CLO-6: For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

CLO-7: Explain the ways to analyze randomized algorithms (expected running time, probability of error).

CLO-8: Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

Text books :

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 4TH Edition, MITPress/McGraw-Hill, 9780262032933, 0262032937
2. E. Horowitz etal. , Sartaj Sahni, Fundamentals of Algorithms , Computer Science Press 9783540120353, 3540120351

Reference books :

1. Jon Kleinberg and ÉvaTardos, Algorithm Design, 1ST Edition, Pearson, 9788131703106, 813170310X
2. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 9780471427568, 047142756X

Online links for study & reference materials:

https://lecturenotes.in/subject/12/design-and-analysis-of-algorithm-daa/note

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: HSMC0401 **Course Name:** Human Values

Course Credit Hour:2hr **Total Contact Hour:** 20hr

Course Objective:

- Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Course Description:

- This course introduces the fundamental ofhuman values. It includes important insights about self-exploration, right conduct, ethics and harmony.

Course Contents:

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.

2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.

3. Continuous Happiness and Prosperity- A look at basic Human Aspirations

4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.

5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.

2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.

3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).

4. Understanding the characteristics and activities of 'I' and harmony in 'I'.

5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

6. Programs to ensure Sanyam and Health.

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 4.Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature

2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. 3.Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.

4.Holistic perception of harmony at all levels of existence.

Unit 5 : Implications of the above Holistic Understanding of Harmony on Professional Ethics

1.Natural acceptance of human values

2. Definitiveness of Ethical Human Conduct

3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

5. Case studies of typical holistic technologies, management models and production systems

Course Learning Outcomes (CLOs):

CLO-1: Develop the basic concept of human values

CLO-2: To understand the importance of self-exploration process

CLO-3: To understand harmony at individual levels

CLO-4: To understand harmony at nature level

CLO-5: Develop professional ethics

Textbooks:

(i) Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010 Reference Books 1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
(ii) Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Reference books:

1. Human Values and Professional Ethics: Values and Ethics of Profession, Jay Shree Suresh and B.S Bahgvan, S.Chand

Assessment method:(Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PCCCSE0405 **Course Name:** Core Java

Course Credit Hour: 3Hr **Total Contact Hour:** 40hr

Course Objective:

- These learning outcomes provide a comprehensive understanding of Java programming, covering its core concepts, multithreading, GUI development, networking, and data structures.

Course Contexts:

UNIT- I

Overview and characteristics of Java, Java program Compilation and Execution Process Organization of the Java Virtual Machine, JVM as an interpreter and emulator, Instruction Set, class File Format, Verification, Class Area, Java Stack, Heap, Garbage Collection. Security Promises of the JVM, Security Architecture and Security Policy. Class loaders and security aspects, sandbox model

UNIT - II

Java Fundamentals, Data Types & Literals Variables, Wrapper Classes, Arrays, Arithmetic Operators, Logical Operators, Control of Flow, Classes and Instances, Class Member Modifiers Anonymous Inner Class Interfaces and Abstract Classes, inheritance, throw and throws clauses, user defined Exceptions, The String Buffer Class, tokenizer, applets, Life cycle of applet and Security concerns.

UNIT - III

Threads: Creating Threads, Thread Priority, Blocked States, Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization, Synchronize Threads, Sync Code Block, Overriding Synced Methods, Thread Communication, wait, notify and notify all.

AWT Components, Component Class, Container Class, Layout Manager Interface Default Layouts, Insets and Dimensions, Border Layout, Flow Layout, Grid Layout, Card Layout Grid Bag Layout AWT Events, Event Models, Listeners, Class Listener, Adapters, Action Event Methods Focus Event Key Event, Mouse Events, Window Event

UNIT - IV

Input/output stream, Stream Filters, Buffered streams, Data input and Output stream, Print Stream Random Access File, JDBC (Database connectivity with MS-Access, Oracle, MS-SQL Server), Object serialization, Sockets, development of client Server applications, design of multithreaded server. Remote Method invocation, Java Native interfaces, Development of a JNI based application.

Collection API Interfaces, Vector, stack, Hash table classes, enumerations, set, List, Map, Iterators.

Course Learning Outcomes (CLOs):

On completion of the course students will be able to:

- **CLO-1:** Understand the fundamental characteristics of the Java programming language.
- **CLO-2:** Understand object-oriented programming concepts such as classes, instances, and class member modifiers.
- **CLO-3:** Design graphical user interfaces (GUIs) using AWT components, containers, and layout managers.
- **CLO-4:** Explore the Collection API, including interfaces, vector, stack, hash table classes, enumerations, set, list, map, and iterators.

Textbook(s):

1. Patrick Naughton and Herbertz Schidt, “Java-2 the Complete Reference”, TMH

References:

1. E. Balaguruswamy, “Programming with Java”, TMH
2. Horstmann, “Computing Concepts with Java 2 Essentials”, John Wiley.
3. Decker & Hirshfield, “Programming Java”, Vikas Publication.

Assessment method:(Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

PCCCSE0402P	**Computer Organization &Architecture Lab**	**0L:0T:2P**	**2 Credits**

List of Experiments

1. To study Half Adder.
2. To study Full Adder (7483).
3. To study ALU (74181).
4. Write a program for hexadecimal addition and multiplication.
5. Write a program for binary multiplication.
6. Write a program for Booth's multiplication.
7. Write programs to simulate memory allocation policies
    a. First-fit algorithm
    b. Best-fit algorithm
8. Write programs to simulate the mapping techniques of Cache memory.
    a. Direct Mapped cache
    b. 2 Associative Mapped cache
    c. Set Associative Mapped cache
9. Write a program to implement stack and branch instructions.
10. Design of 4-bit Universal Shift Registers using D-FF.

PCCCSE0403P	Operating Systems Lab	0L:0T:2P	2 Credits

List of Experiments

1. Write a program to implement CPU scheduling for first come first serve.
2. Write a program to implement CPU scheduling for shortest job first.
3. Write a program to perform priority scheduling.
4. Write a program to implement CPU scheduling for Round Robin.
5. Write a program for page replacement policy using a) LRU b) FIFO c) Optimal.
6. Write a program to implement first fit, best fit and worst fit algorithm for memory management.
7. Write a program to implement reader/writer problem using semaphore.
8. Write a program to implement Banker's algorithm for deadlock avoidance.

PCCCSE0404P	Design and Analysis of Algorithms Lab	0L:0T:2P	2 Credits

List of Experiments

1. Write a Program to implement Insertion sort.
2. Write a Program to implement Binary Search using Divide and Conquer.
3. Write a Program to implement Quicksort.
4. Write a Program to implement shortest path algorithm.
5. Write a Program to implement Merge sort using Divide and Conquer.
6. Write a Program to implement Knapsack problem using Greedy method.
7. Write a Program to implement Prim's algorithm using Greedy method.
8. Write a Program to implement Kruskal's algorithm using Greedy method.
9. Write a Program to implement Graph Traversal: Breadth First Traversal.
10. Write a Program to implement Graph Traversal: Depth First Traversal.
11. Write a Program to implement 8-Queen's problem using Backtracking.
12. Write a Program to implement All Pairs Shortest Path Using Dynamic Programming.

PCCCSE0405P	**Core Java Lab**	**0L:0T:2P**	**2 Credits**

List of Experiments

1. **Write a program to print the table of a number**
2. **Write a program to determine the number is prime or not**
3. **Write a program to find the LCM of number**
4. **Write a program to implement stack and queue.**
5. **Write a Java package to polymorphism and interface**
6. **Write a Applet program in java to display a clock**
7. **Write a java program to add to binary numbers**
8. **Write a java program to convert a decimal number to binary number vice versa.**

Course Code: PCCCSE0501 **Course Name:** Software Engineering

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To provide the idea of decomposing the given problem into Analysis, Design, Implementation,Testing and Maintenance phases.
- To gain the knowledge of how Analysis, Design, Implementation, Testing and Maintenanceprocesses are conducted in a software project.

Course Description:

The basic objective of software engineering is to develop methods and procedures for software development that can scale up for large systems and that can be used consistently to produce high-quality software at low cost and with a small cycle of time.

Course Contents:

Unit-I

Introduction to Software Engineering, Software Components, 8 Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative

Unit-II

Software Requirement Specifications (SRS)

Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document.

Unit-III

Software Design: Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

Unit-IV

Software Testing:Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies:

Unit-V

Software Maintenance and Software Project Management 8 Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO)

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- Students will be able to decompose the given project in various phases of a lifecycle.
- Students will be able to choose appropriate process model depending on the user requirements
- Students will be able perform various life cycle activities like Analysis, Design, Implementation, Testing and

Maintenance

- Students will be able to know various processes used in all the phases of the product.

Text books:

- R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
- Rajib Mall, Fundamentals of Software Engineering, PHI Publication.

Reference books:

- K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.
- Pankaj Jalote, Software Engineering, Wiley
- Deepak Jain,"Software Engineering:Principles and Practices",Oxford University Press

.**Online links for study & reference materials:**

https://nptel.ac.in/courses/106/105/106105182/

Assessment method:(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PCCCSE0502 **Course Name:** Database Management System

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data ware housing.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Description:

Focuses on concepts and structures necessary to design and implement a database management system. Various modern data models, data security and integrity, and concurrency are discussed. An SQL database system is designed and implemented as a group project.

Course Contents:

Module 1: Database system architecture: DataAbstraction,DataIndependence,DataDefinition Language(DDL), Data Manipulation Language(DML).
Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulationoperations.
Module 2: Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver.
Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Losslessdesign.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Module 3: Storage strategies: Indices, B-trees, hashing.

Module 4: Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Module 5: Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Module 6:
Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Course Learning Outcomes (CLOs):

CLO1. For a given query write relational algebra expressions for that query and optimize the developed expressions
CLO2. For a given specification of the requirement design the databases using E R method and

normalization.

CLO3. For a given specification construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.

CLO4. For a given query optimize its execution using Query optimization algorithms

CLO5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

CLO6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Text books :

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts" , 6th Edition, McGraw-Hill, 9780078022159, 0078022150.

Reference books :

1 J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1, Computer SciencePress, 788175155459, 8175155450
2 R. Elmasri and S. Navathe, "Fundamentals of Database Systems" , 5th Edition, PearsonEducation 9788131716250, 8131716252
3 Serge Abiteboul, Richard Hull, Victor Vianu,Addison-Wesley "Foundations of Databases", 9780201537710, 0201537710

Online links for study & reference materials:

https://www.geektonight.com/database-management-systems-notes-pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PCCCSE0503 **Course Name:** Formal Languages and Automata

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- Develop a formal notation for strings, languages and machines.
- Design finite automata to accept a set of strings of a language.
- Prove that a given language is regular and apply the closure properties of languages.
- Design context free grammars to generate strings from a context free language and convert them into normal forms.
- Prove equivalence of languages accepted by Push down Automata and languages generated by context free grammars
- Identify the hierarchy of formal languages, grammars and machines.
- Distinguish between computability and non-computability and Decidability and Undecidability.

Course Description:

- The course introduces fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.

Course Contents:

Unit – I Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition tabl e, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transi ion, Language of NFA, Equi valence of NFA and DFA, Minimization of Finite Automata, Distinguis hing one string from other, Myhill-Nerode Theorem

Unit – II Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

Unit – III Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammer, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Memership, Pumping lemma for CFLs.

Unit – IV Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA

Unit – V Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computerof Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

Course Learning Outcomes (CLOs):

On completion of the course students will be able to:

- **CLO-1**: Write a formal notation for strings, languages and machines.
- **CLO-2**: Design finite automata to accept a set of strings of a language.
- **CLO-3**: Determine whether the given language is regular or not.
- **CLO-4**: Design context free grammars to generate strings of context free language.
- **CLO-5**: Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars.

Text books:

- Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education .
- K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.
- Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
- Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.

Reference books:

- K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education.
- Harry R. Lewis and Christos H. Papadimitriou, Elements of the theory of Computation, Second Edition, Prentice-Hall of India Pvt. Ltd.
- Micheal Sipser, "Introduction of the Theory and Computation", Thomson Learning.

Online links for study & reference materials:

- https://nptel.ac.in/courses/106/106/106106049/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code : PCCCSE0504 **Course Name :** Object Oriented Programming

Course Credit Hour : 3 hr **Total Contact Hour :** 40hr

Course Objective: The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, and an appropriate framework for automated unit and integration tests.

Course Description: Object-oriented programming represents the integration of software components into a large-scale software architecture. The course focuses on the understanding and practical mastery of object-oriented concepts such as classes, objects, data abstraction, methods, method overloading, inheritance and polymorphism.

Course Contents:

Module 1: Introduction: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, importance of modeling, principles of modeling, object oriented modeling, Introduction to UML, conceptual model of the UML, Architecture.

Module II : Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class &Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams, depict a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages.

Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine , Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram.

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams

Module- III : Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations.

Structured analysis and structured design (SA/SD): Jackson Structured Development (JSD).Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance, associations encapsulation.

Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.

Module- IV : Introduction to OOP language: History, Features, Object Oriented concepts, Classes and Objects, Inheritance, Packages, Interface , abstract method and classes, Polymorphism, Inner classes, String Handling, I/O , Networking, Event Handling. Multithreading, Collection, APIs,

Module –V: Swing: Introduction to AWT, AWT v/s Swing, Creating a Swing Applet and Application. Utility of internet programming language, JDBC, The connectivity model, JDBC/ODBC Bridge, Introduction to servlets.

Course Learning Outcomes (CLOs):

CLO1. Specify simple abstract data types and design implementations, using abstraction functions to document them.

CLO2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.

CLO3. Name and apply some common object-oriented design patterns and give examples of their use.

CLO4. Design applications with an event-driven graphical user interface.

Text books :

1. Liskov, John Guttag, *Program Development in Java*, Addison-Wesley, 2001, 780201657685, 0201657686
2. E Balagurusamy, Programming with Java, McGraw-Hill Education, 9789353162337, 9353162335

Reference books :

1. James Rumbaughet. al, "Object Oriented Modeling and Design", PHI . 9788131711064, 8131711064
2. Mark Priestley "Practical Object-Oriented Design with UML", TMH .
3. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education . 9788177583724, 8177583727
4. Naughton, Schildt, "The Complete Reference JAVA2", TMH .

Online links for study & reference materials:

https://sites.google.com/a/mes.ac.in/oopm/lecture-notes

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: HSMC0501 **Course Name:** Soft skills and interpersonal Communication

Course Credit Hour:3Hr **Total Contact Hour:**20hr

Course Objective:

- The student will acquire knowledge of soft skills including motivation, leadership and interview skills.

Course Description:

- This course introduces the fundamental ofsoft skills and hard skills, it includes important insights about motivation, leadership, attitude, stress management and interpersonal communication.

Course Contents:

Unit 1: Soft Skills: An Introduction:

Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. **Self-Discovery:** Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. Positivity and Motivation:

UNIT -2: Interpersonal Communication:

Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships7through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation.**Public Speaking:** Skills, Methods, Strategies and Essential tips for effective public speaking. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective.**Non-Verbal Communication:** Importance and Elements; Body Language. **Teamwork and Leadership Skills:** Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.

UNIT -3: Interview Skills: Interviewer and Interviewee:

Resume writing in-depth perspectives. Before, During and After the Interview. Tips for Success. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. Etiquette and Manners – Social and Business. Time Management – Concept, Essentials, Tips.

UNIT – 4: Decision-Making and Problem-Solving Skills:

Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills. Conflict **Management: Conflict -** Definition, Nature, Types and Causes; Methods of Conflict Resolution. **Stress Management: Stress -** Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress**Leadership and Assertiveness Skills:** A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behavior; Assertiveness Skills.

Course Learning Outcomes (CLOs):

CLO-1: Develop the basic concept of soft skills CLO-2:

Inculcate leadership and motivational skills.

CLO-3: To understand perception, emotional development and interview skills.CLO-4:To understand group development and leadership skills

Text books:

(i) Managing Soft Skills for Personality Development –edited by B.N. Ghosh, McGraw Hill India, 2012.
(ii) English and Soft Skills – S.P. Dhanavel, Orient Black swan

Reference books:

(i) Raman, Singh – Business communication – Oxford Press
(ii) Spoken English for India, R.K. Bansal & J.B. Harrison, Orient Longman, Delhi.

Assessment method:(Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

PCCCSE0502P	Database Management System Lab	0L:0T:2P	2 Credits

LIST OF PROGRAMS

Software Required: Open Source Software - SQL

1. Introduction to MySQL, An exercise on data types in My SQL and DDL commands.
2. Exercise on DML and TCL commands.
3. Exercise on Types of Data Constraints.
4. Exercise on single and multiple table join and using Normalization.
5. Exercise on Order by and Group by Clause and Data arithmetic.
6. Exercise on different functions(Aggregate, math, string)
7. Exercise on Different types of Sub queries.

PCCCSE0504P	Object Oriented Programming Lab	0L:0T:2P	2 Credits

List Of Practical

1. To become familiar with classes that represents entities that can interact with the user.

2. To successfully write simple programs that involve if statements.

3. To gain practice in the use of Boolean operators like && and ||.

4. Write a program to implement 4 types of pyramid.

5. Write a new program called Options that will request that the user enter an integer and then will display the message positive, negative or zero. If the value that was entered was greater than zero, less than zero, or equal to zero, respectively.

6. Write a simple program implement constructor.

7. Write a program to implement inheritance.

8. Write a program to implement function overloading.

Course Code: PCCCSE0601 **Course Name:** Compiler Design

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To understand and list the different stages in the process of compilation.
- Identify different methods of lexical analysis
- Design top-down and bottom-upparsers
- Identify synthesized and inheritedattributes
- Develop syntax directed translationschemes
- Develop algorithms to generate code for a targetmachine

Course Description:

- The aim is to learn how to design and implement a compiler and also to study the underlying theories. The main emphasis is for the imperative language. Introduction: Phases of compilation and overview.
- Compilers and translators. Algorithms and implementation techniques for type-checking, code-generation and optimization. Students will implement static analysis type checking, and optimization.

Course Contents:

Module 1:**Introduction to Compiling**: Compilers, Analysis-synthesis model, The phases of the compiler, Cousins of the compiler. **Lexical Analysis :**The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, lexical analyzer generator (Lex).

Module II : Syntax Analysis: The role of a parser, Top down Parsing, Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR,CLR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.**Syntax directed translation:** Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions.

Module III: **Type checking** :Type systems, Specification of a simple type checker.
Run time environments: Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables.

Module IV: **Intermediate code generation** :Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples). **Code optimization** :Introduction, Basic blocks & flow graphs, Transformation of basic blocks, DAG representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization. **Code generations** :Issues in the design of code generator, Register allocation & assignment.

Course learning outcomes:

1. For a given grammar specification develop the lexical analyser
2. For a given parser specification design top-down and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

Suggested books:

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman.- Compilers Principles, Techniques, and Tools, 2nd Edition, Pearson Education, New Delhi, 2006

Suggested reference books:

1. A.I.Holub -Compiler Design in C, Prentice Hall of India, New Delhi, 1995
2. J.P. Tremblay - The Theory and Practical of Compiler Writing, McGraw Hill, Singapore, 1993.
3. K.C. Louden- Compiler Construction: Principles and Practice, Thomson Learning, New Delhi, 2005.
4. Chattopadhyay , S- Compiler Design (PHI)

Online links for study & reference materials:

1. NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PCCCSE0602 **Course Name:** Computer Networks

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming
- To provide a WLAN measurement ideas.

Course Description:

- The course covers the basic and advanced concepts and techniques of Computer Networks from both theoretical and practical perspective. The material includes Data communication Components, Data Link Layer and Medium Access Sub Layer, Network Layer, Transport Layer and Application Layer. The students will be able to understand almost all algorithms required to understand real world network issues.

Course Contents:

Unit-1
Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit-2
Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA.

Unit-3
Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routingprotocols.

Unit-4
Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit-5:
Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

Course Learning Outcomes (CLOs):

- **CLO-1**: Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
- **CLO-2:** For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.

- **CLO-3**: For a given problem related TCP/IP protocol developed the network programming.
- **CLO-4**: Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Text books:

- BehrouzA. Frozen, Data Communication and Networking, 4th Edition, McGraw- Hill.
- William Stallings, Data and Computer Communication, 8th Edition, , Pearson Prentice Hall India.

Reference books:

- Andrew S. Tanenbaum , Computer Networks, 8th Edition, , Pearson New International Edition.
- Douglas Comer , Internetworking with TCP/IP, Volume 1, 6th Edition , Prentice Hall of India.
- Richard Stevens , TCP/IP Illustrated, Addison-Wesley, United States o f America.

Online links for study & reference materials:

https://nptel.ac.in/courses/106/105/106105183/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: OEC0601 **Course Name:** Operation Research
Course Credit: 4hr **Total Contact Hour:** 40hr

Course Objective:
This course aims at familiarizing the students with quantitative tools and techniques, which are frequently applied to business decision-making & to provide a formal quantitative approach to problem solving and an intuition about situations where such an approach is appropriate.

Course Description:
Operations research helps in solving problems in different environments that needs decisions. The module cover topics that include: linear programming, Transportation, Assignment, and CPM/ MSPT techniques. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments.

Course Contents:

Unit-I

Introduction: Basics of Operations Research, Linear Programming Introduction and Scope, Problem formulation, Graphical Method, Simplex methods, primal and dual problem sensitivity analysis.

Unit-II

Transportation and Assignment problems. Deterministic Dynamic Programming, Multistage decision problems and solution, Principle of optimality.

Unit-III

Decision theory: Decision under various conditions. Game Theory Two Person, Zero sum game, Solution with / without Saddle point, Dominance Rule, Different Methods, like Algebraic, Graphical, Liner Programming, Sequencing-Basic assumption, n Jobs through two / three machines, Jobs on m machines.

Unit-IV

Inventory: Stochastic inventory models Single and multi-period models with continuous and discrete demands, Service level and reorder policy Simulations Use, advantages and limitations, Monte-carlo simulation, Application to queuing, inventory and other problems.

Unit-V

Queuing Models: Characteristics of Queuing Model, M/M/1 and M/M/S system, cost consideration Project Management: Basic concept, Rules for drawing the network diagram, Applications of CPM and PERT techniques in Project planning and control; crashing of operations; resource allocation.

Course Learning Outcomes (CLOs):
On successful completion of the course, students will be able to achieve the following:

- Apply operations research techniques like L.P.P, scheduling and sequencing in Industrial optimization problems.
- Solve Transportation and Assignment Problems with the help of operation research techniques and illustrate the use Of Operation Research tools in a wide range of applications in industries.
- Understand the usage of game theory and Simulation for Solving Business Problems.
- Simulate different real life probabilistic situations using Monte Carlo simulation technique.
- Analyse various OR models like Inventory, Queuing, Replacement, Simulation, Decision etc. and apply them for optimization.

Text books:

- Hira D S and Gupta P K, (2007), Operations Research, S. Chand & Sons.
- Hamdy Taha, (2009), Operations Research: An Introduction, Pearson Education Inc

Reference books:

- Panneerselvan. R. (2006), Operation Research, Prentice Hall of India Pvt Ltd.
- Kanti Swarup, Gupta P.K., and Manmohan, (2004), Operations Research, S.Chand & sons.
- P. Chattopadhyay Boiler Operation Engineering: Questions and Answers 3rd Edition Tata McGraw Hill.

Online links for study & reference materials:
https://nptel.ac.in/courses/112/106/112106134/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: VAC0601 **Course Name:** Value Added Course
Course Credit Hour: 2 Hr **Total Contact Hour:30**hr

Course Objective:

- **The objective of this to provide the exposure to students to gain the knowledge of modern and latest technology.**
- **The course offers the advance theme of latest technological topic to the students.**

Course Content:

The content of the course is designed at the time of start of this course. The contents will include the following.

- **Lecture and expert talk**
- **Conceptual Experiment on the basis of talk**
- **Group discussion**
- **Debate**
- **Quiz**
- **Written exam**

PCCCSE601P	**Compiler Design lab**	**0L:0T: 2P**	**2 credits**

LIST OF EXPERIMENTS

1. Write a program to check whether string is accepted or not for entered grammar.
2. Write a program to convert infix to postfix notation.
3. Write a program to convert infix to prefix notation.
4. Write a program to convert regular expression of NFA.
5. Write a program to convert NFA to DFA.
6. Write a program to calculate LEADING and TRAILING of a grammar.
7. Write a program to calculate FIRST and FOLLOW of a grammar.
8. Write a program to implement shift reduce parser.
9. Write a program to implement top down parser.

PCCCSE602P	**Computer Networks Lab**	**0L:0T: 2P**	**2 credits**

List of Experiments

1. Study of different types of Network cables and practically implements the cross wired cable and straight through cable using clamping tool.

2. To implement & study the peer to peer connection using Cisco packet tracer.

3. To implement & study the bus topology using Cisco packet tracer.

4. To implement & study the star topology using Cisco packet tracer.

5. To implement & study the ring topology using Cisco packet tracer.

6. To implement & study the mesh topology using Cisco packet tracer.

7. To implement and configuration the given network topology having single router through graphical user interface using Cisco Packet Tracer.

8. To implement and configuration the given network topology having single router through command line interface using Cisco Packet Tracer.

9. To implement and configuration the given network topology having multiple routers through graphical user interface using Cisco Packet Tracer.

10. To implement and configuration the given network topology having multiple routers through command line interface using Cisco Packet Tracer.

Course Code: OEC0701 C**ourse Name:** Organizational Behavior & Industrial Psychology

Course Credit Hour:3hr Total Contact Hour:40hr

Course Objective:

Course Description:

- The student will acquire knowledge of human psychology including workplace environment,
  Motivation and perception.
- This course introduces the fundamental of human psychology includes important insightsabout motivation, leadership, perception and work environment.

Course Contents:

Unit 1:Introduction to Psychology(5 lectures)

Definitions & Scope. Types and branches of psychology Major influence on Psychology-Scientific Management and Human relations -Hawthorne Experiments. Taylor Principles, Implications of Psychology on Modern Industries and behavior

Unit 2: Individual at workplace (5lectures)

Attention and Perception, Individual at Workplace-Attitude, Motivation and Job satisfaction. Stress management. Leadership and Group dynamics.

Unit 3: Work Environment & Engineering Psychology-(5 lectures)

Engineering psychology: fatigue, Monotony, Boredom. Accidentsand Safety. Emotional and social development, Cognitive development. Consumer behavior analysis.

Unit 4:Job Analysis (5 lectures)

Job Analysis, Recruitment, Selection and Interview– Reliability & Validity of recruitment tests. Performance Management: Training & Development, Appraisals.

Course Learning Outcomes (CLOs):

CLO-1: Develop the basic concept of human

psychology.CLO-2: Inculcate leadership and

motivational skills.

CLO-3: To understand consumer behavior and emotional development.

CLO-4:To understand about job recruitment process and interviews methods.

Text books:

(i) Aamodt, M.G. (2007) Human/Organizational Psychology: An Applied Approach (5th edition)Wadsworth/Thompson: Belmont, C.A.
(ii) Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi: Tata McGraw Hill.

Reference books:

(i) Miner J.B. (1992) Organizational Psychology. N Y: McGraw Hill.
(ii) Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBSPublication.

Assessment method:(Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

C**ourse Code:** OECCSE0801 **Course Name:** Cyber Law & Ethics

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To understand Cyber Laws and its evolution in Computer Technologies
- To Understand and analyze Information Technology Act.
- To understand cyber laws and related Legislation.
- To understand electronics business and legal issues associated with it.
- Study based on Cyber crime.

Course Description:

- Write a brief summary indicating how this will be conducted specifying the key topics of thewhole course.
- Write about 4 to 5 lines or till 7 lines, if some course description demands.

Course Contents:

UNIT – I

Introduction to Cyber Law Evolution of Computer Technology : Emergence of Cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

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UNIT – II

Information technology Act : Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

UNIT – III

Cyber law and related Legislation : Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

UNIT – IV

Electronic Business and legal issues: Evolution and development in E- commerce, paper vs paper less contracts E-Commerce models- B2B, B2C,E security. **Application area:** Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

UNIT – V

Case Study On Cyber Crimes: Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking.

Course Learning Outcomes (CLOs):

At the end of this course students will be able to

- CLO-1: Understand the concept of cyber law and it evolution in computer technology
- CLO-2: Understand Information Technology Act in detail.
- CLO-3: Understand cyber laws and related Legislation.
- CLO-4: Relate electronics business with its legal issues associated with cyber laws.
- CLO-5: Understand real problems through case studies based on cyber law incidents.

Text books:

- K.Kumar "Cyber Laws :Intellectual Property & E Commerce Security, Dominant Publisher
- Rondey D. Ryder, Guide to Cyber Laws, Wadhwa & Company, New Delhi.
- Information Security Policy & Implementation Issues, NIIT, PHI.

Reference books:

- Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, Edition, PHI.
- Sharma, S.R., "Dimensions Of Cyber Crime", Annual publications Pvt. Ltd-2004

Online links for study & reference materials:

https://nptel.ac.in/courses/106/106/106106129/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: OECCSE0802 **Course Name**: Software Project Management

Course Credit Hour: 5 hr **Total Contact Hour**: 48 hr

Course Objectives (COs):

- In this Software Project Management course, students will master essential principles and practices for successful software project execution. Through comprehensive understanding and practical application, they will learn to analyze, mitigate risks, and integrate Agile methodologies to evaluate and achieve project success.

Course Description:

- This course provides a concise overview of software project management principles and practices. It covers essential topics related to project planning, execution, and monitoring, as well as risk management and Agile methodologies.

Course Contents:

Unit 1: Introduction to Software Project Management
Definition and importance of software project management, Project stakeholders and their roles, Project success criteria, Project selection and feasibility analysis, Project charter and scope definition.

Unit 2: Project Planning and Execution
Work breakdown structure (WBS), Estimation techniques (PERT, COCOMO), Project scheduling (Gantt charts), Resource allocation and leveling, Project execution processes, Team formation and leadership.

Unit 3: Project Monitoring and Control
Progress tracking and control, Change management, Quality planning and assurance, Metrics and measurements, Configuration management.

Unit 4: Risk Management
Risk identification and analysis, Risk mitigation strategies, Risk monitoring and response, Project recovery, Integration of risk management into project processes.

Unit 5: Agile Project Management
Introduction to Agile methodologies (Scrum, Kanban), Agile project planning and execution, User stories and backlog management, Agile team roles and responsibilities, Challenges and benefits of Agile.

Course Learning Outcomes (CLOs):

On completion of the course students will be able to:
CLO1: Achieve a deep understanding of fundamental software project management concepts and stakeholder roles.
CLO2: Apply project management skills effectively in planning, executing, and monitoring software projects.
CLO3: Identify, analyze, and mitigate risks while seamlessly integrating risk management practices into project processes.
CLO4: Evaluate and implement Agile methodologies, enhancing project planning and execution for improved outcomes.

Text Books

1. "Software Project Management" by Bob Hughes and Mike Cotterell
2. "Agile Estimating and Planning" by Mike Cohn
3. "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" by Harold Kerzner
4. “Information Technology Project Management” by Kathy Schwalbe

Reference Books

1. "Effective Project Management: Traditional, Agile, Extreme" by Robert K. Wysocki
2. "Risk Management for IT Projects: How to Deal with Over 150 Issues and Risks" by Bennet Lientz and Lee Larssen

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

LIST OF ELECTIVES

Thread 1: Theory & Algorithms		
Elective(s)	**Subject Code**	**Subject Name**
Elective I	PEC-CS-T 501	Graph Theory
Elective II	PEC-CS-T 601	Advanced Algorithms
Elective III	PEC-CS-T 602	Parallel & Distributed Algorithms
Elective IV	PEC-CS-T 701	Computational Complexity
Elective V	PEC-CS-T 702	Computational Complexity
Elective VI	PEC-CS-T 703	Queuing Theory & Modeling
Additional Subject (can replace with any elective from the same thread): Theory Of Computation		

Thread 2: Systems		
Elective(s)	**Subject Code**	**Subject Name**
Elective I	PEC-CS-S 501	Advanced Computer Architecture
Elective II	PEC-CS-S 601	Software Engineering
Elective III	PEC-CS-S 602	Distributed Systems
Elective IV	PEC-CS-S 701	Embedded Systems
Elective V	PEC-CS-S 702	Advanced Operating Systems
Elective VI	PEC-CS-S 703	Low Power Circuit & Systems
Additional Subject (can replace with any elective from the same thread): Fault Tolerant Computing		
Thread 3: Data Science & Machine Intelligence		
Elective(s)	**Subject Code**	**Subject Name**
Elective I	PEC-CS-D 501	Artificial Intelligence
Elective II	PEC-CS-D 601	Machine Learning
Elective III	PEC-CS-D 602	**Data Mining
Elective IV	PEC-CS-D 701	Soft Computing
Elective V	PEC-CS-D 702	Speech and Natural Language Processing
Elective VI	PEC-CS-D 703	**Data Analytics

Thread 4: Applications		
Elective(s)	**Subject Code**	**Subject Name**
Elective I	PEC-CS-A 501	Image Processing
Elective II	PEC-CS-A 601	Digital Signal Processing
Elective III	PEC-CS-A 602	**Cloud Computing
Elective IV	PEC-CS-A 701	Human Computer Interaction
Elective V	PEC-CS-A 702	Electronic Design Automation
Elective VI	PEC-CS-A 703	Computer Graphics

Thread 1: Theory & Algorithms

Course Code: PEC-CS-T 501 **Course Name: Graph Theory**
Course Credit: 3hr **Total Contact Hour:** 40 HRS

Course Objective:

Graph Theory is one of the essential tools for learning Technology, Engineering and Sciences. In this course students will come across several theorems and proofs. This course is aimed to cover a variety of different problems in Graph Theory. Theorems will be stated and proved formally using various techniques.

Course Description:

Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-flow max-cut algorithm

Course Contents:

Unit-I

Predicate Calculus: Proposition, Logical operators and expressions, predicates, Rules of quantifiers. Rules of Inference for propositions and predicates.

Unit-II

Lattices: Relation, Poset, Hasse diagram, Lattice as Poset Properties of lattices, Lattice as an algebraic system, Duality.

Unit-III

Concepts of Graphs and Trees: Definition of a graph theory, incidence and degree, walks, paths, circuits, Connectedness, Eulerian and Hamiltonian graphs, Trees, basic properties of trees, Binary trees Spanning and Minimal spanning trees

Unit-IV

Matrix representations and Graph Algorithms: Connectivity and Separability, fundamental circuits and cut sets Isomorphism of graphs: 1 and 2-isomorphism Matrix representation of graphs, adjacency and incidence matrix Graph theoretical algorithms: Dijkstra, prims and Kruskal.

Unit-V

Planar graphs and their properties: Planarity of graphs, Planar graphs Stereographic projection and embedding on a sphere Kurtowski's two graphs, Euler's formula, Detection of planarity and elementary reduction

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- Apply concept of Predicate Calculus in computer science like design of computing machines, artificial intelligence, definition of data structures for programming languages etc. (Application)
- Understand the concepts of graph theory, Lattices, and Boolean Algebrain analysis of various computer science applications. (Knowledge, Comprehension)

- Apply the knowledge of Boolean algebra in computer science for its wide applicability in switching theory, building basic electronic circuits and design of digital computers. (Knowledge, Application)

Text books:

- Rosen Kenneth: Discrete mathematics and its applications. McGraw hill- New Delhi. 2. Stanat and McAlister: Discrete Mathematics for Computer Science, PHI

Reference books:

- Kolman and R.C. Busby: Discrete mathematical structures for computer science Prantice Hall, New-Delhi.
- J.P. Tremblay and Manohar: Discrete mathematical structures with application to Computer Science, McGraw hill- New Delhi.

Online links for study & reference materials:

https://nptel.ac.in/courses/111/106/111106102/

Assessment method:(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC- CS-T 601 **Course Name:** Advanced Algorithms
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

Course Description:

This course is concerned with the study of algorithms for solving practical problems efficiently, and the theoretical analysis of their behavior. There will also be a brief introduction to complexity theory, the formal study of algorithm performance. A large variety of algorithms are candidates for study. These include, but are not limited to, the following: greedy algorithms, dynamic programming, network flow algorithms, algorithms for string matching, parallel algorithms, graph algorithms and approximation algorithms.

Course Contents:

Unit-I

Sorting: Review of various sorting algorithms, topological sorting
Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis..

Unit-II

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

Unit-III

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.
Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations,LUP-decomposition

Unit-IV

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programmingparadigm. More examples of dynamic programming.
Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm

Unit-V

Linear Programming: Geometry of the feasibility region and Simplex algorithm

NP-completeness: Examples, proof of NP-hardness and NP-completeness.

One or more of the following topics based on time and interest
Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

Unit-VI

Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- Argue the correctness of algorithms using inductive proofs and invariants.
- Analyze worst-case running times of algorithms using asymptotic analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.

Text books:

- Dasgupta, Sanjoy, Christos Papadimitriou, and Umesh Vazirani. Algorithms. McGraw-Hill, 2006. ISBN: 9780073523408.
- Kleinberg, Jon, and Eva Tardos. Algorithm Design. Addison-Wesley, 2005. ISBN: 9780321295354.

Reference books:

- Even, Shimon. *Graph Algorithms*. Computer Science Press, 1979. ISBN: 9780914894216.

Online links for study & reference materials:

https://nptel.ac.in/courses/106/105/106105157/

Assessment method:(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC- CS- T 602 **Course Name:** Parallel & DistributedAlgorithms

Course Credit Hour: 3 **Total Contact Hour**: 40hr

Course Objective:

- To learn parallel and distributed algorithms development techniques for shared memory and message passing models.
- To study the main classes of parallel algorithms.
- To study the complexity and correctness models for parallel algorithms.

Course Description:

This course will cover widely used parallel and distributed computing methods, including threaded applications, GPU parallel programming, and datacenter-scale distributed methods such as MapReduce and distributed graph algorithms. We'll study the types of algorithms which work well with these techniques, and have the opportunity to implement some of these algorithms. We'll also look at the types of hardware architectures which have been developed along with these computing methods.

Course Contents:

UNIT-I

Basic Techniques, Parallel Computers for increase Computation speed, Parallel & Cluster Computing

UNIT-II

Message Passing Technique- Evaluating Parallel programs and debugging, Portioning and Divide and Conquer strategies examples

UNIT-III

Pipelining- Techniques computing platform, pipeline programs examples

UNIT-IV

Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor constructs for specifying parallelist sharing data parallel programming languages and constructs, open MP

UNIT-V

Distributed shared memory systems and programming achieving constant memory distributed shared memory programming primitives, algorithms – sorting and numerical algorithms

Course Learning Outcomes (CLOs):

CLO-1: Learn about parallel and distributed computers.
CLO-2: Write portable programs for parallel or distributed architectures using Message-Passing Interface (MPI) library
CLO-3: Analytical modeling and performance of parallel programs
CLO-4: Analyze complex problems with shared memory programming with OpenMP.

Text books:

- Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.

Reference books:

Introduction to Parallel algorithms by Jaja from Pearson, 1992.

Online links for study & reference materials:

https://www.britannica.com/science/computer-science/Parallel-and-distributed-computing

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-T 701 **Course Name: Computational Complexity**
Course Credit: 4hr **Total Contact Hour:** 48HRS

Course Objective:

Computational complexity theory is the fundamental subject of classifying computational problems based on their complexities'. In this context, `complexity' of a problem is a measure of the amount of resources

Course Description:

Computational complexity aims to understand the fundamental limitations and capabilities of efficient computation. We will use the powerful notions of reduction and completeness to establish relationships between seemingly unrelated problems, classes, and resources.

Course Contents:

Unit-I

Introduction: Easy and hard problems. Algorithms and complexity. Turing machines: Models of computation. Multi-tape deterministic and non-deterministic Turing machines. Decision problems

Unit-II

The Halting Problem and Undecidable Languages: Counting and diagonalization. Tape reduction. Universal Turing machine. Undecidability of halting. Reductions. Rice's theorem. Deterministic Complexity Classes: DTIME[t]. Linear Speed-up Theorem. P Time. Polynomial reducibility. Polytime algorithms: 2-satisfiability, 2-colourability.

Unit-III

NP and NP-completeness: Non-deterministic Turing machines. NTIME[t]. NP. Polynomial time verification. NP-completeness. Cook-Levin Theorem. Polynomial transformations: 3- satisfiability, clique, colourability, Hamilton cycle, partition problems. Pseudo-polynomial time. Strong NP-completeness. Knapsack. NP-hardness.

Unit-IV

Space complexity and hierarchy theorems: DSPACE[s]. Linear Space Compression Theorem. PSPACE, NPSPACE. PSPACE = NPSPACE. PSPACE-completeness. Quantified Boolean Formula problem is PSPACE-complete. L, NL and NLcompleteness. NL=coNL. Hierarchy theorems

Unit-V

Optimization and approximation: Combinatorial optimization problems. Relative error. Bin-packing problem. Polynomial and fully polynomial approximation schemes. Vertex cover, traveling salesman problem, minimum partition.

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- Determine whether a problem is computable, and prove that some problems are not computable
- Categorize problems into appropriate complexity classes
- Classify problems based on their computational complexity using reductions
- Analyze optimization problems using the concept of interactive proofs

Text books:

- Michael Sipser, Introduction to the Theory of Computation, (First edition - PWS Publishing Company, January 1997, or second edition - Thomson Course Technology, 2005).
- Sanjeev Arora and Boaz Barak, Computational Complexity: A Modern Approach, Cambridge University Press,2009

Reference books:

- Oded Goldreich, Computational Complexity, Cambridge University press, 2008.
- Vijay Vazirani, Approximation Algorithms, Springer--Verlag, 2001

Online links for study & reference materials:

https://nptel.ac.in/courses/106/106/106106229/

Assessment method:(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PEC-CS-T 703 **Course Name:** Queuing Theory & Modeling

Course Credit: 4 **Total Contact Hour:** 48hr

Course Objective:

The objective of a queuing model is to find out the optimum service rate and the number of servers so that the average cost of being in queuing system and the cost of service are minimized. The queuing problem is identified by the presence of a group of customers who arrive randomly to receive some service.

Course Description:

This course deals with the modeling and analysis of queuing systems, with applications in communications, manufacturing, computers, call centers, service industries and transportation. Topics include birth-death processes and simple Markovian queues, networks of queues and product form networks

Course Contents:

Unit-I

Queueing Theory: Introduction of the queuing system, Various components of a queueing system. Permutations, combinations,

Unit-II

counting, summation, generating function, recurrence relations, asymptotic. Sample space and events- Probability- The axioms of probability

Unit-III

Queuing theory- Classification, stationary process, markov process, Binomial process, Poisson process, Birth and death process, Markov chain.

Unit-IV

Markovian and non-Markovian queueing systems, embedded Markov chain applications to M/G/1, G/M/1 and related queueing systems; Networks of queues, open and closed queueing networks; Queues with vacations,

Unit-V

Priority queues, queues with modulated arrival process, discrete time queues, introduction to matrix-geometric methods, applications in manufacturing, computer and communication networks.

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- Single Server Markov Queues.
- Rigorous understanding of the theoretical background of queuing systems.
- Introduction to Queuing Systems and Notation.
- Understand and compute quantitative metrics of performance for queuing systems.
- Apply and extend queuing models to analyze real world systems.

Text books:

- D. Gross and C. Harris, Fundamentals of Queueing Theory, 3rd Edition, Wiley, 1998. (WSE Edition, 2004).
- J. Medhi, Stochastic Models in Queueing Theory, 2nd Edition, Academic Press, 2003. (Elsevier India Edition, 2006).

Reference books:

- Saaty, T.L. (1984): Elements of Queueing Theory with applications, McGraw Hill, New York.
- Jain, J.L., Mohanty, S.G. and Bohm, W. (2006): A Course on Queueing Models, Chapman & Hall/CRC.

Online links for study & reference materials:

https://nptel.ac.in/courses/117/103/117103017/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Thread 2: Systems

Course Code: PEC-CS-S 501 **Course Name: Advanced Computer Architecture**
Course Credit: 3 **Total Contact Hour:** 40HRS

Course Objective:

- Understand the Concept of Parallel Processing and its applications.
- Implement the Hardware for Arithmetic Operations.
- Analyze the performance of different scalar Computers.

Course Description:

This course is a study of the fundamental concepts in the design and organization of modern computer systems. The module aims to provide students with a fundamental knowledge of computer hardware and computer systems, with an emphasis on system design and performance.

Course Contents:

Unit-I

Pipeline and vector processing : Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

Unit-II

Computer Arithmetic : Addition and Subtraction, Hardware Implementation, Multiplication Algorithms and Hardware Implementation, Division Algorithms and Hardware Implementation, Floating Point Arithmetic Operations.

Unit-III

Parallel Computer Models : Evolution of Computer Architecture, System Attributes to Performance, Shared Memory Multiprocessors, Distributed Memory Multicomputers, Vector Super Computers, SIMD Super Computers.

Unit-IV

Processors and Memory Hierarchy : Advanced Processor Technology: Design Space of Processors, Instruction-Set Architectures, CISC scalar Processors, RISC scalar Processors, Super Scalar and Vector Processors: Superscalar Processors.

Unit-V

Pipelining and Superscalar Techniques : Linear Pipeline Processors: Asynchronous and Synchronous models, Clocking and Timing Control, Speedup, Efficiency and Throughput, Pipeline Schedule Optimization, Instruction Pipeline Design: Instruction Execution Phases, Mechanisms for Instruction Pipelining, Dynamic Instruction Scheduling, Branch Handling Techniques.

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- Understand the Concept of Parallel Processing and its applications
- Implement the Hardware for Arithmetic Operations
- Analyze the performance of different scalar Computers
- Develop the Pipelining Concept for a given set of Instructions

Text books:

- Computer System Architecture, Morris M. Mano, 3rd edition, Pearson/Prentice Hall India.
- Advanced Computer Architecture, Kai Hwang, McGraw-Hill, India.

Reference books:

- Computer Organization and Achitecture, William Stallings ,8th edition,PHI
- Computer Organization, Carl Hamachar, Vranesic,Zaky, 5th edition, McGraw Hill.

Online links for study & reference materials:

https://nptel.ac.in/courses/106/102/106102229/

Assessment method:(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-S 601 **Course Name:** Internet of Things

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- The students should be able to understand a broad overview of the essential concepts of Internet of Things.
- To familiarize students with collective network of connected devices and the technology– to lay the foundation necessary for developing applications and programming.
- Students should be able to learn about different types of Internet of Things and devices themselves.

Course Description:

- Learners with more technological experience might pursue IoT courses that take a deep dive into sensors, networks, and protocols.
- IoT course geared toward data analysis professionals may cover data management, machine learning, and cloud computing applications.
- An IoT device's frontend and backend are both programmed.

Course Contents:

Unit 1: Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability

Unit 2: Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Net duino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.

Unit 3: Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor. deployment & Node discovery, Data aggregation &dissemination.

Unit 4: Programming the Ardunio: Arduino Platform Boards Anatomy, Arduino, IDE, coding, using emulator, using libraries, additions in Arduino, programming the Arduino for IoT.

Unit 5: Challenges in IoT Design challenges: Development Challenges, Security, Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smartcards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.

Virtual Memory: Basics of Virtual Memory – Virtual memory enables data that is in RAM and not currently

being used to be transferred to the hard disk.

Suggested books:

1. "The Internet of Things" by Samuel Greengard
2. Internet of Things, The − How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World By Miller Michael.
3. Analytics for the Internet of Things (IoT) − Intelligent analytics for your intelligent devices By Andrew Minteer.

Suggested reference books:

1. "Learning Internet of Things" by Peter Waher
2. "Precision: Principles, Practices and Solutions for the Internet of Things" by Timothy Chou

Online links for study & reference materials:

1. NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-S 602 **Course Name:** Distributed Systems

Course Credit Hour: 3 **Total Contact Hour**: 40hr

Course Objective:

To provide hardware and software issues in modern distributed systems.

- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.

- To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.

Course Description: This course provides a hands-on the challenges faced in constructing client/server software: partial system failures, multiple address spaces, absence of a single clock, latency of communication, heterogeneity, absence of a trusted operating system, system management, binding and naming. Techniques for meeting these challenges: RPC and middleware, naming and directory services, distributed transaction processing, 'thin' clients, data replication, cryptographic security, mobile code. Introduction to Java RMI.

Course Contents:

Unit I

Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models. TheoreticalFoundation for Distributed System: Limitation of Distributed system, absence of global clock,shared memory, Logical clocks, Lamport's& vectors logical clocks. Concepts in Message PassingSystems: causal order, total order, total causal order, Techniques for Message Ordering, Causalordering of messages, global state, termination detection.

Unit II

Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement ofmutualexclusion theorem, Token based and non-token-based algorithms, performance metric fordistributed mutual exclusion algorithms. Distributed Deadlock Detection: system model, resourceVs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralizeddead lock detection, distributed dead lock detection, path pushing algorithms, edge chasingalgorithms.

Unit III

Agreement Protocols: Introduction, System models, classification of Agreement Problem,Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution toByzantine Agreement problem, Application of Agreement problem, Atomic Commit in DistributedDatabase system. Distributed Resource Management: Issues in distributed File Systems,Mechanism for building distributed file systems, Design issues in Distributed Shared Memory,Algorithm for Implementation of Distributed Shared Memory.

Unit IV

Failure Recovery in Distributed Systems: Concepts in Backward and Forward recovery, Recovery in Concurrent systems, Obtaining consistent Checkpoints, Recovery in Distributed Database Systems.Fault Tolerance: Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols

Unit V

Transactions and Concurrency Control: Transactions, Nested transactions, Locks, OptimisticConcurrency control, Timestamp ordering, Comparison of methods for concurrency control.Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions,

Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.

Course Learning Outcomes (CLOs):

CO1: To provide hardware and software issues in modern distributed systems.

CO2: To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.

CO3: To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.

CO4: To know about Shared Memory Techniques.

CO5: Have Sufficient knowledge about file access.

Text books:

1. Singhal&Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill

2. Ramakrishna,Gehrke," Database Management Systems", McGraw Hill

3. Vijay K.Garg Elements of Distributed Compuitng , Wiley

4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", PearsonEducation

5. Tenanuanbaum,Steen," Distributed Systems", PHI

Reference books:

1. Distributed Systems, Principles and Paradigms, Andrew S. Tanenbaum, Maarten Van Steen, 2nd Edition, PHI.

2. Distributed Systems, An Algorithm Approach, Sukumar Ghosh, Chapman&Hall/CRC, Taylor &Fransis Group, 2007.

Online links for study & reference materials:

https://www.ncertbooks.guru/computer-graphics-notes/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-S 701 **Course Name: Embedded Systems**
Course Credit: 4 **Total Contact Hour:** 48hr

Course Objective :

- To provide an overview of Design Principles of Embedded System.
- To provide clear understanding about the role of firmware , operating systems in correlation with hardware systems.

Course Description :

In this course you will learn the basics of designing, interfacing, configuring, and programming embedded systems. By the end of the course you will have mastered the basics of embedded system design and programming. This course will help to prepare you for cutting edge careers in industry and research.

Course Contents :

Unit 1

Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit 2

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Unit 3

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

Unit 4

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Unit 5

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Course Learning Outcomes (CLOs) :

- CLO1: Expected to understand the selection procedure of Processors in the Embedded domain.
- CLO2: Design Procedure for Embedded Firmware.
- CLO 3: Expected to visualize the role of Real time Operating Systems in Embedded Systems
- CLO 4. Expected to evaluate the Correlation between task synchronization and latency issues

Text books:

- Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.

Reference books:

- Embedded Systems - Raj Kamal, TMH.
- Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
- Embedded Systems – Lyla, Pearson, 2013
- An Embedded Software Primer - David E. Simon, Pearson Education.

Online links for study & reference materials :

https://nptel.ac.in/courses/108/102/108102045/
https://nptel.ac.in/courses/106/105/106105193/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PEC-CS-S 702 **Course Name :** Advanced Operating System

Course Credit Hour : 4 **Total Contact Hour :** 48hr

Course Objective:

- To learn the mechanisms of OS to handle processes and threads and their communication
- To learn the mechanisms involved in memory management in contemporary OS
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
- To know the components and management aspects of concurrency management

Course Description:

- Covers the classical internal algorithms and structures of operating systems, including CPU scheduling, memory management, and device management.
- Considers the unifying concept of the operating system as a collection of cooperating sequential processes.
- Covers topics including file systems, virtual memory, disk request scheduling, concurrent processes, deadlocks, security, and integrity.

Course Contents:

ModuleI FUNDAMENTALS OF OPERATING SYSTEMS
Overview –Synchronization Mechanisms , Processes and Threads , Process Scheduling , Deadlocks: Detection, Prevention and Recovery, Models of Resources, Memory Management Techniques.

ModuleII DISTRIBUTED OPERATING SYSTEMS
Issues in Distributed Operating System , Architecture , Communication Primitives , Lamport's Logical clocks, Causal Ordering of Messages, Distributed Mutual Exclusion Algorithms, Centralized and Distributed Deadlock Detection Algorithms, Agreement Protocols.

ModuleIII DISTRIBUTED RESOURCE MANAGEMENT
Distributed File Systems, Design Issues, Distributed Shared Memory, Algorithms for Implementing Distributed Shared memory, Issues in Load Distributing, Scheduling Algorithms, Synchronous and Asynchronous Check Pointing and Recovery, Fault Tolerance , Two-Phase Commit Protocol, Non blocking Commit Protocol , Security and Protection.

ModuleIV REAL TIME AND MOBILE OPERATING SYSTEMS
Basic Model of Real Time Systems, Characteristics, Applications of Real Time Systems , Real Time Task Scheduling, Handling Resource Sharing, Mobile Operating Systems, Micro Kernel Design, Client Server Resource Access, Processes and Threads, Memory Management , File system.

ModuleV CASE STUDIES
Linux System: Design Principles , Kernel Modules, Process Management Scheduling, Memory Management, Input-Output Management, File System, Interprocess Communication. iOS and Android: Architecture and SDK Framework , Media Layer, Services Layer, Core OS Layer, File System.

Course Learning Outcomes (CLOs):

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, and Response Time.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement file management system.

4. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Text books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall ofIndia.

Reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt,Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall ofIndia
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly andAssociates

Online links for study & reference materials:

1. NPTEL

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-S 703 **Course Name:** Low Power Circuit & Systems
Course Credit: 8 **Total Contact Hour:** 48hr

Course Objective:

- To learn fundamentals of power dissipation in microelectronic devices.
- To identify system performance and reliability

Course Description:

This course deals with issues and models to design low-power VLSI circuits, fundamentals of power dissipation in microelectronic devices, will be able to estimate power dissipation due to switching, short circuit.

Course Contents:

Unit 1

Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degreeoffreedom, recurring themes in low-power, emerging low power approaches, dynamicdissipation in CMOS, effects of Vdd& Vt on speed, constraints on Vt reduction, transistorsizing & optimal gate oxide thickness, impact of technology scaling, technologyinnovations.

Unit 2

Low Power Circuit Techniques: Power consumption in circuits, flip-flops & latches, highcapacitance nodes, energy recovery, reversible pipelines, high performance approaches.

Unit 3

Low Power Clock Distribution: Power dissipation in clock distribution, single driverversusdistributed buffers, buffers & device sizing under process variations, zero skew vs.tolerableskew, chip & package co-design of clock network.

Unit 4

Logic Synthesis for Low Power estimation techniques: Power minimization techniques,lowpower arithmetic components- circuit design styles, adders, multipliers.

Unit 5

Low Power Memory Design: Sources & reduction of power dissipation in memorysubsystem, sources of power dissipation in DRAM & SRAM, low power DRAM circuits,low power SRAM circuits.

Unit 6

Low Power Microprocessor Design System: power management support, architecturaltradeoffs for power, choosing the supply voltage, low-power clocking, implementation problemfor low power, comparison of microprocessors for power & performance.

Course Learning Outcomes (CLOs) :

At the end of this course students will demonstrate the ability to

- Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.
- Characterize and model power consumption & understand the basic analysis methods.
- Understand leakage sources and reduction techniques.

Text books:

- Gary Yeap, “Practical low power digital VLSI design”, Kluwer, 1998.

Reference books:

- P. Rashinkar, Paterson and L. Singh, “Low Power Design Methodologies”, Kluwer Academic, 2002
- Kaushik Roy, Sharat Prasad, “Low power CMOS VLSI circuit design”, John Wiley sons Inc.,2000.
- J.B.Kulo and J.H Lou, “Low voltage CMOS VLSI Circuits”, Wiley, 1999.
- A.P.Chandrasekaran and R.W.Broadersen, “Low power digital CMOS design”, Kluwer,1995

Online links for study & reference materials:
https://nptel.ac.in/courses/117/101/117101004/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Thread 3: Data Science & Machine Intelligence

Course Code: PEC-CS-D 501 **Course Name :** Artificial Intelligence

Course Credit Hour: 3 **Total Contact Hour :** 40hr

Course Objective: The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals, not on providing a mastery of specific software tools or programming environments.

Course Description: Artificial intelligence (AI) is a research field that studies how to realize the **intelligent** human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously.

Course Contents:

Module 1: Introduction: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.

Module II: Introduction to Search : Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games,Alpha - Beta pruning.

Module III: Knowledge Representation & Reasoning: Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

Module IV: Machine Learning : Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data – EM algorithm, Reinforcement learning,

Module V: Pattern Recognition : Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.

Course Learning Outcomes (CLOs):

1) Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

2) Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

3) Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

4) Demonstrate profciency developing applications in an 'AI language', expert system shell, or data mining tool.

5) Demonstrate profciency in applying scientifc method to models of machine learning.

6) Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Text books :

1. Elaine Rich and Kevin Knight, "Artificial Intelligence",McGraw-Hill
2. E Charniak and D McDermott, "Introduction to Artificial Intelligence", PearsonEducation Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall ofIndia,

Reference books :

1. A Modern Approach Third Edition Stuart Russell and Peter Norvig, 2010. Pearson Education, Inc. ISBN: 978-0-13-604259-4
2. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", PearsonEducation

Online links for study & reference materials:

1. NPTEL

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-D601 **Course Name:** Machine Learning

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- The course aims to provide basic understanding of issues and challenges of Machine Learning. It aims to train the student to the basic and advanced models and algorithms of the core field of machine learning. This course also involves understanding of the strengths and weaknesses of many popular machine learning approaches.

Course Description:

- The course covers the basic concepts and techniques of Machine Learning from both theoretical and practical perspective. The material includes Introduction to machine learning and different types of learning, Linear Regression, Decision Trees, Instance based learning, Feature Selection, Neural Network, Clustering and Support Vector Machines. The students will be able to understand almost all algorithms required to develop ML applications.

Course Contents:

Unit-1: Introduction to machine learning and different types of learning: Brief Introduction to Machine Learning; Definition, Components of a learning problem, Applications, Choosing a Model Representation, Types of learning: Supervised Learning, Unsupervised Learning, Semi-supervised learning, Reinforcement Learning, Inductive Learning or Prediction,

Unit-2: Linear Regression and Decision Trees, Instance based learning and Feature Selection: Regression, Types of Regression Models (Linear Classification, Logistic Regression, Components Regression, Bias – Variance Linear Regression Multivariate Regression etc), Dimensionality Reduction Subset Selection, Shrinkage Methods, Principle Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification, LMS Algorithm, Decision Tree, Over fitting, Instance- Based Learning, Basic k-nearest neighbor classification, kNN, Euclidean Distance, Feature Reduction in ML, Subset selection, Feature extraction, PCA

Unit-3: Probability and Bayes Learning, Support Vector Machines, Clustering: Probability for Learning, Bayes Theorem, MAP Learner, Naïve Bayes, Bayesian Network, Logistic Regression for classification, Support Vector Machines, Unsupervised learning, Partitioning Algorithms, Hierarchical Clustering, Density based Clustering, K-means algorithm.

Unit-4: Neural Network: Neuron, ANNs, Perceptrons, Gradient Descent, Early models, Back propagation, Initialization, Training & Validation, Parameter Estimation (Maximum Likelihood Estimation, Bayesian Parameter Estimation) Decision Trees Evaluation Measures, Hypothesis Testing Ensemble Methods, Graphical, Deep Learning, Deep Neural Network, Hierarchical Representation, Unsupervised Pre-training, Activation Functions.

Unit-5: Clustering, Gaussian Mixture Models, Spectral Clustering Ensemble Methods Learning Theory, Reinforcement Learning.

Course Learning Outcomes (CLOs):

On completion of the course students will be expected to

- **CLO-1**: Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity etc,

- **CLO-2**: Have an understanding of the strength and weaknesses of many popular machine learning approaches.
- **CLO-3**: Appreciate the underlying mathematical relationship within and across Machine Learning Algorithms and the paradigm of supervised and un-supervised learning.
- **CLO-4**: Be able to design various machine learning algorithms in a range of real world applications.

Text books:

- Alpaydin E, Machine Learning, MIT Press.
- Bishop C, Pattern Recognition and Machine Learning, Springer-2006.
- Duda R, Hart E and Stork D, Pattern Classification, Wiley-Interscience.
- Mitchell T, Machine Learning, McGraw-Hill.

Reference books:

- Hastie T, Tibshirani R and Friedman J, Elements of Statistical Learning, Springer-2017.
- T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e,
- Christopher Bishop. Pattern Recognition and Machine Learning. 2e.

Online links for study & reference materials:

https://onlinecourses.nptel.ac.in/noc21_cs24/preview

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-D 602 **Course Name:** Data Mining

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To identify the scope and essentiality of Data Mining.
- To analyze data, choose relevant models and algorithms for respective applications.
- To study spatial and web data mining.
- To develop research interest towards advances in data mining.

Course Description:

- Data mining refers to a set of techniques that have been designed to efficiently find interesting pieces of information or knowledge in large amounts of data.
- In this course we explore how this interdisciplinary field brings together techniques from databases, statistics, machine learning, and information retrieval

Course Contents:

Module 1: **FUNDAMENTALS:** Relation to Statistics – Databases – Data Mining Functionalities – Steps in Data Mining Process– Architecture of Typical Data Mining Systems –Classification of Data Mining Systems– Overview of Data Mining Techniques.

Module 2: DATA PREPROCESSING AND ASSOCIATION RULES

Data Preprocessing – Data Cleaning – Integration – Transformation – Reduction –Discretization Concept Hierarchies – Concept Description Data Generalization and Summarization Based Characterization – Mining Association Rules in Large Databases.

Module 3: PREDICTIVE MODELING

Classification and Prediction Issues Regarding Classification and Prediction –Classification by Decision Tree Induction – Bayesian Classification – Other Classification Methods– Prediction –Clusters Analysis – Types of Data in Cluster Analysis – Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical Methods.

Module 4: DATA WAREHOUSING

Data Warehousing Components – Multi Dimensional Data Model – Data Warehouse Architecture – Data Warehouse Implementation – Mapping the Data Warehouse to Multiprocessor Architecture – OLAP – Need – Categorization of OLAP Tools.

Course learning outcomes:

- Understand Data Mining data warehouse Principles
- Identify appropriate data mining algorithms to solve real world problems
- Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining
- Describe complex data types with respect to spatial and web mining.
- Benefit the user experiences towards research and innovation. integration.

Suggested books:

1. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, 2002.

Suggested reference books:

1. Alex Berson, Stephen J Smith, “Data Warehousing, Data Mining & OLAP”, Tata Mcgraw Hill, 2004.

2. Usama M. Fayyad, Gregory Piatetsky , Shapiro, Padhrai Smyth and Ramasamy Uthurusamy," Advances In Knowledge Discovery And Data Mining", The M.I.T Press, 1996.

3. Ralph Kimball, "The Data Warehouse Life Cycle Toolkit", John Wiley& Sons Inc., 1998.

4. Sean Kelly, "Data Warehousing In Action", John Wiley & Sons Inc., 1997.

Online links for study & reference materials:

1. NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PEC-CS-D 701 **Course Name:** Soft Computing

Course Credit Hour: 4hr **Total Contact Hour:** 48hr

Course Objective:

1. To make the student to understand the role of imprecision and uncertainty in real world scenarios.
2. To explain the role of Soft Computing in addressing the imprecision and uncertainty.
3. To explain the principal components of soft computing that include Fuzzy Sets and Fuzzy Logic, Artificial Neural Networks, Genetic Algorithms and Rough Sets.
4. To learn the Design and Implementation of Soft Computing methodologies.
5. To explain the design of hybrid systems which is combination of one or more soft computing methodologies mentioned.

Course Description:

This **course** will provide students the basic concepts of different methods and tools for processing of uncertainty in intelligent systems, such as, **fuzzy** models, **neural networks**, probabilistic models, and foundations of its using in real systems.

Course Contents:

Module 1 Soft Computing: Introduction to Fuzzy Computing, Neural Computing, GeneticAlgorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques,Usefulness andApplications.

Module 2. Fuzzy Sets and Fuzzy Logic: Introduction, Fuzzy Sets Versus Crisp Sets, Operations on FuzzySets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, LinguisticVariables, Fuzzy Logic, Linguistic Hedges,Applications,

Module 3. Interference in fuzzy logic: fuzzy if-then rules, Fuzzy implications and Fuzzyalgorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Fuzzy Controllers, FuzzyPattern Recognition, Fuzzy Image Processing, Fuzzy Database. **Artificial Neural Network**: Introduction, Artificial Neuron and its model, activationfunctions, Neural network architecture: single layer and multilayer feed forward networks,re-current networks. Various learning techniques, perception and convergence rule, Auto-associativeand hetro-associative memory , Hebb's Learning, Adaline,Perceptron

Module 4. Multilayer Feed Forward Network: Back Propagation Algorithms, Different IssuesRegarding Convergence of Multilayer Perceptron, Competitive Learning, Self- Organizing, FeatureMaps, Adaptive Resonance Theory, Associative Memories,Applications. **Evolutionary and Stochastic Techniques:** Genetic Algorithm (GA), GeneticRepresentations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis ofSelection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence ofGenetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine,Applications.

Module 5. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reductionof Knowledge, Decision Tables and Applications. Hybrid Systems: Neural- Network-BasedFuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Designand Learning, Fuzzy Logic and Genetic Algorithm for Optimization,Applications

Course learning outcomes:

1. Ability to represent Uncertainty / imprecision data.
2. Ability to select a suitable method of Soft Computing to solve a particular problem.

3. Ability to build hybrid systems using Soft Computing techniques.

TextBooks:

1. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S.Rajsekar an and G.A. Vijayalakshmi Pai, Prentice Hall ofIndia.
2. Rough Sets, Z.Pawlak, Kluwer Academic Publisher,1991.
3. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher,1997

References:

1. Artificial Intelligence and Intelligent Systems, N.P.Padhy, Oxford University Press.
2. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice HallPTR. Addison-Wesley
3. Learning and Soft Computing, V. Kecman, MIT Press,2001
4. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI,1997

Online links for study & reference materials:

1. NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PEC-CS-D 702 **Course Name:** Speech & Natural Language Processing

Course Credit Hour: 4hr **Total Contact Hour:** 48hr

Course Objective: This course introduces the fundamental concepts and techniques of natural language processing (NLP). Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information. The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.

Course Description: **NLP** tasks in syntax, semantics, and pragmatics. Applications such as **information** extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning.

Course Contents:

Module I Introduction: Knowledge in speech and language processing, Ambiguity, Models and Algorithms, Brief History Regular Expressions and Automata: Regular Expressions, Finite-State Automata, Regular Languages and FSA Morphology and Transducers: Inflectional and derivational morphology, finite state morphological parsing, Combining FST Lexicon and rules. Lexicon free FST: Porter Stemmer N-grams: Counting Words in Corpora, SIMPLE (UNSMOOTHED) N-GRAMS, Smoothing, Entropy HMM and Speech Recognition: Speech Recognition Architecture, Overview of HMM, A* decoding .

Module II Word Classes and Part-of-Speech Tagging: English word classes, Targets for English, Part of speech Tagging, Rule Based part of speech Tagging, Transformation Based Tagging. Context Free Grammars for English: Constituency, Context Free rules and Trees, Sentence level construction, The Noun Phrase, Coordination, Agreement, The verb phrase and sub-categorization. Spoken Language Syntax, Grammar Equivalence and Normal form, Finite state context free grammars, Grammar and human processing. Parsing with context free grammars: Parsing as Search, Basic Top down Parser, Problems with basic top-down-parsers, the early Algorithm, Finite state parsing method Features and Unifications: Feature structures, Unification of Features Structures, Features Structures in the grammar, Implementing Unification. Lexicalized and probabilistic parsing: Probabilistic context free grammars, problems with probabilistic context free grammars, probabilistic lexicalized GFG.

Module III Semantics Representing Meaning: Computational Desiderata for representation, Meaning structure of language, First order predicate calculus, linguistically relevant concept, Related Re-presentational approaches, Alternative approaches to meaning. Semantic Analysis: Syntax driven semantic analysis, Attachment of Fragment of English, Integrating semantic analysis with early parser. Robust Semantic Analysis. Lexical Semantics: Relation among lexemes and their senses, Internal Structure of words.

Module IV Pragmatics Discourse: Reference resolution, Text Coherence, Discourse Structure, Psycholinguistics Studies of reference and coherence. Natural Language generation: Introduction to language generation, Architecture for generation, Surface realization, Discourse planning, Macro planning, Lexical selection, evaluating generation systems, generating speech

Course learning outcomes:

After successful completion of this course, student will be able to

1. Understand approaches to syntax and semantics in NLP.
2. Understand approaches to discourse, generation, dialogue and summarization within NLP.
3. Understand current methods for statistical approaches to machine translation.
4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

Text books:

1. Speech and Language processing An introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jurafsky and James H. Martin (ISBN13: 978-0131873216)
2. 2. Natural Language Processing with Python by Steven Bird, Ewan Klein, Edward Lopper(ISBN13:978-0596516499)

Reference book:

1. Handbook of Natural Language Processing, Second Edition—NitinIndurkhya, Fred J. Damerau, Fred J. Damerau (ISBN13: 978-1420085921)

Online links for study & reference materials:

1. **NPTEL**

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-D 703 **Course Name:** Data Analytics

Course Credit Hour: 4hr **Total Contact Hour:** 48hr

Course Objective:

- To provide an overview of an exciting growing field of big data analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSqlMapReduce.
- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Course Description:

- This course prepares students to gather, describe, and analyze data, and use advanced statistical tools to make decisions on operations, risk management, finance, marketing, etc.
- Analysis is done targeting economic and financial decisions in complex systems that involve multiple partners. Topics include probability, statistics, hypothesis testing, regression, clustering, decision trees, and forecasting.

Course Contents:

Module 1: Big Data and its Importance– Four V's of BigData– DriversforBigData– IntroductiontoBigDataAnalytics– BigDataAnalyticsapplications, Hadoop's Parallel World–Data discovery Opensourcetechnology for Big Data Analytics–cloud and Big Data–PredictiveAnalytics– MobileBusinessIntelligenceandBigData–CrowdSourcing Analytics–Inter-andTrans-FirewallAnalytics-InformationManagement.

Module2: Integratingdisparatedatastores-Mappingdatatotheprogrammingframework- Connecting and extracting data from storage -Transforming data for processing – SubdividingdatainpreparationforHadoopMapReduce, Hadoop Map Reduce-Creating the componentsofHadoop.

Module3: MapReducejobs-Distributingdataprocessingacrossserverfarms-Executing HadoopMapReducejobs-Monitoringtheprogressofjobflows-TheBuildingBlocksof Hadoop Map Reduce - Distinguishing Hadoop daemons-Investigating the HadoopDistributedFileSystem Selectingappropriateexecutionmodes:local,pseudo-distributed,Fullydistributed.

Module 4: Real-TimeArchitecture–OrchestrationandSynthesisUsingAnalyticsEngines– Discovery using Data atRest– Implementation of Big Data Analytics – Big Data Convergence– AnalyticsBusinessMaturityModel,InstallingandRunningPig–Comparison with Databases–Pig Latin UserDefineFunctions–Data Processing Operators–Installing andRunningHive–HiveQL–Tables– QueryingData–User-DefinedFunctions–Oracle BigData.

Course learning outcomes:

- Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
- Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

- Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Suggested books:

1. Data Mining and Business Analytics with R, by Johannes Ledolter; Publisher: Wiley (2013), ISBN-13: 978-1118447147;
2. 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;

Suggested reference books:

1. MichaelMinelli,Michehe Chambers,"Big Data,Big Analytics: Emerging Business IntelligenceandAnalyticTrendsforToday'sBusiness",1stEdition,AmbigaDhiraj,WielyCIO Series,2013.
2. ArvindSathi,"BigDataAnalytics:DisruptiveTechnologiesforChangingtheGame", 1stEdition,IBMCorporation,2012.
3. BillFranks,"TamingtheBigDataTidalWave:Finding Opportunities in Huge Data Streams withAdvancedAnalytics",1stEdition,WileyandSASBusinessSeries,2012.
4. Tom White,"Hadoop:TheDefinitiveGuide",3rdEdition,O'reilly,2012.

Online links for study & reference materials:

1. https://catalyst.library.jhu.edu/catalog/bib_6591386
2. https://catalyst.library.jhu.edu/catalog/bib_4637122

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Thread 4: Applications

Course Code : PEC- CS-A 501 **Course Name:** Digital Image Processing
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

- To understand the need for image transforms different types of image transforms and their properties.
- To develop any image processing application.
- To understand the rapid advances in Machine vision.
- To learn different techniques employed for the enhancement of images.

Course Description:

This course will cover the fundamentals of image processing. We will provide a mathematical framework to describe and analyze images as two- and three-dimensional signals in the spatial, spatio-temporal, and frequency domains. In this class not only will you learn the theory behind fundamental processing tasks including image/video enhancement, recovery, and compression – but you will also learn how to perform these key processing tasks in practice using state-of-the-art techniques and tools. We will introduce and use a wide variety of such tools – from optimization toolboxes to statistical techniques.

Course Contents:

UNIT 1

Digital Image Fundamentals-Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

UNIT 2

Image Enhancements and Filtering-Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

UNIT 3

Image Segmentation- Detection of discontinuities, edge linking and boundarydetection, thresholding – global and adaptive, region-based segmentation.

Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

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Image Compression-Redundancy–inter-pixel and psycho-visual; Losslesscompression – predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards–JPEG and JPEG-2000.

UNIT 5

Fundamentals of Video Coding-Inter-frame redundancy, motion estimationtechniques – full-search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy–Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.

Video Segmentation-Temporal segmentation–shot boundary detection, hard-cutsand soft-cuts; spatial segmentation–motion-based; Video object detection and tracking.

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- Mathematically represent the various types of images and analyze them.
- Process these images for the enhancement of certain properties or for optimized use of the resources.
- Develop algorithms for image compression and coding

Text books:

- R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
- Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004

Reference books:

- Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

Online links for study & reference materials:

https://nptel.ac.in/courses/117/105/117105079/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PEC-CS-A601 **Course Name:** Digital Signal Processing
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

- To develop a thorough understanding of the central elements of discrete time signal processing theory and the ability to apply this theory to real-world signal processing applications.
- Use z-transforms and discrete time Fourier transforms to analyze a digital system.
- Understand the discrete Fourier transform (DFT), its applications and its implementation by FFT techniques.
- Design and understand finite & infinite impulse response filters for various applications.

Course Description:

The course covers theory and methods for digital signal processing including basic principles governing the analysis and design of discrete-time systems as signal processing devices. Review of discrete-time linear, time-invariant systems, Fourier transforms and z-transforms. Topics include sampling, impulse response, frequency response, finite and infinite impulse response systems, linear phase systems, digital filter design and implementation, discrete-time Fourier transforms, discrete Fourier transform, and the fast Fourier transform algorithms.

Course Contents:

Unit 1

Discrete time signals: Sequences; representation of signals on orthogonal basis; Samplingand reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequencyAnalysis, Inverse Systems, Discrete Fourier Transform (DFT),Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

Unit 2

Designof FIR Digital filters: Windowmethod,Park-McClellan's method.Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations;Lowpass, Bandpass, Bandstop and High pass filters.

Unit 3

Effect of finite register length in FIR filter design.Parametric and non-parametric spectral estimation.

Unit 4

Introduction to multiratesignalprocessing, Application of DSP.

Course Learning Outcomes(CLOs) :

At the end of this course students will demonstrate the ability to

- Represent signals mathematically in continuous and discrete time and frequency domain
- Get the response of an LSI system to different signals
- Design of different types of digital filters for various applications

Text books:

- S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
- A.S. Sedra and K.C. Smith, Microelectronic Circuits, Edition IV**.**

Reference books:

- A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
- John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
- L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/105/108105055/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PEC-CS-A 602 **Course Name:** Blockchain Technology

Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- The students should be able to understand a broad overview of the essential concepts of blockchain technology.
- To familiarize students with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.
- Students should be able to learn about different types of blockchain and consensus algorithms.

Course Description:

- To explain the basic notion of distributed systems.
- To use the working of an immutable distributed ledger and trust model that defines blockchain.
- To illustrate the essential components of a blockchain platform.

Course Contents:

Unit 1: Tiers of Blockchain Technology: Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains.Basics: The Double-Spend Problem, Byzantine Generals' Computing Problems, Public-Key
Cryptography, Hashing, Distributed Systems, Distributed Consensus.
Unit 2: Technology Stack: Blockchain, Protocol, Currency. Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model.
Unit 3: Ethereum Blockchain: Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.
Unit 4: Basics: The Double-Spend Problem, Byzantine Generals' Computing Problems, Public-Key Cryptography, Hashing, Distributed Systems, Distributed Consensus.
Unit 5: Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Blockchain Use Case: Supply Chain Management.

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

Suggested books:

4. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.

5. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House.
6. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
7. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).

Suggested reference books:

3. Mastering Bitcoin: Programming the Open Blockchain by Andreas Antonopoulos.
4. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'Reilly Publisher Media; 1st edition (2015).

Online links for study & reference materials:

2. NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	-	**40%**

Course Code: PEC-CS-A 701 **Course Name:** Human Computer interaction

Course Credit Hour: 4hr **Total Contact Hour:** 48hr

Course Objective:

- Provide an overview of the concepts relating to the design of human-computer interfaces in ways making computer-based systems comprehensive, friendly and usable.
- Identify the various tools and techniques for interface analysis, design, and evaluation.

Course Description:

- Write a brief summary indicating how this will be conducted specifying the key topics of the whole course.
- Write about 4 to 5 lines or till 7 lines, if some course description demands.

Course Contents:

Unit 1

Introduction: Importance of user Interface – definition, importance of 8 good design. Benefits ofgood design. A brief history of Screen design. The graphical user interface – popularity of graphics,theconceptofdirectmanipulation,graphicalsystem,Characteristics,Webuser–Interfacepopularity,characteristics-Principlesofuserinterface

Unit 2

Designprocess: Human interaction with computers, importance of 8 human characteristics human consideration,Humaninteractionspeeds,understandingbusinessjunctions.IIIScreenDesigning:Designgoals – Scre

Unit 3

ScreenDesigning: Designgoals–Screenplanningandpurpose,8organizingscreenelements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition –amount of information – focus and emphasis – presentation information simply and meaningfully – informationretrievalonweb–statisticalgraphics–Technologicalconsiderationininterfacedesign.

Unit 4

Windows: New and Navigation schemes selection of window, 8 selection of devices based andscreen based controls. Components – text and messages, Icons and increases – Multimedia, colors,usesproblems, choosingcolors

Unit 5

Softwaretools: Specificationmethods,interface–BuildingTools.8InteractionDevices–Keyboardandfunctionkeys–pointingdevices–speechrecognitiondigitizationandgeneration–image and video displays –drivers.

Course Learning Outcomes (CLOs):

Understand fundamental design and evaluation methodologies of human computer interaction. Demonstrate knowledge of human computer interaction design concepts and related methodologies.

Apply theories and concepts associated with effective work design to real-world application

Text books:

1. AlanDix,JanetFinlay,GregoryAbowd,RussellBealeHumanComputer Interaction,3rdEditionPrenticeHall,2004.
2. JonathanLazarJinjuanHeidiFeng,HarryHochheiser,ResearchMethodsinHumanComputerInteraction,Wiley,2010.
3. BenShneidermanandCatherinePlaisantDesigningtheUserInterface:StrategiesforEffectiveHuman-ComputerInteraction(5thEdition,pp.672,ISBN0-321-53735-1,March2009),Reading,MA:Addison-WesleyPublishingCo.

Reference books:

"Human-Computer Interaction" by Dix

"Designing the User Interface: Strategies for Effective Human-Computer Interaction" by Shneiderman

Online links for study & reference materials:

https://guides.lib.uw.edu/research/hcid/hcid-rec

Assessment method:(Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code : PEC-CS-A 702 **Course Name:** ELECTRONIC DESIGN AUTOMATION
Course Credit: 4 **Total Contact Hour:** 48hr

Course Objective :

To describe both simple and complex RTL design scenarios using VHDL/verilog. It gives practical information on the issues in ASIC prototyping using FPGAs, design challenges and how to overcome practical issues and concerns.

Course Description :

With this course the students will able to understand the concept of simulation &sysnthesis of complex circuits using VHDL/VERILOG.

Course Contents :

Unit1

Top down approach to design, Design of FSMs (Synchronous and asynchronous), Static timing analysis, Meta-stability, Clock issues, Need and design strategies for multi-clock domain designs.

Unit 2

Design entry by Verilog/VHDL/FSM, Verilog AMS.

Unit 3

Programmable Logic Devices, Introduction to ASIC Design Flow, FPGA, SoC, Floor planning, Placement, Clock tree synthesis, Routing, Physical verification, Power analysis, ESD protection.

Unit 4

Design for performance, Low power VLSI design techniques. Design for testability.

Unit 5

IP and Prototyping: IP in various forms: RTL Source code, Encrypted Source code, Soft IP, Netlist, Physical IP, Use of external hard IP during prototyping

Unit 6

Case studies and Speed issues.

Course Learning Outcomes(CLOs) :

CO1: Describe Finite State Machines and comprehend concepts of clock related issues.

CO2: Model digital circuits using Verilog and understand the concepts of analog and mixed signal Systems design using Verilog AMS.

CO3: Outline the concepts of different design flows in VLSI.

CO4: Illustrate different low power latches and Flip-flops.

CO5: Explain the concepts of IP cores and Prototyping.

Text books :

- Richard S. Sandige, Modern Digital Design , MGH, International Editions,1990
- T. R. Padmanabhan and B. F.V.G. Bala Tripura Sundari, Design through Verilog HDL , WSE, IEEE Press, 2004.
- Zeidman, Bob. Designing with FPGAS and CPLDS . CRC Press, 2002.
- KiatSeng Yeo, Samir S. Rofail, Wang-Ling Goh, CMOS/Bi CMOS ULSI Low Voltage Low Power , Pearson Education Asia 1st Indian reprint, 2002.
- Doug Amos, Austin Lesea, Rene Richter, FPGA based prototyping methodology manual , Xilinx.

Reference books :

- Palnitkar, Samir. Verilog HDL: a guide to digital design and synthesis . Pearson Education India, 2003.
- Givone, Donald D. Digital principles and design . Palgrave Macmillan, 2003.
- Roth, Charles H. Digital systems design using VHDL . Wadsworth Publ. Co., 1998.

Online links for study & reference materials :

http://smdpc2sd.gov.in/downloads/IEP/IEP%208/24-02-18%20Rejender%20pratap.pdf
https://inst.eecs.berkeley.edu/~cs150/sp02/useful_files/Synthesis_Simulation_Design_Guide.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**

Course Code: PEC-CS-A 703 **Course Name:** Computer Graphics

Course Credit Hour: 4hr **Total Contact Hour**: 4hr

Course Objective:

 Provide an overview of the concepts relating to the design of human-computer interfaces in ways making computer-based systems comprehensive, friendly and usable.

 Identify the various tools and techniques for interface analysis, design, and evaluation.

Course Description:

Basic principles and techniques for computer graphics on modern graphics hardware. Students will gain experience in interactive computer graphics using the OpenGL API. Students will gain experience using a graphics application programming interface (OpenGL) by completing several programming projects.

Course Contents:

Unit- I
Introduction and Line Generation: Types of computer graphics, Graphic Displays- Random scandisplays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawingalgorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallelversionofthese algorithms.
Unit– II
Transformations: Basic transformation, Matrix representations and homogenous coordinates,Compositetransformations,Reflectionsandshearing.
Windowing and Clipping:Viewing pipeline, viewing transformations, 2-D Clipping algorithms-Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barskyalgorithm, Line clipping against non-rectangular clip windows; Polygon clipping – SutherlandHodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Textclipping.
Unit– III
Three Dimensional: 3-D geometric primitives, 3-D Object representation, 3-D Transformation,3-Dviewing,projections,3-D Clipping.
Unit– IV
Curves and Surfaces: Quadric surfaces, Spheres, Ellipsoid, Blobby objects, IntroductoryconceptsofSpline, Bspline and Beziercurvesandsurfaces.Hidden Lines and Surfaces: Back Face Detection algorithm, Depth buffer method, A-buffermethod, Scan line method, basic illumination models– Ambient light, Diffuse reflection,Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation,Color consideration,Transparencyand Shadows.

Course Learning Outcomes (CLOs):

CLO1: Have a basic understanding of the core concepts of computer graphics.

CLO2: Be capable of using OpenGL to create interactive computer graphics.

CLO3: Understand a typical graphics pipeline.

CLO 4: Have made pictures with their computer.

Text books:

1.Interactive Computer Graphics: A Top-Down Approach with Shader-Based OpenGL, Sixth Edition, Edward Angel, Dave Shreiner, Pearson Education, 2011. ISBN 0132545233.

Reference books:

1. Hughes, Van Dam, et al. Computer Graphics Principles and Practice 3e, Pearson, 2014

2. OpenGL Programming Guide, Addison-Wesley, 2004.

1. OpenGL Reference Manual, Addison-Wesley, 2004.

2. E. Angel, OpenGL: A Primer Addison-Wesley, 2004. P Shirley, Fundamentals of Computer Graphics, 2e, AK Peters, 2005

3. Hearn and Baker Computer Graphics with OpenGL, 3e, Prentice Hall, 2004.

4. Foley and Van Dam, Fundamentals of Interactive Computer Graphics

5. Moller and Haines, Real-time Rendering, AK Peters,

Online links for study & reference materials:

https://www.ncertbooks.guru/computer-graphics-notes/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Open Book Examination	-	08%
Group Discussion	-	08%
Class text	-	08%
Assignment	-	08%
Internal Viva Voice	-	08%
Total Internal Assessment	**-**	**40%**